County of Nevada
Information & General Services Department
Purchasing Division

Project Manual
Book 2 of 2
STANDARD SPECIFICATIONS

For

Nevada County Operations Center (NCOC)

Bids Due: December 14, 3:00:00 PM

Date issued: October 23, 2018

Pre-Bid Conference and Walk Through

November 8, 2018, 10:00 AM

at:
12350 LaBarr Meadows Road, Grass Valley, California.

PROFESSIONAL ENGINEERS SIGNATURE PAGE

THE STANDARD SPECIFICATIONS CONTAINED HEREIN HAVE BEEN PREPARED BY OR UNDER THE DIRECTION OF THE FOLLOWING REGISTERED PERSON(S).

Registered Architect

Registered Engineer

Registered Landscape Architect

Registered Engineer

Registered Engineer

Registered Engineer

Registered Engineer

Registered Engineer

Registered Engineer

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SECTION 01 10 00 - SUMMARY

PART 1. - GENERAL

1.01 PROJECT

A. Abbreviated Written Summary: Briefly and without force and effect upon the Contract Documents, the Work of the Contract can be summarized as follows:
   1. The Project consists of the construction of a new corporation yard, herein referred to as Project. The Project consists of the following structures: main operations building, a sand barn for covered bulk material storage, uncovered bulk material storage bins, carports, water station, backup generator enclosure, and trash enclosure. The Wash Building is an Additive Alternate 1. Site work consists of paved parking and drive aisles, gravel laydown yard, compacted earth laydown yard, septic system, site lighting and security cameras, and perimeter fencing.
   2. The Project site is located at 12350 LaBarr Meadows Road, Grass Valley, California, as shown on Documents prepared by LDA Partners, LLC.

1.02 COUNTY OCCUPANCY

A. The County intends to occupy the Project no later than four hundred and fifty (450) Calendar Days from the date listed on the Notice to Proceed. Substantial Completion shall be obtained by this date.
B. The County intends to have beneficial occupancy six weeks prior to Substantial Completion to transfer equipment, setup computer systems, move furniture, and complete other tasks so that the project is fully usable and operational at Substantial Completion.
C. The Contractor shall schedule the Work so as to obtain a certificate of occupancy by the Substantial Completion date, so the County can occupy and use the building for its intended use.

1.03 CONTRACTOR USE OF SITE

A. Construction Operations: Limited to boundary of Work within the parcel and private property (if private property the Contractor shall obtain written permission from the private property owner to use such site and provide the County with a copy of the agreement with the private property owner), exclusive of designated wetland area.
B. Provide access to and from site as required by law and by County:
   1. Emergency Building Exits During Construction: Keep all exits required by the 2016 California Building Code open during construction period; provide temporary exit signs if exit routes are temporarily altered.
   2. Do not obstruct roadways, sidewalks, or other public ways without permit from County.
C. Time Restrictions:
   1. Limit conduct of construction noise, malodorous, and dusty exterior Work to the hours of 7:00 a.m. to 5:00 p.m. daily, unless otherwise authorized by County.
   2. Limit conduct of loading and unloading activities to the hours of 7:00 a.m. to 5:00 p.m., Monday through Friday, unless otherwise authorized by County.
   3. See County of Nevada Municipal Code for Noise Control for additional restrictions that shall be followed.
D. Utility Outages and Shutdown:
   1. Do not disrupt or shut down life safety systems, including but not limited to fire sprinklers and fire alarm system, without 14 Calendar Days' notice and approval by County and authorities having jurisdiction.
   2. Prevent accidental disruption of utility services to other facilities and properties.
E. Nonsmoking Building: Smoking is not permitted on the Project's site.

F. Controlled Substances: Use of tobacco products and other controlled substances on the Project's site is not permitted.

1.04 SPECIFICATION AND DRAWING CONVENTIONS

A. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:
   1. Imperative mood and streamlined language are generally used in the Specifications. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.
   2. Specification requirements are to be performed by Contractor unless specifically stated otherwise.

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

C. Drawing Coordination: Requirements for materials and products identified on Drawings are described in detail in the Technical Specifications. One or more of the following are
   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 published as part of the U.S. National CAD Standard and scheduled on Drawings.
   3. Keynoting: Materials and products are identified by reference keynotes referencing Specification Section numbers found in this Specification.

PART 2 - PRODUCTS – NOT USED

PART 3 - EXECUTION – NOT USED

END OF SECTION

SECTION 01 25 00 SUBSTITUTION PROCEDURES

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes administrative and procedural requirements for substitutions.

1.03 RELATED SECTIONS

A. Section 01 6000 - Product Requirements, for submittal procedures and Contract document revisions initiated by Contractor.

1.04 DEFINITIONS

A. Substantial Completion: The building can be used by the County for its intended use; if it passes the required fire and life safety inspections from the Building Department, and Fire Department. The Contractor shall submit a letter stating that the Project is substantially complete and include a list of items that are incomplete. Refer to 01 7000, Execution and Closeout Requirements for close out procedures for more information.

B. Project Completion: Final Acceptance, this is unless otherwise indicated. Note: warranty dates shall start at the date of Final Acceptance.

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

1. Substitutions for Convenience: Changes proposed by Contractor or County that are not required in order to meet other Project requirements but may offer advantage to Contractor or County.
    a. Substitutions for Convenience shall include any comparable ("or equivalent") product, including proposed changes to named products, proposed changes to listed manufacturers and proposed changes to basis-of-design products, unless a Substitution for Cause regarding the comparable products are proposed in which case the Contractor shall provide information of the cause.
2. 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.

1.05 SUBMITTALS

A. Substitution Requests: Submit complete request electronically by PDF or three hard copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.

1. Substitution Request Form: Appropriate form as approved by Engineer.
2. Documentation: Submit the information indicated below to provide the Engineer with the minimum information necessary to fairly review and evaluate the proposed substitutions, proposed comparable products and proposed changes to specified products. Show compliance with requirements and the following, as applicable:
    a. Statement indicating why specified product or fabrication or installation cannot be provided, if applicable.
    b. Coordinate information which shall be necessary to accommodate proposed substitution, including a list of changes or modifications needed to other parts of the Work and to construction performed by County and separate Contractors.
    c. Detailed side by side comparison of the quality of proposed substitution with those already specified for the Work. Include annotated copy of applicable specification section. 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 and mock-ups, where applicable or requested.
f. Certificates and qualification data, where applicable or requested.
g. List of similar installations for completed projects with project's names and addresses and names and addresses of Architects and Owners.
h. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
i. Research reports evidencing compliance with the California Building Code in effect for Project, from ICC-ES or other code organizations acceptable to authorities having jurisdiction.
j. Detailed comparison of Contractor's construction schedule using proposed substitution with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating date of receipt of purchase order, lack of availability, or delays in delivery.
k. Cost information, including a proposal of change, if any, in the Contract Sum.
l. Contractor's certification that proposed substitution complies with requirements in the Contract Documents except as indicated in substitution request, is compatible with related materials, and is appropriate for applications indicated.
m. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.

3. Engineer's Action: If necessary, Engineer will request additional information or documentation for evaluation within seven days of receipt of a request for substitution. Engineer will notify Contractor of acceptance or rejection of proposed substitution within fourteen (14) Calendar Days of receipt of request, or within fourteen (14) Calendar Days of receipt of additional information or documentation, whichever is later.
   a. Forms of Acceptance: Change Order or Construction Change Directive. Engineer's Supplemental Instructions may be used for minor changes in the Work.
   b. Use product specified if Engineer does not issue a decision on use of a proposed substitution within time allocated.

1.06 QUALITY ASSURANCE

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

1.07 PROCEDURES

A. Coordination: Modify or adjust affected Work as necessary to integrate Work of the approved substitutions.

PART 2 – PRODUCTS

2.01 SUBSTITUTIONS

A. Substitutions for Convenience: Per the following:
   1. Conditions: If the following conditions are not satisfied, Engineer will return requests as Rejected, noting noncompliance with these requirements:
      a. Requested substitution offers County a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities County must assume. County's additional responsibilities may include compensation to others for redesign and evaluation services, increased cost of other construction by County, and similar considerations.

b. Requested substitution does not require extensive revisions to the Contract Documents.
c. Requested substitution is consistent with the Contract Documents and must produce indicated results.
d. Requested substitution provides sustainable design characteristics that specified product provided.
e. Substitution request is fully documented and properly submitted.
f. Requested substitution shall not adversely affect Contractor's construction schedule.
g. Requested substitution has received necessary approvals of authorities having jurisdiction.
h. Requested substitution is compatible with other portions of the Work.
i. Requested substitution has been coordinated with other portions of the Work.
j. Requested substitution provides specified warranty.
k. 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 Cause: Submit requests for substitution immediately upon discovery of need for change, but not later than 14 Calendar Days prior to time required for preparation and review of related submittals.
1. Conditions: Engineer will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Engineer will return requests without action, except to record noncompliance with these requirements:
a. Describe the non-convenience cause that is triggering the request for the change.
b. Requested substitution is consistent with the Contract Documents and will produce indicated results.
c. Requested substitution provides sustainable design characteristics that specified product provided.
d. Substitution request is fully documented and properly submitted.
e. Requested substitution will not adversely affect Contractor's construction schedule.
f. Requested substitution has received necessary approvals of authorities having jurisdiction.
g. Requested substitution is compatible with other portions of the Work.
h. Requested substitution has been coordinated with other portions of the Work.
i. Requested substitution provides specified warranty.
j. If requested substitution involves more than one Contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

PART 3 - EXECUTION - NOT USED

END OF SECTION

SECTION 01 26 00 CONTRACT MODIFICATION PROCEDURES

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes administrative and procedural requirements for handling and processing Contract modifications.
B. Related Requirements:
   1. Division 01 25 00 Section "Substitution Procedures" for administrative procedures for handling requests for substitutions made after Contract award.

1.03 MINOR CHANGES IN THE WORK

A. Engineer may issue supplemental instructions authorizing minor changes in the Work, not involving adjustment to the Contract Sum or the Contract Time, on the following form:
   1. AIA Document G710, "Supplemental Instructions" or similar form acceptable to the Engineer.

1.04 PROPOSAL REQUESTS

A. County-Initiated Proposal Requests: Engineer 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. The Contractor and Engineer shall refer to Contract Article VI & IX as part of these Project specifications.
   1. Proposal Requests issued by Engineer are not instructions either to stop Work in progress or to execute the proposed change.
   2. Within the time specified in Proposal Request or twenty (14) Calendar Days, when not otherwise specified, after receipt of Proposal Request, submit a quote 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. Reference 01 3200 for time impact procedures
      e. Quotation Form: Use form acceptable to Engineer.
      f. Contractor’s Fee – Allowable mark-ups as noted in Article VI

B. Contractor-Initiated Proposals: If latent or changed conditions require modifications to the Contract, Contractor may initiate such modification by submitting a request for a change to Engineer.
   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. Reference 01 3200 for time impact procedures
6. Comply with requirements in Division 01 25 00 Section "Substitution Procedures" if the proposed change requires substitution of one product or system for product or system specified.
7. Proposal Request Form: Use form acceptable to Engineer.

1.05 CHANGE ORDER PROCEDURES

A. On County's approval of a Proposal Request, Engineer will issue a Change Order for signatures of County and Contractor on AIA Document G701, or similar form.

1.06 CONSTRUCTION CHANGE DIRECTIVE

A. Construction Change Directive: Engineer may issue a Construction Change Directive on AIA Document G714 or similar form. 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 the method to be followed to determine change(s) in the Contract Sum or the Contract Time.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION - NOT USED

END OF SECTION

SECTION 01 29 00 PAYMENT PROCEDURES

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

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

B. Related Requirements:

1. Division 01 26 00 Section "Contract Modification Procedures" for administrative procedures for handling changes to the Contract.
2. Division 01 32 00 Section "Construction Progress Documentation" for administrative requirements governing the preparation and submittal of the Contractor's construction schedule.
3. Division 01 30 00 Section "Submittal Procedures" for administrative requirements governing the preparation and submittal of the submittal schedule.
4. Contract Article VII – Payments to Contractor

1.03 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. Schedule of Values line items to be broken down to a level of detail acceptable to Engineer, to include the value of the scope of work for each Specification Section at a minimum.

1.04 SCHEDULE OF VALUES

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

1. Correlate line items in the schedule of values with other required administrative forms and schedules, including the following:
   a. Application for Payment forms with continuation sheets.
   b. Submittal schedule.
   c. Items required to be indicated as separate activities in Contractor's construction schedule.
1. Submit the schedule of values to Engineer at earliest possible date but no later than ten (10) Calendar Days before the date scheduled for submittal of initial Application for Payment.

B. Format and Content: Use the Specification’s 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. Provide additional detail as required or requested.

1. Identification: Include the following Project identification on the schedule of values:
   a. Project name and location.
   b. Name of Engineer.
   c. County's Project number.
   d. Contractor's name and address.
   e. Date of submittal.
2. Arrange schedule of values consistent with format of AIA Document G703.
3. Arrange the schedule of values in tabular form with separate columns to indicate the following for each item listed:
   a. Item number.
   b. Description of the Work.
   c. Dollar value.

1) Labor.
2) Materials/Equipment.

4. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Coordinate with the Specification's table of contents. Provide at least two line items for principal subcontract amounts in excess of five percent of Contract Sum, as follows:
   a. Labor
   b. Equipment and material.
5. Include separate line items under Division 01 heading for prime Contract and principal subcontracts for Project's closeout requirements in an amount of at least five percent of the Contract Sum and Sub-contract amounts.
6. Round all amounts to nearest whole dollar; total shall equal the Contract Sum.
7. Allowances: Provide a separate line item in the schedule of values for each allowance. Show line-item value of unit-cost allowances, as a product of the unit cost, multiplied by measured quantity. Use information indicated in the Contract Documents to determine quantities.
8. Purchase Contracts: Provide a separate line item in the schedule of values for each purchase Contract. Show line-item value of purchase Contract. Indicate County payments or deposits, if any, and balance to be paid by Contractor.
9. Each item in the schedule of values and Applications for Payment shall be complete. Include total cost and proportionate share of general overhead and profit for each item.
   a. Temporary facilities and other major cost items that are not direct cost of actual Work-in-place may be shown either as separate line items in the schedule of values or distributed as general overhead expense, at Contractor's option.
10. Schedule Updating: Update and resubmit the schedule of values before the next Applications for Payment when Change Orders or Construction Change Directives result in a change in the Contract Sum.

1.05 APPLICATIONS FOR PAYMENT

A. Each Application for Payment shall be consistent with previous applications and payments as certified by Engineer and paid for by County.
   1. Initial Application for Payment, Application for Payment at time of Project Completion, and final Application for Payment involve additional requirements.
B. Payment Application Times: The date for each progress payment is indicated in the Agreement between County and Contractor. The period of construction Work covered by each Application for Payment is the period indicated in the Agreement.
C. Payment Application Times: Progress payments shall be submitted to Engineer by the last day of the month. The period covered by each Application for Payment is one month, ending on the last day of the month.
   1. Submit draft copy of Application for Payment five days prior to due date for review by Engineer.
D. Application for Payment Forms: Use forms acceptable to Engineer and County for Applications for Payment. Submit forms for approval with initial submittal of schedule of values.
E. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor. Engineer 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. The amount of retention with respect to progress payments will be five percent (5%)
   4. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.

5. Indicate separate amounts for Work being carried out under County-requested Project acceleration.

F. Stored Materials: No materials shall be paid for until incorporated into the Work, unless approved in advance by County, in accordance with Article VII.

G. Transmittal: Submit three signed and notarized original copies of each Application for Payment to Engineer by a method ensuring receipt within 24 hours. County's copy shall include waivers of lien and similar attachments.
   1. Transmit each copy with a transmittal form listing attachments and recording appropriate information about application.

H. 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. County reserves the right to designate which entities involved in the Work must submit waivers.
   4. Waiver Forms: Submit waivers of lien on forms complying with California law, executed in a manner acceptable to County.

I. Waivers of Mechanic's Lien: Upon request by the Engineer, with each Application for Payment, submit waivers of mechanic's liens from Subcontractors, Sub-subcontractors, and suppliers for construction period covered by the previous application.
   1. Submit partial waivers on each item for amount requested in previous application, after deduction for retainage, on each item.
   2. When an application shows completion of an item, submit conditional final or full waivers.
   3. County 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 could be lawfully entitled to a lien.
   5. Waiver Forms: Submit waivers of lien on forms, executed in a manner acceptable to County.

J. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of first Application for Payment include the following:
   1. List of Subcontractors.
   2. Schedule of values.
   3. Contractor's construction schedule (preliminary if not final).
   4. Submittal schedule (preliminary if not final).
   5. List of Contractor's principal consultants.
   6. Copies of building permits.
   7. Initial progress report.

K. Application for Payment at Project’s Completion: Submit an Application for Payment showing 100 percent completion for portion of the Work claimed as complete.
   1. Include documentation supporting claim that the Work is complete and a statement showing an accounting of changes to the Contract Sum.
   2. This application shall reflect any Certificates of Partial Project Completion issued previously for County occupancy of designated portions of the Work.

L. 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. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
   3. Updated final statement, accounting for final changes to the Contract Sum.

4. Final, unconditional lien releases (in exchange for final payment).
5. AIA Document G706, "Contractor's Affidavit of Payment of Debts and Claims."
6. AIA Document G706A, "Contractor's Affidavit of Release of Liens."
7. AIA Document G707, "Consent of Surety to Final Payment."
8. Evidence that claims have been settled.
9. Final meter readings for utilities, a measured record of stored fuel, and similar data as of date of Project Completion or when County took possession of and assumed responsibility for corresponding elements of the Work.
10. Final liquidated damages settlement statement.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION - NOT USED

END OF SECTION

SECTION 01 31 00 PROJECT MANAGEMENT AND COORDINATION

PART 1 – GENERAL

1.01 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.

1.02 SUMMARY

A. Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:
   1. General Project coordination procedures.
   2. Coordination drawings.
   3. Requests for Interpretation (RFIs).
   4. Project meetings.

B. Related Requirements:
   1. All the Division 01 sections, but especially the following:
   2. Division 01 3000 Submittal Procedures.
   3. Division 01 3200 Section "Construction Progress Documentation" for preparing and submitting Contractor's construction schedule.
   4. Division 01 7000 Section "Execution" for procedures for coordinating general installation and field-Engineering services, including establishment of benchmarks and control points.
   5. Division 01 7800 Section "Closeout Procedures" for coordinating closeout of the Contract.

1.03 DEFINITIONS

A. RFI: Request For Interpretation (RFI) from Engineer or Contractor, seeking information from each other during construction.

1.04 INFORMATIONAL SUBMITTALS

A. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Include the following information in tabular form:
   1. Name, address, and telephone number of entity performing Subcontract or supplying products.
   2. Number and title of related Specification Section(s) covered by Subcontract.
   3. Drawing number and detail references, as appropriate, covered by Subcontract.
   4. Key Personnel Names: Within fifteen (15) Calendar Days of starting construction operations, submit a list of key personnel assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list addresses and telephone numbers, including home, office, and cellular telephone numbers and e-mail addresses. Provide names, addresses, and telephone numbers of individuals assigned as alternates in the absence of individuals assigned to Project.

1.05 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 County 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. Pre-installation conferences.
   7. Project closeout activities.
   8. Startup and adjustment of systems.
D. Conservation: Coordinate construction activities to ensure that operations are carried out with consideration given to conservation of energy, water, and materials. Coordinate use of temporary utilities to minimize waste.
   1. Salvage materials and equipment involved in performance of, but not actually incorporated into, the Work. Refer to other Sections for disposition of salvaged materials that are designated as County's property.

1.06 COORDINATION DRAWINGS

A. Coordination Drawings, General: Prepare coordination drawings in accordance with requirements in individual Sections, where installation is not completely shown on Shop Drawings, where limited space availability necessitates coordination, or if coordination is required to facilitate integration of products and materials fabricated or installed by more than one entity.
   1. Content: Project-specific information, drawn accurately to a scale large enough to indicate and resolve conflicts. Prepare coordination drawings to comply with accepted industry drafting standards. Do not base coordination drawings on standard printed data. Include the following information, as applicable:
      a. Applicable Drawings may be used as a basis for preparation of coordination drawings, provide title blocks, stamps and certifications are removed. Prepare additional sections, elevations, and details as needed to describe relationship of various systems and components.
         1) Provide review stamp, with signature and date, of each trade proposed to Work within the opening or penetration
      b. Coordinate the addition of trade-specific information to the coordination drawings by multiple Contractors in a sequence that best provides for coordination of the information and resolution of conflicts between installed components before submitting for review.
         1) Provide review stamp, with signature and date, of each Contractor and trade proposed to Work within the opening or penetration.
      c. Indicate functional and spatial relationships of components of Engineering, structural, civil, mechanical, and electrical systems.
         1) Grid lines and levels, and references to appropriate Contract drawings.
         2) Location and dimensions of openings and penetrations.
      d. Indicate dimensions shown on the Drawings. Specifically note dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternate sketches to Engineer indicating proposed resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.
      e. Indicate space requirements for routine maintenance and for anticipated replacement of components during the life of the installation.
      f. Show location and size of access doors required for access to concealed dampers, valves, and other controls.
      g. Indicate required installation sequences.

B. Coordination Drawing Organization: Organize coordination drawings as follows:
   1. Floor Plans and Reflected Ceiling Plans: Show Engineering 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 sub-framing for support of ceiling and wall systems, mechanical and electrical equipment, and related Work. Locate components within ceiling plenum to accommodate layout of light fixtures indicated on Drawings. Indicate areas of conflict between light fixtures 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.
      a. Include all items located within the opening or penetration, and dimensioned clearance to edge of penetration. Include framing, equipment, suspension systems, piping, ductwork, cable systems and other construction. Include insulation, supports, clamps, sealants and accessory items.
   5. Slab Edge and Embedded Items: Indicate slab edge locations and sizes and locations of embedded items for metal fabrications, sleeves, anchor bolts, bearing plates, angles, door floor closers, slab depressions for floor finishes, curbs and housekeeping pads, and similar items.
   6. Mechanical and Plumbing Work: Show the following:
      a. Sizes and bottom elevations of ductwork, piping, and conduit runs, including insulation, bracing, flanges, and support systems.
      b. Dimensions of major components, such as dampers, valves, diffusers, access doors, cleanouts and electrical distribution equipment.
      c. Fire-rated enclosures around ductwork.
   7. Electrical Work: Show the following:
      a. Runs of vertical and horizontal conduit 1-1/4 inches (32 mm) diameter and larger.
      b. Light fixture, exit light, emergency battery pack, smoke detector, and other fire alarm locations.
      c. Panel board, switch board, switchgear, transformer, busway, generator, and motor control center locations.
      d. Location of pull boxes and junction boxes, dimensioned from column center lines.
   8. Fire Protection System: Show the following:
      a. Locations of standpipes, mains piping, branch lines, pipe drops, and sprinkler heads.
   9. Review: Engineer will review coordination drawings to confirm that the Work is being coordinated, but not for the details of the coordination, which are the Contractor's responsibility. If the Engineer determines that the coordination drawings are not being prepared in sufficient scope or detail, or are otherwise deficient, the Engineer will so inform the Contractor, who shall make changes as directed and resubmit.
   10. Coordination Drawing Prints: Prepare coordination drawing prints in accordance with requirements of Division 01 Section "Submittal Procedures."

C. Coordination Digital Data Files: As requested by Engineer, Contractor shall prepare coordination digital data files in accordance with the requirements of Division 01 Section "Submittal Procedures."
   1. File Preparation Format: DWG, Version, operating in Microsoft Windows operating system or .pdf, as requested by Engineer.

1.07 REQUESTS FOR INTERPRETATION (RFI)

A. General: Immediately on discovery of the need for additional information or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI in the form specified.
   1. Engineer will return RFIs submitted to Engineer by other entities controlled by Contractor with no response.
   2. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's Work or Work of Subcontractors.

B. Content of the RFI: Include a detailed, legible description of item needing information or interpretation and the following:
   1. Project name.
   2. Project number.
   3. Date.
   4. Name of Contractor.
   5. Name of Engineer.
   6. RFI number, numbered sequentially.
   7. RFI subject.
   8. Specification Section number and title and related paragraphs, as appropriate.
   9. Drawing number and detail references, as appropriate.
   10. Field dimensions and conditions, as appropriate.
   11. Contractor's suggested resolution. If Contractor's solution(s) impacts the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
   12. Contractor's signature.
   13. Attachments: Include sketches, descriptions, measurements, 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.
      b. Photographs shall not be accepted as a substitute for engineering sketches. Photographs may be submitted as supplements to properly prepared sketches and coordination drawings.

C. RFI Forms: Software-generated form acceptable to Engineer.
   1. Attachments shall be electronic files in Adobe Acrobat PDF format.

D. Engineer's Action: Engineer will review each RFI, determine action required, and respond. Allow 15 Calendar Days for Engineer's response for each RFI. RFIs received by Engineer after 1:00 p.m. will be considered as received the following Working Day.
   1. The types of RFIs listed below will be returned without action. The RFI process is not the proper mechanism to address such topics. Submit requests under appropriate procedures outlined in Contract Document.
      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 Engineer's actions on submittals.
      g. Incomplete RFIs or inaccurately prepared RFIs.
   2. Engineer's action may include a request for additional information, in which case Engineer's time for response will date from time of receipt of additional information.
   3. Engineer's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal according to Division 01 26 00 Section "Contract Modification Procedures."
      a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Engineer in writing within seven days of receipt of the RFI response.
   4. Name and address of Engineer.
   5. Date Engineer's response was received.

E. On receipt of Engineer's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Engineer within seven days if Contractor disagrees with response.
   1. Identification of related Minor Change in the Work, Construction Change Directive, and Proposal Request, as appropriate.
   2. Identification of related Field Order, Work Change Directive, and Proposal Request, as appropriate.

F. Upon completion of Project, submit an archive copy of Project’s files to Engineer in a digital storage format acceptable to the Engineer.

1.08 PROJECT MEETINGS

A. General: Engineer will schedule and conduct basic meetings and conferences at Project site, unless otherwise indicated.
   1. Attendees: Entity responsible for conducting meeting shall inform participants and others involved, and individuals whose presence is required, of date and time of each meeting.
   2. Agenda: Entity responsible for conducting meeting shall prepare and distribute the meeting agenda.
   3. Minutes: Entity responsible for conducting meeting shall record significant discussions and agreements achieved, and distribute the meeting minutes to everyone concerned, within seven calendar days of the meeting.

B. Preconstruction Conference: Engineer shall schedule and conduct a preconstruction conference before starting construction, at a time convenient to Engineer, but no later than fifteen (15) Calendar Days after execution of the Agreement.
   1. Conduct the conference to review responsibilities and personnel assignments.
   2. Attendees: Engineer and Engineer's 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.
   3. Agenda: Discuss items of significance that could affect progress, including the following:
      a. Tentative construction schedule.
      b. Phasing.
      c. Critical Work sequencing and long-lead items.
      d. Designation of key personnel and their duties.
      e. Lines of communications.
      f. Procedures for processing field decisions and Change Orders.
      g. Procedures for RFIs.
      h. Procedures for testing and inspecting.
      i. Procedures for processing Applications for Payment.
      j. Distribution of the Contract Documents.
      k. Submittal procedures.
      l. Sustainable design requirements.
      m. Preparation of record documents.
      n. Use of the premises.
      o. Work restrictions.
      p. Working hours.
      q. County's occupancy requirements; including beneficial occupancy.
      r. Responsibility for temporary facilities and controls.
      s. Procedures for moisture and mold control.
      t. Procedures for disruptions and shutdowns.
      u. Construction waste management and recycling.
      v. Parking availability.
      w. Office, Work, and storage areas.
      x. Equipment deliveries and priorities.
      y. First aid.
      z. Security.
      aa. Progress cleaning.
      bb. Labor law, including payment and reporting requirements.
   4. Minutes: Entity responsible for conducting meeting will record and distribute meeting minutes.

C. Pre-installation Conferences: Contractor shall conduct a pre-installation conference at Project site before each construction activity that requires coordination with other contractors.
   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.
      a. Advise the following of scheduled meeting dates:
         1) Engineer

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 problems.
   l. Time schedules.
   m. Weather limitations.
   n. Manufacturer's written recommendations.
   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: The Project closeout conference shall review requirements and responsibilities related to Project closeout.
   1. If not conducted as part of a normally scheduled job progress meeting, Engineer shall schedule and conduct a Project closeout conference, at a time convenient to Engineer and Contractor, but no later than eight weeks prior to the scheduled date of Project Completion.
   2. Attendees: Authorized representatives of Engineer, 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 Project Completion and for final inspection for acceptance.
      c. Submittal of written warranties.
      d. Requirements for completing sustainable design documentation.
      e. Requirements for preparing operations and maintenance data.
      f. Requirements for delivery of material samples, attic stock, and spare parts.
      g. Requirements for demonstration and training.
      h. Preparation of Contractor's punch list.

i. Procedures for processing Applications for Payment at Project Completion and for final payment.
j. Submittal procedures.
k. Coordination of separate Contracts.
l. Requirements for completing sustainable design documentation.
m. County's partial/benefical occupancy requirements.
n. Installation of County's furniture, fixtures, and equipment.
o. Responsibility for removing temporary facilities and controls.

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

E. Progress Meetings: Engineer shall conduct progress meetings at weekly intervals.
1. Coordinate preparation of payment requests with dates of meetings.
2. Attendees: In addition to representatives of Engineer, 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 shall be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities shall 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) Resolution of BIM component conflicts.
4) Status of submittals.
5) Status of sustainable design documentation.
6) Deliveries.
7) Off-site fabrication.
8) Access.
9) Site utilization.
10) Temporary facilities and controls.
11) Progress cleaning.
12) Quality and Work standards.
13) Status of correction of deficient items.
14) Field observations.
15) Status of RFIs.
16) Status of proposal requests.
17) Pending changes.
18) Status of Change Orders.
19) Pending claims and disputes.
20) Documentation of information for payment requests.
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: Contractor shall revise construction schedule after each progress meeting where revisions to the schedule have been made or recognized. Contractor shall provide revised schedule to reporting entity so that it may be issued concurrently with the report of each meeting.

F. Coordination Meetings: Project coordination meetings are in addition to specific meetings held for other purposes, such as progress meetings and pre-installation conferences.

1. Engineer shall conduct Project coordination meetings as needed. Revise first subparagraph below if Project requires coordination meetings on a monthly or weekly basis.
2. Attendees: In addition to representatives of Engineer, 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.
3. 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 shall be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities shall 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) Resolution of BIM component conflicts.
        4) Status of submittals.
        5) Deliveries.
        6) Off-site fabrication.
        7) Access.
        8) Site utilization.
        9) Temporary facilities and controls.
        10) Work hours.
        11) Hazards and risks.
        12) Progress cleaning.
        13) Quality and Work standards.
        14) Change Orders.
4. 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

REQUEST FOR INTERPRETATION

Project Name:			RFI No.
To:	Contractor:		
Subject:			
Specified Section	Paragraph No.	Drawing No.	Detail No.
Category: ☐ Need for Clarification ☐ Unforeseen Condition ☐ Conflict Within Documents		☐ Coordination Problem ☐ Other	
Description:			
Contractor's Proposed Resolution:			
☐ Attachments: ☐ Cost Impact: $ (Estimated) ☐ Time Impact:			
Contractor Signature			Date:
Engineer's Response:			
☐ Attachments:			
Engineer Signature:			Date:

SECTION 01 32 00 CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 – GENERAL

1.01 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.

1.02 SUMMARY

A. Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:
   1. Contractor's construction schedule.
      a. Upcoming Work Summaries (Short Interval Schedules).
   2. Construction schedule updating reports.
   3. Special reports.

1.03 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 schedule.
   3. Successor Activity: An activity that follows another activity in the schedule.

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

C. Critical Path: The longest continuous chain of interdependent activities through the network schedule that establishes the minimum overall Project duration.

D. Event: The starting or ending point of an activity.
   1. Float: The measure of leeway in starting and completing an activity. Float time may be utilized by either County or Contractor. It is an expiring Project resource available to both parties as needed to meet schedule milestones and Contract completion date. The Contractor shall obtain written approval from the Engineer prior to using Float time. Free float is the amount of time an activity can be delayed without extending the start of the successor activity. The Contractor shall obtain written approval from the Engineer prior to using Free Float time. Total float is the measure of leeway in starting or completing an activity without extending the Project completion.

E. Project Completion: See Contract Article III – Contract Time.

F. Contract Schedule: This includes the Preliminary Contract Schedule and Detailed Construction Schedule (CPM Baseline).

G. Fragnet: A partial or fragmentary network that breaks down activities into smaller activities for greater detail.

H. Milestone: A key or critical point in time for reference or measurement. Milestone dates shall not be changed by submission of a Schedule that shows earlier or later completion dates, unless specifically authorized by a Change Order.

I. Network Diagram: A graphic diagram of a network schedule, showing activities and activity relationships.

1.04 SUBMITTALS

A. Contractor shall supply the county with one separate standalone copy of the CPM software (latest version of Primavera P6 Viewer).

B. Format for Submittals: The CPM schedule shall be prepared using the latest version of Primavera P6. All schedule submissions shall include a copy of the Primavera .XER schedule file along with any .pdf reports specified in the following Sections or requested by the County. The schedule will be developed utilizing the “Project Level” coding not the “Enterprise” or

"Global" Level. It is the Contractor's sole responsibility to ensure that all coding included in its schedule is transferred and readable by the County in the electronic P6 format.

C. Scheduler Qualification Data: Within ten (10) Calendar Days following receipt of the Notice of Award, the Contractor shall submit, for County approval, the resume of their proposed Project Scheduler who will be responsible for developing and maintaining the Project schedules. The Project Scheduler must be proficient in CPM scheduling, using Primavera P6 software, have demonstrated experience in projects with similar scheduling complexity and requirements, and be capable of fulfilling the requirements of this Section. The acceptability of the proposed scheduler will be at the sole discretion of the County.
D. Preliminary 90-Calendar Day Contract Schedule: is to be submitted no later than fourteen (14) Calendar Days after the Notice to Proceed. Approval of the Contractor's Preliminary 90-Calendar Day Contract Schedule by the County will be a condition precedent to the making of any progress payment.
E. CPM Reports: Concurrent with CPM schedule, submit each of the following reports. Format for each activity in reports shall contain activity number, activity description, original duration, remaining duration, early start date, early finish date, late start date, late finish date, and total float in Calendar Days.
    1. Activity Report: List of all activities sorted by activity number and then early start date, or actual start date if known.
    2. Total Float Report: List of all activities sorted in ascending order of total float.

F. Contract Schedule (Baseline): Submit the proposed Contract Schedule within 45 Calendar Days after the Notice to Proceed. Upon acceptance by the County, the proposed Contract Schedule shall be used as the baseline to evaluate all Work yet to be performed and subsequent updates to the Contract Schedule.
G. Monthly Contract Schedule Updates: to be submitted along with each monthly pay application. Update schedules shall include only progress information changes such as activity Actual Start/Finish, Percent Complete and Remaining Duration changes. Schedule revisions/changes other than these shall be submitted as a separate file, including a narrative to describe the proposed changes, as detailed in Paragraph 1.11 below.
H. Other Required Reports: Submit three (3) color plots on "E" size sheets (approximately 34" x 44") of the Preliminary 90-Calendar Day and Contract Schedules. Periodically submit plots of subsequent schedule Updates, on "E" size sheets, as requested by the County.

1.05 QUALITY ASSURANCE

A. Pre-scheduling Conference: Conduct conference at Project site to comply with requirements in Division 01 31 00 Section "Project Management and Coordination." Review methods and procedures related to the preliminary construction schedule and Contractor's construction schedule, including, but not limited to, the following: Discuss schedule format, deliverables and constraints.

1.06 COORDINATION

A. Coordinate preparation and processing of schedules and reports with performance of construction activities and with scheduling and reporting of separate Contractors.
B. Coordinate Contractor's construction schedule with the schedule of values, list of Subcontracts, submittal schedule, progress reports, payment requests, and other required schedules and reports.
    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.
C. Contract Time generally refers to calendar days. Coordinate Working days, nonworking days and holidays as required to correlate with Contract Time.

1.07 PRELIMINARY 90-DAY CONTRACT SCHEDULE

A. Within fourteen (14) Calendar Days after the date of the NTP, the Contractor must submit, for County's review, a Preliminary Contract Schedule. This Schedule must show detailed activities for Work to be completed in the first ninety (90) Calendar Days of the Project. All Work planned to be performed during the remainder of the Project performance period may be represented by summary activities.

B. The Preliminary Contract Schedule must indicate contractual Milestones for the Project and define the following:

1. Proposed procurement activities to be accomplished during the first ninety (90) Calendar Days of the Project. Procurement activities must include product data and shop drawing submittals, submittals review and approval as well as fabrication and delivery of key and long lead procurement elements.
2. Proposed construction activities to be accomplished during the first ninety (90) Calendar Days of the Project. For those activities, activity durations must be in units of whole work days and must be limited to a maximum of fifteen (15) work days for each activity, unless otherwise specified herein.
3. The Work for each phase or area, beyond the first 90 Calendar Days, must be represented by at least one summary activity such that the entire Work of the project is represented. The approximate duration for each summary activity must be shown on the Preliminary Contract Schedule.

C. The Preliminary Contract Schedule must conform to the requirements in Paragraph 1.09 of this Section.

D. The Preliminary Contract Schedule must be updated on a monthly basis while the Contract Schedule is being developed. The monthly updating of the Preliminary Contract Schedule must be consistent with the procedures and requirements described in Paragraph 1.10 of this Section.

E. The Accepted Preliminary Contract Schedule must be used for the review of time extension request(s) during the first ninety (90) Calendar Days of the Project while the Contract Schedule is being developed.

F. Within fourteen (14) calendar days after receipt by the County of the Preliminary Contract Schedule, County will make recommendations to the Contractor as to adjustments to the Preliminary Contract Schedule. These recommendations, if accepted by both County and Contractor, will be incorporated into the development of the Contract Schedule. The Contractor must provide a response to the concerns of County, to its satisfaction, before the submittal of the Contract Schedule.

G. Once accepted by County, the Preliminary Contract Schedule will form the basis of the initial Accepted Contract Schedule.

1.08 CONTRACT SCHEDULE

A. Within forty-five (45) Calendar Days following Notice to Proceed, Contractor must submit to County a proposed Contract Schedule in CPM format. The proposed Contract Schedule must conform to the requirements in Paragraph 1.09 of this Section. The Contractor must use the Accepted Preliminary Contract Schedule and County comments thereon as the basis for the Contract Schedule. The proposed Contract Schedule will be reviewed in the following manner:

1. Within fourteen (14) Calendar Days after receipt by County of the proposed Contract Schedule, County will notify the Contractor of any concerns it may have in regard to the Schedule.
2. If County questions the Contractor's proposed activities, logic, durations, the Contractor must, within seven (7) Calendar Days after receipt of County's request, provide a

satisfactory revision to, or adequate justification for, these activities, logic, durations, to the satisfaction of County.

3. Upon the Contractor addressing the comments and Contract Schedule requirements to the satisfaction of County, the County will accept the proposed Contract Schedule and it will then be considered the Accepted Contract Schedule.
4. In the event the Contractor fails to define any element of Work, activity or logic and County's review does not note this omission or error, such omission or error, when discovered by the Contractor or County, must be corrected by the Contractor and immediately submitted to County as a schedule revision request (see Paragraph 1.11) and will not affect the Contract Time.

B. Accepted Contract Schedule
1. The Accepted Contract Schedule will be used as the baseline to evaluate all Work yet to be performed and subsequent updates to the Contract Schedule.
2. Acceptance by County of the Contractor's Contract Schedule will be a condition precedent to the making of any progress payments after the first ninety (90) Calendar Days of the Contract.
3. The detailed activities planned to be performed during the first ninety (90) Calendar Days after the NTP, as reflected by the County accepted Preliminary Contract Schedule, must remain unchanged in the Contract Schedule.

C. The initial Contract Schedule submission must reflect the Contractor's initial "plan of execution" as contemplated at the date of the Notice to Proceed, with no regard for actual progress or conditions encountered through the preparation time for its submittal.

D. If requested by County, the Contractor must furnish a written narrative of the Contractor's determination of durations and or sequence of Critical Activities. Such explanation must include the number of crews, crew composition, number of shifts per day, number of hours in a shift and the number of days per week.

1.09 TECHNICAL REQUIREMENTS

A. General:
1. Contract Milestone dates must be adhered to and must be clearly identified on the Schedule.
2. Contract Milestone dates must not be changed without the written consent of County via an executed Change Order
3. Start Milestones must be constrained by "Start On or Before", or "Start No Earlier Than" constraints.
4. Completion Milestones must be constrained by "Finish On or Before" constraints.
5. "Mandatory", "Start On", and "Finish On" constraints will not be allowed.
6. Activity Type – for each work activity should be "Task"
7. Schedule/Level Calculation Options – must be set as follows:
   a. When scheduling activities apply - Retained Logic,
   b. Calculate start-to-start lag from – early start, and
   c. Schedule durations – contiguous.

B. Scope Definition:
1. Activities scheduled to occur in the first ninety (90) Calendar Days in the Preliminary Contract Schedule and the entire Contract Schedule must be developed to an acceptable level of detail that is adequate for progress monitoring and payment evaluation, as determined by County. The level of detail of the Contractor's Schedule will be a function of the complexity of the Work involved. Construction activities must represent the continuous work of a single crew in a defined Work area or location and have duration of

no longer than fifteen (15) work days, unless otherwise accepted by County. Non-construction activities (such as procurement, fabrication, or similar activities) may have durations in excess of fifteen (15) work days.

2. Activity descriptions must be unique, full, clear and readily identifiable from Construction Documents.
3. Activity IDs must be alpha-numeric, indicating the activity's building or area.
4. Indicate a responsibility code for each activity. Responsibility for each activity must be identified with a single performing organization, typically the Subcontractor name.
5. If requested by County Representative, the Schedule activities must also be assigned a code indicating the relevant Specification Section.
6. The Schedule must be organized in a Work Breakdown Structure as agreed by County to assist in understanding work flow and sequencing.
7. The Schedule must reflect the entire scope of Work required by the Contract Documents, including but not limited to:
    a. Submittal and Procurement activities as set out under Paragraph C, Submittals, below.
    b. Field testing of equipment and materials.
    c. Detailed activities for mobilization, all temporary and preparatory Work necessary before the commencement of construction activities.
    d. A finish milestone type activity denoting the "dry-in' of the building, to represent when the building is water tight.
    e. All construction of mock-ups, and prototypes and/or samples.
    f. Work by County: Include a separate activity for each portion of Work performed by County.
    g. Separate activities for submittals, fabrication & delivery and installation of Contractor-Furnished-Contractor-Installed (CFCI) and Owner-Furnished-Contractor-Installed (OFCI) items.
    h. Activities for Furnishings, Fixtures & Equipment (FFE) installation, whether performed by the Contractor, County or others.
    i. Complete startup, testing and commissioning sequence at each building / major area, including but not limited to: final utility connections, start-up & pre-functional testing of equipment/system, testing & balancing for water / air system, functional performance testing and building flush-out. The schedule must include all testing activities conducted by authorities having jurisdiction. Allow a minimum of fifteen (15) Calendar Days for startup, testing and commissioning at each building / major area.
    j. All close-out activities including:
        1) Preparation and submittal of operations and maintenance manuals and as-built documents;
        2) Demonstration and training;
        3) Final cleanup;
        4) County pre-final inspection, punch list development, Contractor's correction of punch list, County final inspection at each building / major area as may be applicable. Activity duration for punch list development and punch list correction must be no less than seven (7) Calendar Days and fourteen (14) Calendar Days, respectively.

C. Submittals:
    1. The Schedule must identify detailed activities for the following:
        a. Preparation, review and approval of all Submittals which are key to timely and orderly completion of Work or as required by County's representative.
        b. Procurement Activities: for all time sensitive and long lead items and / or major items requiring a total duration for all tasks below of more than sixty (60) Calendar Days, the Schedule must show a sequence of activities, including:
            1) Preparation of shop drawings and sample submissions.

2) Review and approval of shop drawings and samples: Coordinate submittal review dates and durations in the Schedule with the Submittal Log.
3) All involved State or regulatory agency document reviews (deferred reviews) times and permits required for the performance of the Work.
4) Shop fabrication and delivery time.

D. Calendars and Durations:
1. The schedule shall include, as a minimum, a 5-day and 7-day calendar.
2. All Work activities shall be coded to the 5-day calendar, which will include a list of nonworking days and holidays.
3. All activities whose durations are stipulated by the Contract Documents, as well as Milestones, must be Scheduled on a 7-day work week calendar.
4. Use "one calendar day" as the unit of time. Proposed durations assigned to each activity will be the Contractor's best estimate of time required to complete the activity considering the scope and resources planned for the activity. However, activity durations and / or dates must not be resource driven.

E. Logic Network:
1. Include all constraints, phasing or Work restrictions indicated in the Contract Documents.
2. All activity start and finish ends must be tied into the Schedule by logical restraints. The Schedule must only contain two (2) open ended activities: NTP with no predecessor relationship, and the latest completion Milestone with no successor relationship.
3. All activities requiring time to complete must be included in the Schedule as an activity (Cure time, or similar activities).
4. The Schedule must not include any Start-to-Finish relationships.
5. Finish-to-start relationships are permitted to have negative lags, but in no case shall positive lags be permitted. Lags in Start-to-Start or Finish-to-Finish relationships must not exceed the duration of the predecessor or successor activity, respectively.
6. The Schedule's Longest Critical Path must be comprised of the anticipated controlling operations, which are most significant in nature and are key for completing the Work per the Milestone dates.
7. The number of critical and near critical activities must be kept to a minimum and must not exceed thirty (30) percent. A near Critical Activity is one who's Total Float value is less than twenty (20) Calendar Days.
8. With the exception of Milestones, the use of constraints that override Schedule calculated early or late dates shall not be allowed.
9. Acceptance of the Schedule shall not preclude County from later rejecting what it deems to be float suppression. Correction of float suppression must be a prerequisite for consideration of any Milestone adjustment.
10. The use of Float and Free Float shall be requested in writing by the Contractor and shall be approved by the County.

F. Weather:
1. Normal inclement weather conditions, also referred to as anticipated weather days, will be considered and included in the planning and scheduling of all Work influenced by high or low ambient temperatures, wind, and / or precipitation to ensure completion of all Work within the Contract Time.
2. Normal inclement weather conditions have been determined by an assessment of average historical climatic conditions using the preceding ten (10) year records published by the National Ocean and Atmospheric Administration (NOAA). Adverse weather conditions shall be considered only as those conditions that exceed the average annual number of rain days and rain quantities for the project area.
3. Include a critical path activity titled "Inclement Weather Days" in the Contract Schedule, to account for the anticipated weather conditions. This activity shall have an initial duration

equal to 2-calendar days for each month of Contract time. The Inclement Weather Days activity shall be the last activity in the schedule prior to the Project finish milestone. All predecessor activities must pass through the Inclement Weather Days activity.

4. The Contractor shall apply to the County to use an Inclement Weather Day when a critical path activity has been delayed because of inclement weather. An Inclement Weather Delay day is defined as when the weather or effect thereof prevents the Contractor from working on the current critical path with at least 75% of its normal work force for more than 50% of the normal workday. The Contractor must apply for use of Inclement Weather Days in the same month as the inclement weather delay. The County shall determine if the Contractor's request for use of Inclement Weather Days is approved or denied. The Inclement Weather Days activity shall not be updated with an actual start, actual finish date, or percentage of completion. Rather, it is a graphical accounting tool where the original duration shall be reduced by the agreed to weather impact.
5. Inclement Weather Delays to non-critical activities shall not be the basis for adjustment under this Paragraph. If, at Completion, there are inclement weather days remaining, the Completion date shall not be adjusted. If, at completion, additional inclement weather days are required, the County shall adjust the Completion date accordingly by Contract Change Order. Any time extension granted the Contractor due to inclement weather delays shall be in the form of excusable non-compensable days.
6. No time extensions shall be allowed due to inclement weather unless it impacts the Contract Time as demonstrated by a Time Impact Analysis prepared in accordance with Paragraph 1.14 of this Section.
7. Work must be planned to minimize the impact of rain and include the grading of the Work area, installation of dewatering pumps and provision of covers.
8. Keep drainage and dewatering systems operable 24 hours per Day and 7 Days each week throughout construction.

G. Reports: for the Preliminary Contract and Contract Schedules, Update and Revision schedule submissions, provide:
   1. An electronic copy of the Schedule in P6 format, and labeled to comply with requirements for submittals. Include type of Schedule (Preliminary Contract, Contract Schedule, Update or Revision), revision number and date on label.
   2. Narrative explaining:
      a. The Schedule's general plan, sequencing and major crew rotation.
      b. Work restrictions and / or constraints accounted for in the Schedule.
      c. Adequate substantiation of critical and near-critical activities, identifying those to be performed by County.
      d. The anticipated impact of weather delays on and how it has been accounted for in the Schedule.
      e. Assumptions used for activity durations, assumptions regarding crew sizes, equipment requirements and production rates.
      f. Any potential areas of concern or specific areas requiring coordination it may have identified.
      g. Any long-lead time materials or equipment in the Work.
   3. Activity Table grouped by WBS and sorted by Early Finish, including Activity ID, Activity Name, Original Duration, Early & Late dates, Total Float, Calendar together with a color coded Gantt Chart (Red being Longest Critical Path, Green Being non-critical) showing logic links.
   4. Same report as described above, filtered for the Longest Critical Path activities only.
   5. Activity Table including Activity ID, Activity Name, Original Duration, Start & Finish dates, Total Float, and Responsibility Code together with a color coded Gantt Chart.

1.10 UPDATE OF SCHEDULE

A. Update pertains to, and is limited to, the posting of actual progress of all activities.

B. Logic changes, addition or deletion of activities, modifications to activity original durations are all considered Schedule revisions and must be submitted separately in a Schedule Revision request. Provide a schedule document which superimposes the revised schedule over the original base schedule.

C. On a monthly basis, the Contractor must meet with the County for the purpose of updating the Schedule. This updating process will be performed by County and Contractor making an assessment of Schedule activity progress during a joint Project Site walkthrough with County's representative.

D. Consistent with information recorded during the joint Project Site walkthrough, the Schedule must be updated with:
   1. Actual Start and Actual Finish dates, consistent with dates provided by the Contractor's Daily Reports.
   2. Actual Start and Finish dates inserted into the Schedule must only be based on the activity's physical progress.
   3. Activity Physical Percent Complete, based on the actual progress of the activity through the update Data Date.
   4. Activity Remaining Duration and Duration Percent Complete.

E. In addition to these monthly updates, interim updates may be performed on the Contract Schedule at the discretion of County. Upon request, the Contractor must provide such update data to County as required to complete these updates.

F. Logical relationships between activities performed out of sequence during the month of the schedule update, must be adjusted after their completion to reflect the actual sequence and must be identified in the accompanying narrative report. Sequence revisions occurring beyond the Update's data date must be submitted to the County Representative.

G. As requested by County, executed Proposed Change Orders must be added to the Schedule Updates at an appropriate level of detail, consistent with the executed Proposed Change Order

H. The Schedule update calculations must:
   1. Retain the existing logic relationships when activities start or finish out-of-sequence. The use of "Progress Override" is prohibited;
   2. Not be resource leveled. Activity dates and durations must not be driven by assigned resources;
   3. Dissociate remaining duration from activity's Physical Percent Complete.

I. Neither acceptance, nor lack of County's comment on a Schedule Update that shows late completion will modify the Contract Time or Milestones.

J. Approved schedule revision requests and comments provided by County representative on the preceding month's update must be incorporated into the schedule.

K. Upon finalization of the computerized Schedule update, the Contractor must submit the following reports for the processing of the Contractor's payment application:
   1. An electronic copy of the Schedule Update in P6 format.

2. Activity Table including Activity ID, Activity Name, Original Duration, Remaining Duration, Physical Percent Complete, Start (Early or Actual Start), Finish (Early or Actual Finish), Total Float, together with a color coded Gantt Chart showing logic links.
3. Activity Table and Gantt Chart including Activity ID, Activity Name, Original Duration, Remaining Duration, latest Accepted Contract Schedule Start / Finish Dates & Total Float, current update Start / Finish dates & Total Float, and Finish Variance. Activity Table must show subtotals per major area and Grand Totals.
4. Narrative report describing:
    a. Actual Work performed during the reporting period.
    b. Any areas of concern, current or anticipated Schedule impacts and proposed corrective actions to mitigate those impacts.
    c. Corrected out-of-sequence occurrences in addition to any changes or deviations from the planned sequence as reflected in the Accepted Contract Schedule.
    d. Proposed revisions, including added or deleted Work that will be submitted before the next schedule update via a schedule revision request.
    e. The current Schedule's critical path Work and any changes thereto from the previous update. Review of Contractor's interface and coordination with other Work on the Project.
    f. A list of major construction equipment used on the Work during the reporting period and any construction equipment idle during the reporting period.
    g. A total number of labor by craft actually engaged on the Work during the reporting period, with such total stated separately as to office, supervisory, and direct labor per subcontractor.
5. The current status of long lead items and equipment and critical material deliveries.

1.11 REVISED CONTRACT SCHEDULE

A. Updating the Contract Schedule to reflect actual progress will not be considered revisions to the Contract Schedule.

B. If, as a result of the monthly Schedule Update, the Contract Schedule no longer represents the actual prosecution and progress of the Work, or if County believes further Schedule detailing is necessary, upon County's request, the Contractor must propose a Revised Contract Schedule, within ten (10) Calendar Days.

C. The Contractor may also request revisions to the Accepted Contract Schedule in the event the Contractor's planned performance methods are revised. If revisions to the Accepted Contract Schedule are contemplated, the Contractor must submit the proposed changes along with a written narrative of the proposed changes. If accepted by County, these changes will be incorporated into the Contract Schedule.

D. Schedule revisions must be submitted utilizing a copy of the most recent Accepted Contract Schedule update as modified with proposed changes; a narrative explanation of the change(s); and a copy of a detailed comparison with the most recent County Accepted Contract Schedule update detailing all proposed changes.

E. Upon acceptance, the revised Contract Schedule becomes the Accepted Contract Schedule and the basis for evaluating future, status, impacts, and / or changes.

1.12 RECOVERY SCHEDULE

A. If the Engineer determines that Contractor's progress is not sufficient to achieve completion of Work within the Milestone dates or any adjustments thereof, County Representative may order the Contractor to do any or all of the following, at no cost to County:
   1. Furnish a plan and / or recovery Schedule, in Contract Schedule format, for improving progress and recovering the Contractor delays.
   2. Take steps as necessary to improve progress and advise County Representative thereof in writing.
   3. Increase the personnel employed, add overtime operations, increase the number of shifts per Day, increase the capaCounty of construction equipment and plants, change sequence of operations, change methods of operation, or take other steps to improve progress and recover the Contractor's delays.

B. An order pursuant to the above shall not be considered an order for Acceleration.

1.13 SHORT INTERVAL SCHEDULE:

A. The Contractor must submit, on a weekly basis, a progress Schedule, hereinafter referred to as Short Interval Schedule, listing the activities in progress or completed during the previous week and the activities Scheduled for the succeeding three (3) weeks.

B. The Short Interval Schedule must be generated out of the Contract Schedule and include further details to provide a day-to-day plan of upcoming Work. All activities shown in this short interval Schedule must be identified by a corresponding Activity ID and Activity Description as shown in the Accepted Contract Schedule.

1.14 TIME IMPACT ANALYSIS

A. In the event the Contractor encounters an excusable delay and intends to submit a request for time extension, the Contractor must furnish a Time Impact Analysis illustrating the impact of the change or delay on the Milestone durations. The Time Impact Analysis must be prepared in accordance with the requirements set forth below:
   1. The impact must be represented by a sub-network of activities, hereinafter referred to as the Impact Fragnet that represents the scope of the change or delay.
   2. The impact fragnet will be inserted into a copy of the latest Accepted Contract Schedule update prior to the onset of the impact's effect on the schedule. Said copy is defined as the "Impacted Schedule".
   3. The impact fragnet must tie into the existing schedule activities that are immediately impacted by the change or delay. Every reasonable effort to mitigate the potential delay by either isolating its impact or planning "work-around" approaches to the Work must be considered and incorporated where deemed effective.
   4. The Impacted Schedule must be calculated compared to the original Accepted Contract Schedule update used for the analysis to quantify the extent of the time adjustment due the Contractor.
   5. The delay demonstrated by the Impacted Schedule must not exceed actual delay when the analysis is performed after the fact. The Impact Schedule must incorporate all actual dates and durations known as at the time of its submittal.
   6. Correction of float suppression in the Impacted Schedule, as may be determined by County, may be a condition precedent to any time adjustment determination. No time extension will be awarded unless the delay: 1) impacts the Longest Critical Path, 2) consumes all available Total Float of the Longest Critical Path whether expressly indicated by the Schedule or embedded in the remaining activity durations and / or sequence, and 3) extends the remaining performance period beyond the Project Milestone date(s).

7. The Contractor must provide adequate justification for the Impact Fragnet durations and linkages to the schedule activities. The Impacted Schedule, along with a narrative describing the foregoing must be submitted to County for review.
8. If approved, the impact fragnet will become a permanent part of the Accepted Contract Schedule. The Contractor shall not unilaterally make changes to the Accepted Contract Schedule to justify impacts without the approval of County.
9. County shall not have any obligation to consider any time extension request unless the requirements of this Section are met. County shall not be responsible or liable to Contractor for any constructive acceleration due to failure of County to grant time extensions should Contractor fail to substantially comply with the submission requirements and the justification requirements of this Contract for time extension requests.
10. If the Contractor is requesting compensation for the delay, the TIA must demonstrate lack of concurrency with other non-excusable or non-compensable critical delays. To establish entitlement to compensation, all activity paths and their respective float must be examined. The Contractor must clearly demonstrate that but-for the County caused delay, the Contractor could have finished the Work in accordance with the approved Contract Time.

1.15 AS-BUILT SCHEDULE

A. As a condition precedent to the release of retention and making final payment, submit an "As-Built Schedule," as the last Schedule update showing all activities at 100 percent completion and indicating Actual Start and Finish Dates. This Schedule must reflect the sequence in which the Project was actually constructed.

END OF SECTION

SECTION 01 33 00 - SUBMITTAL PROCEDURES

PART 1. - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section includes administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other miscellaneous submittals.

1.03 DEFINITIONS

A. Action Submittals: Written and graphic information that requires Architect's and Construction Manager's responsive action.

B. Informational Submittals: Written information that does not require Architect's and Construction Manager's approval. Submittals may be rejected for not complying with requirements.

1.04 SUBMITTAL PROCEDURES

A. General: All documents transmitted for purposes of administration of the Contract are to be in electronic (PDF) format and transmitted via e-mail to the Engineer. File numbering and descriptions to be defined by the Engineer. This procedure applies to requests for information (RFIs), progress documentation, contract modification documents (e.g. supplementary instructions, change proposals, change orders), applications for payment, field reports and meeting minutes, and any other document any participant wishes to make part of the Project record. This electronic document requirement does not apply to samples or color selection charts.

B. Electronic copies of CAD Drawings of the Contract Drawings will not be provided by Architect for Contractor's use in preparing submittals.

C. Coordination: Coordinate preparation and processing of submittals with performance of construction activities, so as to not impact the project schedule.
   1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
   2. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.
      a) Architect and Construction Manager reserve the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

D. Submittals Schedule: Contractor shall submit, within ten (10) calendar days of the Notice to Proceed, an itemized listing of all required submittals, in spreadsheet format acceptable to Engineer, with a scheduled date for when each submittal is projected to be submitted. The schedule of submittals shall provide adequate time between submittals in order to allow for proper review without negative impact to the Construction Schedule. Contractor shall revise, update and submit submittal schedule to Engineer on the first of each month, or as required by the County.

E. Processing Time: Allow enough time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Construction Manager's receipt of submittal.
   1. Initial Review: Allow 21 calendar days for initial review of each submittal. Allow additional time if processing must be delayed to permit coordination with subsequent submittals. Construction Manager will advise Contractor when a submittal being processed must be delayed for coordination.
   2. If intermediate submittal is necessary, process it in same manner as initial submittal.
   3. Allow 21 calendar days for processing each resubmittal.
   4. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing.

F. Identification: Place a permanent label or title block on each submittal for identification. Contractor to include a cover sheet, as the first page of each .pdf submittal file, that includes at a minimum the following information:
   1. Indicate name of firm or entity that prepared each submittal on label or title block.
      a) Project name.
      b) Date.
      c) Name and address of Contractor.
      d) Name and address of subcontractor.
      e) Name and address of supplier.
      f) Name of manufacturer.
      g) Submittal #, including revision number, as defined by Engineer. Submittal package #'s to be sequential, as submitted, and include applicable Specification Section (Ex: 001-03 30 00)
      h) Number and title of appropriate Specification Section and sub-sections
      i) Drawing number and detail references, as appropriate.
      j) Other necessary identification.
      k) Include area for Architect/Engineer stamp recording action taken
      l) Include Contractor's Certification stamp stating that the information submitted has been reviewed, checked and coordinated with the requirements of the Contract Documents and other submittals.

G. Deviations: Highlight, encircle, or otherwise identify deviations from the Contract Documents on submittals. Substitutions are to be clearly identified and submitted in accordance with section 01 2500.

H. Additional Copies: Up to (6) paper copies of submittals are to be provided by Contractor, but only upon request of the Engineer.
   1. Additional copies submitted for maintenance manuals will not be marked with action taken and will be returned.

I. Transmittal: Package each submittal individually and appropriately for transmittal and handling. Transmit each submittal using a transmittal or cover form. Architect and Construction Manager will return submittals, without review, received from sources other than Contractor.
   1. On an attached separate sheet, prepared on Contractor's letterhead, record relevant information, requests for data, revisions other than those requested by Architect and Construction Manager on previous submittals, and deviations from requirements of the Contract Documents, including minor variations and limitations. Include the same label information as the related submittal.
   2. Include Contractor's certification stating that information submitted complies with requirements of the Contract Documents.

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

K. Use for Construction: Use only final submittals with mark indicating action taken by Architect and Construction Manager in connection with construction.

PART 2. - PRODUCTS

2.01 ACTION SUBMITTALS

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

B. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment. Submit all products required by a specific specification section, in one submittal. Clearly indicate on cover sheet or transmittal, the specification sub-section and description of each of the products included in the submittal.
   1. If information must be specially prepared for submittal because standard printed data are not suitable for use, submit as Shop Drawings, not as Product Data.
   2. Mark each copy to show or delineate pertinent materials, products, models, applicable choices, or options specific to this project. Where Product Data includes information on several products that are not required, clearly mark copies to indicate the applicable information applicable only to this project. Include the following information, as applicable:
      a) Manufacturer's written recommendations.
      b) Manufacturer's product specifications.
      c) Manufacturer's installation instructions.
      d) Color charts.
      e) Manufacturer's catalog cuts.
      f) Wiring diagrams showing factory-installed wiring.
      g) Printed performance curves.
      h) Operational range diagrams.
      i) Mill reports.
      j) Standard product operating and maintenance manuals.
      k) Compliance with recognized trade association standards.
      l) Compliance with recognized testing agency standards.
      m) Application of testing agency labels and seals.
      n) Notation of coordination requirements.

C. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not reproduce Contract Documents or copy standard information as the basis of Shop Drawings. Copies of the Contract Drawing marked to show Shop Drawing information are not acceptable and will not be reviewed and shall be promptly returned to the Contractor.
   1. Preparation: Include the following information, as applicable:
      a) Dimensions.
      b) Identification of products.
      c) Fabrication and installation drawings.
      d) Roughing-in and setting diagrams.
      e) Wiring diagrams showing field-installed wiring, including power, signal, and control wiring.
      f) Shop work manufacturing instructions.
      g) Templates and patterns.
      h) Schedules.
      i) Design calculations.
      j) Compliance with specified standards.

k) Notation of coordination requirements.
l) Notation of dimensions established by field measurement.

2. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches (215 by 280 mm) but no larger than 30 by 40 inches (750 by 1000 mm).

D. Samples: Prepare physical units of materials or products, including the following:
1. 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.
2. 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.

2.02 INFORMATIONAL SUBMITTALS

A. General: Prepare and submit Informational Submittals required by other Specification Sections.
1. Certificates and Certifications: Provide a notarized statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.
2. Test and Inspection Reports: Comply with requirements in Division 1 Section "Quality Requirements."

B. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements. Submit record of Welding Procedure Specification (WPS) and Procedure Qualification Record (PQR) on AWS forms. Include names of firms and personnel certified.

C. Material Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements.

D. Field Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, 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.

E. Maintenance Data: Prepare written and graphic instructions and procedures for operation and normal maintenance of products and equipment. Comply with requirements in Division 1 Section "Closeout Procedures Operation and Maintenance Data."

F. Insurance Certificates and Bonds: Prepare written information indicating current status of insurance or bonding coverage. Include name of entity covered by insurance or bond, limits of coverage, amounts of deductibles, if any, and term of the coverage.

PART 3. - EXECUTION

3.01 CONTRACTOR'S REVIEW

A. Review each submittal and check for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect and Construction Manager.

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

3.02 ARCHITECT'S AND CONSTRUCTION MANAGER'S ACTION

A. General: Architect and Construction Manager will not review submittals that do not bear Contractor's approval stamp and will return them without action.
   1. Action Submittals: Architect and Construction Manager will review each submittal, make marks to indicate corrections or modifications required, and return it. Architect and Construction Manager will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action taken.

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

END OF SECTION

SECTION 01 40 00 QUALITY REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES
- A. References and standards.
- B. Quality assurance submittals.
- C. Mock-ups.
- D. Control of installation.
- E. Inspection services.
- F. Manufacturers' field services.

1.02 RELATED REQUIREMENTS

- A. Section 01 60 00 - Product Requirements: Requirements for material and product quality.

1.03 REFERENCE STANDARDS
- A. ASTM C1021 - Standard Practice for Laboratories Engaged in Testing of Building Sealants; 2008 (Reapproved 2014).
- B. ASTM C1077 - Standard Practice for Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation; 2014.
- C. ASTM C1093 - Standard Practice for Accreditation of Testing Agencies for Masonry; 2013.
- D. ASTM D3740 - Standard Practice for Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction; 2012a.
- E. ASTM E329 - Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection; 2014a.
- F. ASTM E543 - Standard Specification for Agencies Performing Nondestructive Testing; 2013.
- G. IAS AC89 - Accreditation Criteria for Testing Laboratories; 2010.
- H. Title 24 CCR, Part 1: Continuous inspection, Section 4-333
- I. CBC Chapter 17A - California Building Code Structural Testing and Inspection

1.04 SUBMITTALS
- A. Testing Agency Qualifications: As approved by the County.
- B. Test Reports: After each test/inspection, promptly submit two copies of report to Engineer and to Contractor.
  1. Include:
     - a. Date issued.
     - b. Project title and number.
     - c. Name of inspector.
     - d. Date and time of sampling or inspection.
     - e. Identification of product and specifications section.
     - f. Location in the Project.
     - g. Type of test/inspection.
     - h. Date of test/inspection.
     - i. Results of test/inspection.
     - j. Conformance with Contract Documents.
     - k. When requested by Engineer, provide interpretation of results.
  2. Test report submittals are for Engineer's knowledge as Contract administrator for the limited purpose of assessing conformance with information given and the design concept expressed in the Contract documents, or for Engineer’s information.
- C. Certificates: When specified in individual specification sections, submit certification by the manufacturer and Contractor or installation/application subcontractor to Engineer, in quantities specified for Product Data.
  1. Indicate material or product conforms to or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.

2. Certificates may be recent or previous test results on material or product, but must be acceptable to Engineer.

D. Manufacturer's Instructions: When specified in individual specification sections, submit printed instructions for delivery, storage, assembly, installation, start-up, adjusting, and finishing, for the County's information. Indicate special procedures, perimeter conditions requiring special attention, and special environmental criteria required for application or installation.

E. Manufacturer's Field Reports: Submit reports for Engineer's benefit as Contract administrator for County.
   1. Submit report in duplicate within 30 Calendar Days of observation to Engineer for information.
   2. Submit for information for the limited purpose of assessing conformance with information given and the design concept expressed in the Contract documents.

1.05 REFERENCES AND STANDARDS

A. For products and Workmanship specified by reference to a document or documents not included in the Specifications, also referred to as reference standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.

B. Conform to reference standard of date of issue current on date of Contract Documents, except where a specific date is established by applicable code.

C. Obtain copies of standards where required by product specification sections.

D. Maintain copy at Project site during submittals, planning, and progress of the specific Work, until Substantial Completion.

E. Should specified reference standards conflict with Contract Documents, request clarification from Engineer before proceeding.

F. Neither the Contractual relationships, duties, and responsibilities of the parties in Contract nor those of Engineer shall be altered from the Contract Documents by mention or inference otherwise in any reference document.

1.06 TESTING AND INSPECTION AGENCIES

A. County will employ and pay for services of an independent testing agency (Agency) to perform special inspections required by the 2016 California Building Code Chapter 17 Part 2 Volume 2 Structural Test and Special Inspections. All other testing and inspection shall be provided by Contractor unless otherwise noted.

B. Employment of Agency in no way relieves Contractor of obligation to perform Work in accordance with requirements of Contract Documents.

PART 2 PRODUCTS - NOT USED PART 3 EXECUTION

3.01 CONTROL OF INSTALLATION

A. Monitor quality control over suppliers, manufacturers, products, services, site conditions, and Workmanship, to produce Work of specified quality.

B. Comply with manufacturers' instructions, including each step in sequence.

C. Should manufacturers' instructions conflict with Contract Documents, request clarification from Engineer before proceeding.

D. Comply with specified standards as minimum quality for the Work except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise Workmanship.

E. Have Work performed by persons qualified to produce required and specified quality.

F. Verify that field measurements are as indicated on shop drawings or as instructed by the manufacturer.

G. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, and disfigurement.

3.02 MOCK-UPS

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

3.03 TESTING AND INSPECTION

A. Testing Agency Duties:
   1. Test samples of mixes submitted by Contractor.
   2. Provide qualified personnel at site. Cooperate with Engineer and Contractor in performance of services.
   3. Perform specified sampling and testing of products in accordance with specified standards.
   4. Ascertain compliance of materials and mixes with requirements of Contract Documents.
   5. Promptly notify Engineer and Contractor of observed irregularities or non-conformance of Work or products.
   6. Perform additional tests and inspections required by Engineer.
   7. Attend preconstruction meetings and progress meetings.
   8. Submit reports of all tests/inspections specified.

B. Limits on Testing/Inspection Agency Authority:
   1. Agency may not release, revoke, alter, or enlarge on requirements of Contract Documents.
   2. Agency may not approve or accept any portion of the Work.
   3. Agency may not assume any duties of Contractor.
   4. Agency may not stop the Work without authorization from County.

C. Contractor Responsibilities:
   1. Deliver to Agency at designated location, adequate samples of materials proposed to be used that require testing, along with proposed mix designs.
   2. Cooperate with laboratory personnel, and provide access to the Work and to manufacturers' facilities.
   3. Provide incidental labor and facilities:
      a. To provide access to Work to be tested/inspected.
      b. To obtain and handle samples at the site or at source of Products to be tested/inspected.
      c. To facilitate tests/inspections.
      d. To provide storage and curing of test samples.
   4. Notify Engineer and laboratory 48 hours prior to expected time for operations requiring testing/inspection services.
   5. Employ services of an independent qualified testing laboratory and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.
   6. Arrange with County's Agency and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.

D. Re-testing required because of non-conformance to specified requirements shall be performed by the same agency on instructions by Engineer.

E. Re-testing required because of non-conformance to specified requirements shall be paid for by Contractor.

3.04 MANUFACTURERS' FIELD SERVICES

A. When specified in individual specification sections, require material or product suppliers or manufacturers to provide qualified staff personnel to observe site conditions, conditions of surfaces and installation, quality of Workmanship, start-up of equipment, test, adjust and balance of equipment as applicable, and to initiate instructions when necessary.

B. Report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.

3.05 DEFECT ASSESSMENT

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

END OF SECTION

SECTION 01 50 00 TEMPORARY FACILITIES AND CONTROLS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Temporary utilities.
B. Temporary telecommunications services.
C. Temporary sanitary facilities.
D. Temporary Controls: Barriers, enclosures, and fencing.
E. Security requirements.
F. Vehicular access and parking.
G. Waste removal facilities and services.
H. Project temporary signs
I. Field offices.
J. Traffic Control
K. Removal of utilities, facilities, and controls
L. Areas of use
M. Public Safety
N. Traffic stripes, pavement markings, and pavement markers
O. Dust control
P. Maintaining traffic
Q. Traffic control systems and payment
R. Noise control

1.02 QUALITY ASSURANCE

A. Standards: Comply with ANSI A10.6, NECA's "Temporary Electrical Facilities," and NFPA 241

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

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

1.03 TEMPORARY UTILITIES

A. Provide and pay for all electrical power, lighting, water, heating and cooling, ventilation, and janitorial service and supplies required for construction purposes.
B. Use trigger-operated nozzles for water hoses, to avoid waste of water.
C. Provide required conduit and infrastructure for temporary power, telephone, and fiber at staging area (eastern staff parking lot) per PG&E requirements. PG&E flat rate for up to 150ft distance on site. Coordinate with PG&E. Contractor to include in bid remaining infrastructure beyond 150ft to extend to staging area.

1.04 TELECOMMUNICATIONS SERVICES

A. Provide equipment and connections for Contractor’s and Engineer’s field offices.
B. Telecommunications services shall include:
    1. One (1) networkable color printer/scanner/copier with a minimum of 25 pages per minute color print speed. Must be capable of printing 11 x 17
    2. Telephone Land Lines: two lines, minimum; one handset per line.
    3. Internet Connection: High speed data connection adequate to serve Project needs.

1.05 TEMPORARY SANITARY FACILITIES

A. Provide and maintain required sanitary facilities and enclosures.
B. Provide at time of Project mobilization.
C. Provide sanitary facilities within each office trailer where office trailer is provided.
D. Maintain daily in clean and sanitary condition.
E. At end of construction, return facilities to same or better condition as originally found.

1.06 BARRIERS

A. Provide barriers with key pad to prevent unauthorized entry to construction areas, to prevent access to areas that could be hazardous to Workers or the public and to protect existing facilities and adjacent properties from damage from construction operations and demolition.
B. Provide barricades and covered walkways required by governing authorities for public rights-of-way and for public access to existing building.
C. Provide protection for plants designated to remain. Replace damaged plants.
D. Protect non-owned vehicular traffic, stored materials, site, and structures from damage.
E. Traffic Controls: As needed per local authorities.

1.07 FENCING

A. Provide 6 foot (1.8 m) high fence around Project limits of construction site. Equip fence with vehicular and pedestrian gates with locks. Provide heavy duty polyethylene privacy screen on fence at entire perimeter of Project limits in color as selected by County. County reserves right to install graphics and other overlay banner on fence.

1.08 EXTERIOR ENCLOSURES

A. Provide temporary weather tight closure of exterior openings to accommodate acceptable Working conditions and protection for Products, to allow for temporary heating and maintenance of required ambient temperatures identified in individual specification sections, and to prevent entry of unauthorized persons. Provide access doors with self-closing hardware and locks.

1.09 SECURITY

A. Provide security and facilities to protect Work, and County's operations from unauthorized entry, vandalism, or theft.

1.010 VEHICULAR ACCESS AND PARKING

A. Comply with regulations relating to use of streets and sidewalks, access to emergency facilities, and access for emergency vehicles.
B. Coordinate access and haul routes with governing authorities and Engineer.
C. Provide and maintain access to fire hydrants, free of obstructions.
D. Provide means of removing mud from vehicle wheels before entering streets.
E. Provide dust-control treatment that is nonpolluting and non-tracking. Reapply treatment as required to minimize dust.
F. Provide temporary parking areas to accommodate construction personnel. When site space is not adequate, provide additional off-site parking.

1.011 WASTE REMOVAL

A. See Section 01 7419 - Construction Waste Management and Disposal, for additional requirements.
B. Provide waste removal facilities and services as required to maintain the site and all temporary facilities in clean and orderly condition.
C. Provide containers with lids. Remove trash from site weekly or as needed.
D. If materials to be recycled or re-used on the Project must be stored on-site, provide suitable non-combustible containers; locate containers holding flammable material outside the structure unless otherwise approved by the authorities having jurisdiction.

1.012 PROJECT TEMPORARY SIGNS – as needed or required by the Engineer

1.013 FIELD OFFICES

A. Field office trailer to be located at the proposed east staff parking lot.
B. Provide a separate private 12’x60’ field office trailer for use by County Engineer: Weathertight, with lighting, electrical outlets, heating, cooling equipment, and equipped with sturdy furniture, drawing rack and drawing display table. Provide all permits and necessary power, water,

sanitary utilities and high-speed internet service for a fully operational field office trailer. Provide submittal of proposed trailer and equipment for approval by Engineer.

C. Field office trailer to include (2) offices, one on each end of the trailer, and space in between for Project meetings, with table and chairs to accommodate 10 persons.
D. In addition to other requirements of this section, provide:
    1. Two (2) desk workstations, each with a chair acceptable to Engineer, one for each office
    2. One (1) networkable color printer/scanner/copier with a minimum of 25 pages per minute color print speed. Must be capable of printing 11 x 17.
    3. Three (3) 3-high lateral file cabinets.
    4. One (1) 5'x3' white board
    5. Conference table and chairs for 10
    6. Plan table
    7. Water cooler and refill service.
    8. Microwave oven.
    9. Restroom in office trailer.
E. Locate offices a minimum distance of 30 feet (10 m) from existing and new structures.
F. Provide full janitorial services as needed to keep facility clean. Provide and maintain expendable janitorial supplies including, but not limited to:
    1. Toilet paper.
    2. Toilet seat cover.
    3. Paper hand towels.
    4. Hand soap.
F. Remove trash and dispose in accordance with 1.11 Waste Removal above.

1.014 REMOVAL OF UTILITIES, FACILITIES, AND CONTROLS

A. Remove temporary utilities, equipment, facilities, and materials, prior to Final Application for Payment inspection.
B. Clean and repair damage caused by installation or use of temporary Work.
C. Restore existing facilities used during construction to original condition.
D. Restore new permanent facilities used during construction to specified condition.

1.015 AREAS OF USE

A. The highway right-of-way shall be used only for purposes that are necessary to perform the required work. The Contractor shall not occupy the right-of-way, or allow others to occupy the right-of-way, for purposes which are not necessary to perform the required work except as provided below.
B. Use of the Contractor's work areas and other County-owned property shall be at the Contractor's own risk, and the County shall not be held liable for any damage to or loss of materials or equipment located within such areas.
C. The Contractor shall obtain encroachment permits prior to occupying County-owned parcels outside the contract limits. The required encroachment permits may be obtained from the Department of Public Works. No fee will be assessed.
D. The Contractor shall remove all equipment, materials and rubbish from the work areas and other County-owned property which it occupies and shall leave the areas in a clean, presentable condition.
E. Personal vehicles must not be parked on the traveled way or shoulders, including sections closed to traffic.

1.016 PUBLIC SAFETY

A. Comply with sections 7-1.04 and 12-4.02 of the Cal Trans Standard Specifications and these provisions.Install temporary railing (Type K) between any lane carrying public traffic and any excavation, obstacle, or storage area when the following conditions exist:
    1. Excavations.--Any excavation near edge of the excavation is within 12-feet from the edge of the open traffic lane, except:
    2. Excavations covered with sheet steel or concrete covers of adequate thickness to prevent accidental entry by traffic or the public.

3. Excavations less than 0.15 feet deep.
4. Excavations in side slopes where the slope is steeper than 4:1.
5. Excavations protected by barrier or railing.
6. Temporarily Unprotected Permanent Obstacles.--Whenever the work includes the installation of a fixed obstacle together with a protective system, such as a sign structure together with protective railing and the Contractor elects to install the obstacle prior to installing the protective system; or whenever the Contractor, for its convenience and with permission of the Engineer, removes a portion of an existing protective railing at an obstacle and does not replace such railing complete in place during the same day.
7. Storage Areas.--Whenever material or equipment is stored within 12 feet of the lane and such storage is not otherwise prohibited by the specifications.
8. When traffic cones or delineators are used to delineate a temporary edge of traffic lane, the line of cones or delineators shall be considered to be the edge of traffic lane, however, the Contractor shall not reduce the width of an existing lane to less than 10 feet without written approval from the Engineer. The lane closure provisions of this section shall not apply if the work area is protected by permanent or temporary railing or barrier.
9. When work is not in progress on a trench or other excavation that required a lane closure, the traffic cones or portable delineators used for the lane closure shall be placed off of and adjacent to the edge of the traveled way. The spacing of the cones or delineators shall be not more than the spacing used for the lane closure.

B. One lane of traffic must be left open at all times on all roads.

1.017 TRAFFIC STRIPES, PAVEMENT MARKINGS, AND PAVEMENT MARKERS

A. Comply with section 10-1.02D of the Cal Trans Standard Specifications, the provisions in Article XVIII, "Order of Work," of the Contract and these provisions.
B. Upon completion of the Contractor's daily operations which obliterate pavement delineation (lane lines, either pavement markers or painted lane lines or both), such pavement delineation shall be replaced by temporary delineation. Temporary delineation shall consist of reflective traffic line tape applied in pieces not less than four (4) inches long nor less than four (4) inches wide spaced no more than twelve (12) feet apart on curves nor more than twenty-four (24) feet apart on tangents. Reflective traffic line tape shall be applied in accordance with the manufacturer's instructions. Temporary delineation shall be the same color as the permanent delineation. Full compensation for temporary delineation shall be considered as included in the prices paid for the contract items of work that obliterated the existing delineation and no separate payment will be made therefor.

1.018 DUST CONTROL

A. Comply with section 10-5 of the Cal Trans Standard Specifications and these provisions.
B. It is understood that the provisions in Section 10, "Dust Control," will not prevent the Contractor from applying water or dust palliative for its convenience if it so desires; however, the Contractor shall endeavor, whenever possible, to restrict the use of water to control dust for its convenience due to the ongoing need to conserve water.

1.019 MAINTAINING TRAFFIC

A. Comply with section 12-4 of the Cal Trans Standard Specifications, the County encroachment permit, and these provisions.
B. Whenever vehicles or equipment are parked on the shoulder within six (6) feet of a traffic lane, the shoulder area shall be closed with fluorescent traffic cones or portable delineators placed on a taper in advance of the parked vehicles or equipment and along the edge of the pavement at twenty-five (25) foot intervals to a point not less than twenty-five (25) feet past the last vehicle or piece of equipment. A minimum of nine (9) cones or portable delineators shall be used for the taper. A C23 (Road Work Ahead) or C24 (Shoulder Work Ahead) sign shall be mounted on a telescoping flag tree with flags. The flag tree shall be placed where directed by the Engineer.
C. A minimum of one traffic lane, not less than 10-feet wide, shall be open for use by public traffic. When construction operations are not actively in progress, not less than two such lanes shall be open to public traffic.

D. As directed by the Engineer when possible, the full width of the traveled way shall be open for use by public traffic on Saturdays, Sundays and designated legal holidays after 3:00 p.m. on Fridays and the day preceding designated legal holidays and when construction operations are not actively in progress.

1.020 TRAFFIC CONTROL SYSTEMS AND PAYMENT

A. Comply with sections 12 and 7-1.04 of the Cal Trans Standard Specifications and these provisions.
B. A traffic control system shall consist of closing traffic lanes in accordance with Section 12, "Temporary Traffic Control," of the Cal Trans Standard Specifications, the provisions under Section 12-4,"Maintaining Traffic" , and these provisions.
C. The provisions in this section will not relieve the Contractor from its responsibility to provide such additional devices or take such measures as may be necessary to comply with the provisions in Section 7-1.04, "Public Safety," of the Standard Specifications.
D. When lane closures are made for work periods only, at the end of each work period all components of the traffic control system, except portable delineators placed along open trenches or excavation adjacent to the traveled way, shall be removed from the traveled way and shoulder. If the Contractor so elects, said components may be stored at selected central locations, approved by the Engineer, within the limits of the County Road right-of-way.
E. Full payment for Traffic control system shown, including flaggers, changeable message signs, and signs is included payment for the bid items of work involved.
F. The Department pays for change order work for a traffic control system by force account for increased traffic control, as provided in Article VI of the Contract, and uses a force account analysis for decreased traffic control.
G. Care must be taken when working around signal loop detectors and conduits. If the signal is compromised, it must be repaired and replaced within 72 hours
H. During the hours of darkness, as defined in Division 1, Section 280, of the Vehicle Code, portable signs shall be, at the option of the Contractor, either illuminated signs in conformance with the provisions in Section 12-3.11B(3), "Portable signs", of the Standard Specifications; or Reflexite vinyl microprism reflective sheeting signs; or 3M high intensity reflectorized sheeting on aluminum substrate signs or Seibulite Brand Ultralite Grade Series, encapsulated lens retroreflective sheeting signs; or equal.
I. If any component in the traffic control system is displaced or ceases to operate or function as specified, from any cause, during the progress of the work, the Contractor shall immediately repair said component to its original condition or replace said component and shall restore the component to its original location.
J. When lane closures are made for work periods only at the end of each work period, all components of the traffic control system, except portable delineators placed along open trenches or excavation adjacent to the traveled way, shall be removed from the traveled way and shoulder. If the Contractor so elects, said components may be stored at selected central locations, approved by the Engineer, within the limits of the County road right-of-way.
K. Care must be taken when working around signal loop detectors and conduits. If the signal is compromised, it must be repaired and replaced within 72 hours.

1.021 NOISE CONTROL

A. Control and monitor noise resulting from work activities.
B. Do not exceed 86 dBA Lmax at 50 feet from the job site from 9:00 p.m. to 6:00 a.m. This requirement in no way relieves the Contractor from responsibility for complying with local ordinances regulating noise level.
C. Said noise level requirement applies to all equipment on the job or related to the job, including but not limited to trucks, transit mixers or transient equipment that may or may not be owned by the Contractor. The use of loud sound signals shall be avoided in favor of light warnings except those required by safety laws for the protection of personnel.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 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.

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

3.02 TEMPORARY UTILITY INSTALLATION

A. General: Engage appropriate local utility company to install temporary service or connect to existing service. Where utility company provides only part of the service, provide the remainder with matching, compatible materials and equipment. Comply with utility company recommendations. Contractor is required to provide power as required during all electrical service transfers and shutdowns.
   1. Arrange with utility company, and Owner for time when service can be interrupted, if necessary, to make connections for temporary services.
   2. Provide adequate capacity at each stage of construction. Before temporary utility is available, provide trucked-in services.
   3. Obtain easements to bring temporary utilities to Project site where Owner's easements cannot be used for that purpose.

B. Water Service: Install water service and distribution piping in sizes and pressures adequate for construction until permanent water service is in use. The Contractor is to supply water as required during shutdown of existing service during change-over.
   1. Provide rubber hoses as necessary to serve Project site.
   2. Where installations below an outlet might be damaged by spillage or leakage, provide a drip pan of suitable size to minimize water damage. Drain accumulated water promptly from pans.

C. Sanitary Facilities: Provide temporary toilets, wash facilities, and drinking-water fixtures. Comply with regulations and health codes for type, number, location, operation, and maintenance of fixtures and facilities.
   1. Disposable Supplies: Provide toilet tissue, paper towels, paper cups, and similar disposable materials for each facility. Maintain adequate supply. Provide covered waste containers for disposal of used material.
   2. Wash Facilities: Install wash facilities supplied with potable water at convenient locations for personnel who handle materials that require wash up. Dispose of drainage properly. Supply cleaning compounds appropriate for each type of material handled.

D. Electric Power Service: Provide weatherproof, grounded electric power service and distribution system of sufficient size, capacity, and power characteristics during construction period. Include meters, transformers, overload-protected disconnecting means, automatic ground-fault interrupters, and main distribution switchgear.
   1. Connect temporary service to power source, as directed by electric company officials.

E. Electric Distribution: Provide receptacle outlets adequate for connection of power tools and equipment.
   1. Provide waterproof connectors to connect separate lengths of electrical power cords if single lengths will not reach areas where construction activities are in progress. Do not exceed safe length-voltage ratio.

2. Provide warning signs at power outlets other than 110 to 120 V.

F. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations and traffic conditions.
   1. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.

G. Telephone Service: Provide temporary telephone service throughout construction period for common-use facilities used by all personnel engaged in construction activities. Install separate telephone line for each field office and first-aid station.
   1. Provide additional telephone lines for the following:

   2. At each telephone, post a list of important telephone numbers.
      a) Police and fire departments.
      b) Ambulance service.
      c) Contractor's home office.
      d) Architect's office.
      e) Owner's office.
      f) Principal subcontractors' field and home offices.
   3. Provide voice-mail service on superintendent's telephone.
      a) Provide telecommunications

A. 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.

B. Ventilation and Humidity Control: Provide temporary ventilation required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce ambient condition required and minimize energy consumption.

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

3.03 SUPPORT FACILITIES INSTALLATION

A. General: Comply with the following:
   1. Locate field offices, storage sheds, sanitary facilities, and other temporary construction and support facilities for easy access.
   2. Maintain support facilities until near Substantial Completion. Remove before Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to Owner.

B. Waste Disposal Facilities: Provide waste-collection containers in sizes adequate to handle waste from construction operations. Containerize and clearly label hazardous, dangerous, or unsanitary waste materials separately from other waste.
   1. If required by authorities having jurisdiction, provide separate containers, clearly labeled, for each type of waste material to be deposited.
   2. Develop a waste management plan for Work performed on Project. Indicate types of waste materials Project will produce and estimate quantities of each type. Provide detailed

information for on-site waste storage and separation of recyclable materials. Provide information on destination of each type of waste material and means to be used to dispose of all waste materials.

3.04 SECURITY AND PROTECTION FACILITIES INSTALLATION

A. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction in ways and by methods that comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects. Avoid using tools and equipment that produce harmful noise. Restrict use of noisemaking tools and equipment to hours that will minimize complaints from persons or firms near Project site.

B. Security Enclosure and Lockup: Install substantial temporary enclosure around partially completed areas of construction. Provide lockable entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security.

C. Barricades, Warning Signs, and Lights: Comply with standards and code requirements for erecting structurally adequate barricades. Paint with appropriate colors, graphics, and warning signs to inform personnel and public of possible hazard. Where appropriate and needed, provide lighting, including flashing red or amber lights.
   1. For safety barriers, sidewalk bridges, and similar uses, provide minimum 5/8-inch- (16-mm-) thick exterior plywood.

D. Temporary Fire Protection: Until fire-protection needs are supplied by permanent facilities, install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241.
   1. Provide fire extinguishers, installed on walls on mounting brackets, visible and accessible from space being served, with sign mounted above.
      a) Field Offices: Class A stored-pressure water-type extinguishers.
      b) Other Locations: Class ABC dry-chemical extinguishers or a combination of extinguishers of NFPA-recommended classes for exposures.
      c) Locate fire extinguishers where convenient and effective for their intended purpose; provide not less than one extinguisher on each floor at or near each usable stairwell.
   2. Store combustible materials in containers in fire-safe locations.
   3. Maintain unobstructed access to fire extinguishers, fire hydrants, temporary fire-protection facilities, stairways, and other access routes for firefighting. Prohibit smoking in hazardous fire-exposure areas.
   4. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition.
   5. Permanent Fire Protection: At earliest feasible date in each area of Project, complete installation of permanent fire-protection facility, including connected services, and place into operation and use. Instruct key personnel on use of facilities.
   6. Develop and supervise an overall fire-prevention and first-aid fire-protection program for personnel at Project site. Review needs with local fire department and establish procedures to be followed. Instruct personnel in methods and procedures. Post warnings and information.

3.05 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. Protect from damage caused by freezing temperatures and similar elements.

1. Prevent water-filled piping from freezing. Maintain markers for underground lines. Protect from damage during excavation operations.

C. Temporary Facility Changeover: Except for using permanent fire protection, as soon as available, 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 the property of Contractor. Owner reserves right to take possession of Project identification signs.
   2. At Substantial Completion, clean and renovate permanent facilities used during construction period. Comply with final cleaning requirements in Division 1 Section "Closeout Procedures."

END OF SECTION

SECTION 01 57 13 TEMPORARY EROSION AND SEDIMENT CONTROL

PART 1 GENERAL

1.01 SUMMARY

A. This section must comply with section 21-1 and 21-2 of the Cal Trans Standard Specifications and these provisions.
B. The work consists of applying three separate applications of erosion control materials to embankment slopes, excavation slopes and all other ground disturbed or exposed as a result of this project as designated by the Engineer.
C. Apply hydroseed with hydraulic spray equipment that mixes fiber, tackifier, fertilizer, seed, and other erosion control materials specified. Seed may be dry applied to small areas not accessible by hydroseeding equipment if authorized.
D. Add water to hydroseed materials as recommended by the manufacturer and mix sufficiently to ensure an even application. A dispersing agent may be added to the mixture if authorized.
E. Equipment must have a built-in continuous agitation and discharge system capable of producing a homogeneous mixture and a uniform application rate. The tank must have a minimum capacity of 1,000 gallons. A smaller tank may be used if authorized.
F. After the final application, do not allow pedestrians or equipment on the treated areas.

1.01 SECTION INCLUDES

A. Prevention of erosion due to construction activities.
B. Prevention of sedimentation of waterways, open drainage ways, and storm and sanitary sewers due to construction activities.
C. Restoration of areas eroded due to insufficient preventive measures.
D. Compensation of County for fines levied by authorities having jurisdiction due to non-compliance by Contractor.

1.02 RELATED REQUIREMENTS

A. Division 31 - Earthwork
B. Division 32 - Exterior Improvements
C. Section 03 3000 - Cast-in-Place Concrete: Concrete for temporary and permanent erosion control structures indicated on drawings.
D. Section 01 5723 - Storm Water Pollution Prevention

1.03 REFERENCE STANDARDS

A. ASTM D4355 - Standard Test Method for Deterioration of Geotextiles by Exposure to Light, Moisture, and Heat in a Xenon Arc Type Apparatus; current edition.
B. ASTM D4491 - Standard Test Methods for Water Permeability of Geotextiles by Permittivity; current edition.
C. ASTM D4533 - Standard Test Method for Trapezoid Tearing Strength of Geotextiles; current edition.
D. ASTM D4632 - Standard Test Method for Grab Breaking Load and Elongation of Geotextiles; current edition.
E. ASTM D4751 - Standard Test Method for Determining Apparent Opening Size of a Geotextile; current edition.
F. ASTM D4873 - Standard Guide for Identification, Storage, and Handling of Geosynthetic Rolls and Samples; current edition.
G. California State Water Resources Control Board, Construction General Permit; current edition.
H. California Stormwater Quality Association (CASQA), California Stormwater Best Management Practice (BMP) Handbook; current edition.
I. EPA (NPDES) - National Pollutant Discharge Elimination System (NPDES), Construction General Permit; current edition.
J. USDA TR-55 - Urban Hydrology for Small Watersheds; USDA Natural Resources Conservation Service; current edition.

1.04 PERFORMANCE REQUIREMENTS

A. Comply with all requirements of the State Water Resource Control Board (SWRCB) Construction General Permit (CGP) for erosion and sedimentation control.
B. Best Management Practices Standard: CASQA Storm water BMP Handbook.
C. Do not begin clearing, grading, or other Work involving disturbance of ground surface cover until applicable permits have been obtained; furnish all documentation required to obtain applicable permits.
    1. Contractor will obtain permits and pay for all fees as required by authority having jurisdiction.
    2. County will withhold payment to Contractor equivalent to all fines resulting from non-compliance with applicable regulations.
D. Timing: Put preventive measures in place as soon as possible after disturbance of surface cover and before precipitation occurs.
E. Storm Water Runoff: Control increased storm water runoff due to disturbance of surface cover due to construction activities for this Project.
1. Prevent runoff into storm and sanitary sewer systems, including open drainage channels, in excess of actual capacity or amount allowed by authorities having jurisdiction, whichever is less.

F. Erosion On Site: Minimize wind, water, and vehicular erosion of soil on Project site due to construction activities for these Project.
    1. Control movement of sediment and soil from temporary stockpiles of soil.
    2. Prevent development of ruts due to equipment and vehicular traffic.
    3. If erosion occurs due to non-compliance with these requirements, restore eroded areas at no cost to County.
G. Erosion Off Site: Prevent erosion of soil and deposition of sediment on other properties caused by water leaving the Project site due to construction activities for the Project.
    1. Prevent windblown soil from leaving the Project site.
    2. Prevent tracking of mud onto public roads outside site.
    3. Prevent mud and sediment from flowing onto sidewalks and pavements.
    4. If erosion occurs due to non-compliance with these requirements, restore eroded areas at no cost to County.
H. Sedimentation of Waterways On Site: Prevent sedimentation of waterways on the Project site, including rivers, streams, lakes, ponds, open drainage ways, storm sewers, and sanitary sewers.
    1. If sedimentation occurs, install or correct preventive measures immediately at no cost to County; remove deposited sediments; comply with requirements of authorities having jurisdiction.
    2. If sediment basins are used as temporary preventive measures, pump dry and remove deposited sediment after each storm.
I. Sedimentation of Waterways Off Site: Prevent sedimentation of waterways off the Project site, including rivers, streams, lakes, ponds, open drainage ways, storm sewers, and sanitary sewers.
    1. If sedimentation occurs, install or correct preventive measures immediately at no cost to County; remove deposited sediments; comply with requirements of authorities having jurisdiction.
J. Open Water: Prevent standing water that could become stagnant.
K. Maintenance: Maintain temporary preventive measures until permanent measures have been established.
L. Comply with Section 01 5723 - Storm Water Pollution Prevention.

1.05 SUBMITTALS
    A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
    B. Prepare Storm Water Pollution Prevention Plan (SWPPP) in conformance with Section 01 5723 - Storm Water Pollution Prevention.

PART 2 PRODUCTS

2.01 MATERIALS
    A. All erosion and sediment control materials shall be weed free.

B. Mulch: Use one of the following:
   1. Straw or hay.
   2. Erosion control matting or netting.
   3. Polyethylene film, where specifically indicated only.

C. Grass Seed For Temporary Cover:
   1. Seed mix must comply with:
   a. Seed Mix
   b.

Common Name	Pounds Pure Live Seed Per Acre (Slope Measurement)
Blando Brome	16
Rose Clover	12
Sub Clover	12
Ettlin's Wildflower Mix	10
Total	50

   2. Application Rate
   a.

Application	Rate Pounds Per Acre (Slope Measurement)
Seed	50
Straw	4,000
Commercial Fertilizer (Ammonia Phosphate 16-20-0)	500
Fiber	500
Stabilizing Emulsion (Solids)	200

   3. All legume seed shall be pellet-inoculated as specified in the Cal Trans Standard Specifications except the inoculations shall be as provided in Bullentin 842, "Range-Legume Inoculation and Nitrogen Fixation by Root-Nodule Bacteria", of the University of California, Division of Agricultural Sciences. Legume seed must be sown within 90 days of inoculation or must be reinoculated prior to application.
   4. Commercially inoculated legume seed must be delivered to the job site in unopened containers. If hydro-seeding equipment is used to apply legume seed the inoculation rates shall be four times that required for dry seeding. Seed rates shall be increased by 25 percent and the mixture shall be applied within 30 minutes after the seed has been added to the mixture.
   5. Written evidence by label of letter for seed shall be from the vendor or vendors supplying applicable materials
   6. Seed shall be mixed and weighed on the project site in the presence of the Engineer.

D. Bales: Refer to Civil drawings
E. Bale Stakes: Refer to Civil drawings
F. Silt Fence Fabric: Polypropylene geotextile resistant to common soil chemicals, mildew, and insects; non-biodegradable; in longest lengths possible; fabric including seams with the following minimum average roll lengths:

1. Average Opening Size: 30 U.S. Std. Sieve (0.600 mm), maximum, when tested in accordance with ASTM D4751.
2. Permittivity: 0.05 sec^-1, minimum, when tested in accordance with ASTM D4491.
3. Ultraviolet Resistance: Retaining at least 70 percent of tensile strength, when tested in accordance with ASTM D4355 after 500 hours exposure.
4. Tensile Strength: 100 lb-f (450 N), minimum, in cross-machine direction; 124 lb-f (550 N), minimum, in machine direction; when tested in accordance with ASTM D4632.
5. Elongation: 15 to 30 percent, when tested in accordance with ASTM D4632.
6. Tear Strength: 55 lb-f (245 N), minimum, when tested in accordance with ASTM D4533.
7. Color: Manufacturer's standard, with embedment and fastener lines preprinted.

G. Silt Fence Posts: One of the following, minimum 5 feet (1500 mm) long:
   1. Steel U- or T-section, with minimum mass of 1.33 lb per linear foot (1.98 kg per linear m).

H. Comply with Section 01 57 23 - Storm Water Pollution Prevention

I. Fiber must comply with section 21-2.02D of the Cal Trans Standard Specifications except fiberization shall be the result of either a chemical or mechanical process.

J. Tackifier must comply with section 21-2.02E of the Cal Trans Standard Specifications.
   1. Netting may be substituted for tackifier, where approved by the Engineer.
   2. Straw may be uniformly spread and incorporated into the soil in lieu of applying tackifier, where approved by the Engineer.

PART 3 EXECUTION

3.01 EXAMINATION

A. Section 01 57 23 - Storm Water Pollution Prevention

3.02 PREPARATION

A. Section 01 57 23 - Storm Water Pollution Prevention

3.03 MAINTENANCE

A. Section 01 57 23 - Storm Water Pollution Prevention

3.04 CLEAN UP

A. Remove temporary measures after permanent measures have been installed, unless permitted to remain by Engineer.

B. Clean out temporary sediment control structures that are to remain as permanent measures.

C. Where removal of temporary measures would leave exposed soil, shape surface to an acceptable grade and finish to match adjacent ground surfaces.

END OF SECTION

SECTION 01 57 21 INDOOR AIR QUALITY CONTROLS

PART 1 GENERAL

1.01 SECTION INCLUDES
- A. Construction procedures to promote adequate indoor air quality after construction.
- B. Building flush-out after construction and before occupancy.
- C. Testing indoor air quality after completion of construction.

1.02 PROJECT GOALS
- A. Dust and Airborne Particulates: Prevent deposition of dust and other particulates in HVAC ducts and equipment.
  1. Cleaning of ductwork is not contemplated under this Contract.
  2. Contractor shall bear the cost of cleaning required due to failure to protect ducts and equipment from construction dust.
- B. Airborne Contaminants: Procedures and products have been specified to minimize indoor air pollutants.
  1. Furnish products meeting the specifications.
  2. Avoid construction practices that could result in contamination of installed products leading to indoor air pollution.

1.03 REFERENCE STANDARDS
- A. ASHRAE Std 129 - Measuring Air-Change Effectiveness; 1997 (Reaffirmed 2002).
- B. ASTM D5197 - Standard Test Method for Determination of Formaldehyde and Other Carbonyl Compounds in Air (Active Sampler Methodology); 2009.
- C. CAL (CDPH SM) - Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions From Indoor Sources Using Environmental Chambers; California Department of Public Health; v1.1, 2010.
- D. EPA 600/4-90/010 - Compendium of Methods for the Determination of Air Pollutants in Indoor Air; April 1990.
- E. EPA 625/R-96/010b - Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air; January 1999.
- F. SMACNA (OCC) - IAQ Guideline for Occupied Buildings Under Construction; 2007.

1.04 DEFINITIONS
- A. Adsorptive Materials: Gypsum board, acoustical ceiling tile and panels, carpet and carpet tile, fabrics, fibrous insulation, and other similar products.
- B. Contaminants: Gases, vapors, regulated pollutants, airborne mold and mildew, and the like, as specified.
- C. Particulates: Dust, dirt, and other airborne solid matter.
- D. Wet Work: Concrete, plaster, coatings, and other products that emit water vapor or volatile organic compounds during installation, drying, or curing.

1.05 SUBMITTALS
- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Indoor Air Quality Management Plan: Describe in detail measures to be taken to promote adequate indoor air quality upon completion; use SMACNA (OCC) as a guide.
  1. Submit not less than 60 Calendar Days before enclosure of building.
  2. Identify potential sources of odor and dust.
  3. Identify construction activities likely to produce odor or dust.
  4. Identify areas of Project potentially affected, especially occupied areas.
  5. Evaluate potential problems by severity and describe methods of control.

6. Describe construction ventilation to be provided, including type and duration of ventilation, use of permanent HVAC systems, types of filters and schedule for replacement of filters.
7. Describe cleaning and dust control procedures.

C. Interior Finishes Installation Schedule: Identify each interior finish that either generates odors, moisture, or vapors or is susceptible to adsorption of odors and vapors, and indicate air handling zone, sequence of application, and curing times.
D. Duct and Terminal Unit Inspection Report.
E. Air Contaminant Test Plan: Identify:
   1. Testing agency qualifications.
   2. Locations and scheduling of air sampling.
   3. Test procedures, in detail.
   4. Test instruments and apparatus.
   5. Sampling methods.
F. Air Contaminant Test Reports: Show:
   1. Location where each sample was taken, and time.
   2. Test values for each air sample; average the values of each set of 3.
   3. HVAC operating conditions.
   4. Certification of test equipment calibration.
   5. Other conditions or discrepancies that might have influenced results.

PART 2 EXECUTION

2.01 CONSTRUCTION PROCEDURES

A. Prevent the absorption of moisture and humidity by adsorptive materials by:
   1. Sequencing the delivery of such materials so that they are not present in the building until wet Work is completed and dry.
   2. Delivery and storage of such materials in fully sealed moisture-impermeable packaging.
   3. Provide sufficient ventilation for drying within reasonable time frame.
B. Begin construction ventilation when building is substantially enclosed.
C. Do not store construction materials or waste in mechanical or electrical rooms.
D. Prior to use of return air ductwork without intake filters clean up and remove dust and debris generated by construction activities.
   1. Inspect duct intakes, return air grilles, and terminal units for dust.
   2. Clean plenum spaces, including top sides of lay-in ceilings, outsides of ducts, tops of pipes and conduit.
   3. Clean tops of doors and frames.
   4. Clean mechanical and electrical rooms, including tops of pipes, ducts, and conduit, equipment, and supports.
   5. Clean return plenums of air handling units.
   6. Remove intake filters last, after cleaning is complete.
E. Do not perform dusty or dirty Work after starting use of return air ducts without intake filters.
F. Use other relevant recommendations of SMACNA (OCC) for avoiding unnecessary contamination due to construction procedures.

2.02 BUILDING FLUSH-OUT

A. Contractor's Option: Either full continuous flush-out OR satisfactory air contaminant testing is required, not both.
B. Perform building flush-out before occupancy.
C. Do not start flush-out until:
   1. All construction is complete.
   2. HVAC systems have been tested, adjusted, and balanced for proper operation.
   3. Inspection of inside of return air ducts and terminal units confirms that cleaning is not necessary.

4. New HVAC filtration media have been installed.

D. Building Flush-Out: Operate all ventilation systems at normal flow rates with 100 percent outside air until a total air volume of 14,000 cubic feet per square foot (4500 cubic meters per square meter) of floor area has been supplied.
   1. Obtain County's concurrence that construction is complete enough before beginning flush-out.
   2. Maintain interior temperature of at least 60 degrees F (15 degrees C) and interior relative humidity no higher than 60 percent.
   3. If additional construction involving materials that produce particulates or any of the specified contaminants is conducted during flush-out, start flush-out over.
   4. If interior spaces must be occupied prior to completion of the flush-out, supply a minimum of 25 percent of the total air volume prior to occupancy, and:
      a. Begin ventilation at least three hours prior to daily occupancy.
      b. Continue ventilation during all occupied periods.
      c. Provide minimum outside air volume of 0.30 cfm per square foot (0.0015 cu m/s/sq
      d. m) or design minimum outside air rate, whichever is greater.

E. Install new HVAC filtration media after completion of flush-out and before occupancy or further testing.

2.03 AIR CONTAMINANT TESTING

A. Contractor's Option: Either full continuous flush-out OR satisfactory air contaminant testing is required, not both.
B. Perform air contaminant testing before occupancy.
C. Do not start air contaminant testing until:
   1. All construction is complete, including interior finishes.
   2. HVAC systems have been tested, adjusted, and balanced for proper operation.
   3. New HVAC filtration media have been installed.
D. Indoor Air Samples: Collect from spaces representative of occupied areas:
   1. Collect samples while operable windows and exterior doors are closed, HVAC system is running normally as if occupied, with design minimum outdoor air, but with the building unoccupied.
   2. Collect samples from spaces in each contiguous floor area in each air handler zone, but not less than one sample per 25,000 square feet (2300 square meters); take samples from areas having the least ventilation and those having the greatest presumed source strength.
   3. Collect samples from height from 36 inches (915 mm) to 72 inches (1830 mm) above floor.
   4. Collect samples from same locations on 3 consecutive days during normal business hours; average the results of each set of 3 samples.
   5. Exception: Areas with normal very high outside air ventilation rates, such as laboratories, do not need to be tested.
   6. When retesting the same building areas, take samples from at least the same locations as in first test.
E. Outdoor Air Samples: Collect samples at outside air intake of each air handler at the same time as indoor samples are taken.
F. Analyze air samples and submit report.
G. Air Contaminant Concentration Limits:
   1. Formaldehyde: Not more than 27 parts per billion.
   2. PM10 Particulates: Not more than 50 micrograms per cubic meter.
   3. Total Volatile Organic Compounds (TVOCs): Not more than 500 micrograms per cubic meter.
   4. Chemicals Listed in CAL (CDPH SM) Table 4-1, except Formaldehyde: Allowable concentrations listed in Table 4-1.
   5. Carbon Monoxide: Not more than 9 parts per million and not more than 2 parts per million higher than outdoor air.
H. Air Contaminant Concentration Test Methods:
   1. Formaldehyde: ASTM D5197, EPA 625 Method TO-11A, or EPA 600 Method IP-6.

2. Particulates: EPA 600 Method IP-10.
3. Total Volatile Organic Compounds (TVOC): EPA 625 Method TO-1, TO-15, or TO-17; or EPA 600 Method IP-1.
4. Chemicals Listed in CAL (CDPH SM) Table 4-1, except Formaldehyde: ASTM D5197, or EPA 625 Method TO-1, TO-15, or TO-17.
5. Carbon Monoxide: EPA 600 Method IP-3, plus measure outdoor air; measure in ppm; report both indoor and outdoor measurements.

PART 3 EXECUTION – NOT USED

END OF SECTION

SECTION 01 57 23 STORM WATER POLLUTION PREVENTION

PART 1 GENERAL

1.01 Summary

A. This Work includes developing and implementing a Storm Water Pollution Prevention Plan (SWPPP). Refer to SWPPP developed for the overall site and Best Practices shown civil drawings. Use these to develop a specific SWPPP for our site.

B. Projects are assumed to be Risk Level 2 for bidding purposes. The Contractor is responsible for any assumptions made in calculating the risk level for the Projects, including any adjustments made to the calculated risk level made during construction by the State Water Resource Control Board (SWRCB) or Central Valley Regional Water Quality Control Board as a result of noncompliance issues pertaining to this Project.

C. Discharges of storm water from the Project must comply with National Pollutant Discharge Elimination System (NPDES) General Permit for Storm Water Discharges Associated with Construction and Land Disturbance Activities (WDID Application ID No. 500933, NPDES No. To Be Determined, including any subsequent amendments, referred to herein as "Permit."

D. Information on forms, reports, and other documents can be found in the following State manuals:
   1. Field Guide for Construction Site Dewatering
   2. Storm Water Pollution Prevention Plan (SWPPP) and Water Pollution Control Program (WPCP) Preparation Manual
   3. Construction Site Best Management Practices (BMP) Manual
   4. For the above-referenced manuals, go to the State's Web site for the Division of Construction, Storm Water and Water Pollution Control Information, or the State's Publication Distribution Unit.

E. Job site activities shall not start until:
   1. The SWPPP is reviewed by the contractor and revisions by are provided for project specific scheduling and location of task specific BMP’s (e.g. concrete washout, stockpiled material, vehicle maintenance).
   2. BMP’s have been implemented.

F. If you operate a Contractor-support facility, protect storm water systems and receiving waters from the discharge of potential pollutants by using water pollution control practices.
   1. Contractor-support facilities include:
      a. Staging areas
      b. Storage yards for equipment and material
      c. Mobile operations
      d. Other facilities installed for your convenience, such as haul roads

G. If you obtain or dispose of material at a non-commercially operated borrow or disposal site, prevent water pollution due to erosion at the site during and after completion of your activities. Upon completion of your Work, leave the site in a condition such that water shall not collect or stand therein.

H. The County does not pay for water pollution control practices at Contractor-support facilities and non-commercially operated borrow or disposal sites.

I. Water pollution control work applies to project where work activities result in less than 1 acre of soil disturbance and projects that qualify for an erositivty waiver. Manage work activities to reduce the discharge of pollutants to surface waters, groundwater, or municipal separate storm sewer systems including contract work item for Prepare Water Pollution Control Program.

J. Do not begin work until the WPCP is accepted.

K. Your Engineer approved Water Pollution Control Plan must be submitted to the County of Nevada for approval when requesting your encroachment permit.

1.02 Definitions

A. Active area: Area where soil-disturbing Work activities have occurred at least once within 14 days.

B. BMPs: Best Management Practices are water pollution control practices
C. Construction phase: Includes
    1. Site activities
    2. Highway construction phase for building roads and structures,
    3. Plant establishment and maintenance phase for placing vegetation for final stabilization, and
    4. Suspension phase for suspension of Work activities or winter shutdown. The construction phase continues from the start of Work activities to Contract acceptance.
D. Inactive area: Area where soil-disturbing Work activities have not occurred within 15 days.
E. Normal working hours: Hours you normally Work on the Project
F. Qualifying rain event: Storm that produces at least 0.25 inch of precipitation with a 24-hour or greater period between rain events.
G. Storm event: Storm with fifty percent (50%) or greater probability of producing precipitation per NOAA data.
H. NPDES: National Pollutant Discharge Elimination System
I. RWQCB: Regional Water Quality Control Board SWPPP: Storm Water Pollution Prevention Plan; SWRCB: State Water Resources Control Board
J. Water Pollution Control Manager: The Water Pollution Control Manager implements water pollution control work described in the WPCP and oversees revisions and amendments to the WPCP.
K. WPCP: Water Pollution Control Program

1.03 Submittals

A. Storm Water Pollution Prevention Plan alterations.

1.04 General

A. Within 10 Calendar Days of Contract approval:
    1. Contractor to designate QSP to be responsible for SWPPP compliance. Submit user name of individual with State Water Resource Control Board Storm Water Multiple Application and Report Tracking System (SMARTS) account to upload documents.
    2. Contractor to submit 2 copies of SWPPP updates for review. Allow 14 Calendar Days for the Engineer of Record's review.
    3. Resubmit a revised SWPPP within -5 Calendar Days of receiving the Engineer's comments.
    4. When the Engineer approves the SWPPP, submit an electronic copy and 4 printed copies of the approved SWPPP.
    5. Upload the SWPPP documents to the State SMARTS website. County pays any fees.
    6. If the Engineer requests changes to the SWPPP based on the RWQCB's comments, amend the SWPPP within 10 Calendar Days.
B. A qualified SWPPP practitioner (QSP) must submit alterations to the SWPPP.
C. The SWPPP alterations must comply with the State's Storm Water Pollution Prevention Plan (SWPPP) and Water Pollution Control Plan (WPCP) Preparation Manual. Include the following in the SWPPP:
    1. Description of the Work involved in the installation, maintenance, repair, and removal of temporary and permanent water pollution control practices.
D. Maps showing:
    1. Locations of disturbed soil areas
    2. Water bodies and conveyances
    3. Locations and types of water pollution control practices that will be used for each Contractor-support facility
    4. Locations and types of temporary water pollution control practices that will be used in the Work for each construction phase
    5. Locations and types of water pollution control practices that will be installed permanently under the Contract
    6. Pollutant sampling locations
    7. Locations planned for storage and use of potential nonvisible pollutants
    8. Receiving water sampling locations

E. Copy of permits obtained by the County and State, including US Army Corps of Engineers permits and RWQCB 401 certifications.
F. Include the following items in the SWPPP:
    1. For all Projects:
        a. Schedule
        b. Construction site monitoring program (CSMP)

1.05 Schedule

A. The SWPPP schedule must show when:
    1. Work activities shall be performed that could cause the discharge of pollutants into storm water
    2. Water pollution control practices associated with each construction phase shall be implemented
    3. Soil stabilization and sediment control practices for disturbed soil areas shall be implemented

1.06 Construction Site Monitoring Program

A. A QSP must prepare the CSMP alterations. Change the program to reflect current job site activities as needed. The CSMP must include the following:
    1. For all Projects:
        a. Visual monitoring procedures
        b. Sampling and analysis plan (SAP) for nonvisible pollutants
        c. SAP for non-stormwater discharges
        d. SAP for monitoring required by RWQCB

1.07 Sampling and Analysis Plan

A. Include a SAP in the CSMP.
B. Describe the following water quality sampling procedures in the SAP:
    1. Sampling equipment
    2. Sample preparation
    3. Collection
    4. Field measurement methods
    5. Analytical methods
    6. Quality assurance and quality control

7. Sample preservation and labeling
8. Collection documentation
9. Sample shipping
10. Chain of custody
11. Data management and reporting
12. Precautions from the construction site health and safety plan
13. Laboratory selection and certifications

1.08 The SAP must identify the State-certified laboratory, sample containers, preservation requirements, holding times, and analytical method. For a list of State-certified laboratories go to the CDPH Web site.

A. The SAP must include procedures for sample collection during precipitation
B. The SAP must list conditions when you shall not be required to physically collect samples such as:
   1. Dangerous weather
   2. Flooding or electrical storms
   3. Times outside of normal working hours
C. Amend the SAP whenever discharges or sampling locations change because of changed Work activities or knowledge of site conditions
D. The SAP for nonvisible pollutants must describe the sampling and analysis strategy for monitoring nonvisible pollutants.
E. The SAP for nonvisible pollutants must identify potential nonvisible pollutants present at the job site associated with any of the following:
   1. Construction materials and wastes
   2. Existing contamination due to historical site usage
   3. Application of soil amendments, including soil stabilization materials, with the potential to change pH or contribute toxic pollutants to stormwater
F. The SAP for nonvisible pollutants must include sampling procedures for the following conditions when observed during a stormwater visual inspection. Include a procedure for collecting at least 1 sample for each storm event for:
   1. Materials or wastes containing potential nonvisible pollutants not stored under watertight conditions
   2. Materials or wastes containing potential nonvisible pollutants stored under watertight conditions at locations where a breach, leak, malfunction, or spill occurred and was not cleaned up before the precipitation
   3. Chemical applications occurring within 24 hours before precipitation or during precipitation that could discharge pollutants to surface waters or drainage systems, including fertilizer, pesticide, herbicide, methyl methacrylate concrete sealant, or non-pigmented curing compound
   4. Applied soil amendments, including soil stabilization materials that could change pH levels or contribute toxic pollutants to stormwater runoff and discharge pollutants to surface waters or drainage systems, unless independent test data is available to indicate acceptable concentrations of nonvisible pollutants in the material
   5. Stormwater runoff from an area contaminated by historical usage of the site that could discharge pollutants to surface waters or drainage systems
G. The SAP for nonvisible pollutants must provide sampling procedures and a schedule for:
   1. Sample collection during the first 2 hours of rain events that generate runoff
   2. Sample collection during normal working hours
   3. Each nonvisible pollutant source
   4. Uncontaminated control sample
H. The SAP for nonvisible pollutants must identify locations for sampling downstream and control samples and the reasons for selecting those locations. Select locations for control samples where the sample does not come in contact with materials, wastes, or areas associated with potential nonvisible pollutants or disturbed soil areas.

1.09 Amendments

A. Amend and resubmit the SWPPP:

1. Annually before 'September 1st.
2. Whenever:
   a. Changes in Work activities could affect the discharge of pollutants
   b. Water pollution control practices are added by Contract Change Order
   c. Water pollution control practices are added at your discretion
   d. Changes in the quantity of disturbed soil
   e. Objectives for reducing or eliminating pollutants in stormwater discharges have not been achieved
3. You receive a written notice of a permit violation for the Project from the RWQCB or any other regulatory agency

B. Allow the same review time for amendments to the SWPPP as for the original SWPPP.

1.10 Training Records

A. Submit water pollution control training records for all employees and subcontractors who will be working at the job site. Include the training subjects, training dates, ongoing training, and tailgate meetings with your submittal. Submit records for:
   1. Existing employees within 5 Working Days of obtaining SWPPP approval
   2. New employees within 5 Working Days of receiving the training
   3. A subcontractor's employees at least 5 Working Days before the subcontractor starts Work

1.11 Contractor-Support Facility

A. At least 5 Working Days before operating any Contractor-support facility, submit:
   1. A plan showing the location and quantity of water pollution control practices associated with the Contractor-support facility
   2. A copy of the notice of intent approved by the RWQCB and the SWPPP approved by the RWQCB if you will be operating a batch plant or a crushing plant under the General Industrial Permit

1.12 Annual Certification

A. Submit an annual certification of compliance as described in the State's Storm Water Pollution Prevention Plan (SWPPP) and Water Pollution Control Plan (WPCP) Preparation Manual before 'September 1st of each year.

1.13 Site Inspection Reports

A. The water pollution control (WPC) manager must submit the following within 24 hours of completing a weekly inspection:
   1. Completed Stormwater Site Inspection Report form.
   2. Best management practices (BMP) status report. The WPC manager must oversee the preparation of the report. The report must include:
      a. Location and quantity of installed water pollution control practices
      b. Location and quantity of disturbed soil for active and inactive areas
      c. Required repairs,improvements or additions to meet the objectives of the SWPPP.

1.14 Visual Monitoring Reports

A. Submit a visual monitoring report for:

1. Each storm event. Include:
   a. Date, time, and rain gauge reading
   b. Visual observations:
      i. Within 2 Working Days before the storm for:
      ii. Spills, leaks, and uncontrolled pollutants in drainage areas
      iii. Proper implementation of water pollution control practices
      iv. Leaks and adequate freeboard in storage areas
   c. Every 24 hours during the storm for:
      i. Effective operation of water pollution control practices
      ii. Water pollution control practices needing maintenance and repair
   d. Within 2 Working Days after a qualifying rain event for:
      i. Stormwater discharge locations
      ii. Evaluation of design, implementation, effectiveness, and locations of water pollution control practices including locations where additional water pollution control practices may be needed
2. Non-Stormwater discharges during each of the following periods:
   a. January through March
   b. April through June
   c. July through September
   d. October through December
3. Use the Stormwater Site Inspection Report form to document visual monitoring. A visual monitoring report must include:
   a. Name of personnel performing the inspection, inspection date, and date the inspection report is completed
   b. Storm and weather conditions
   c. Location of any:
      i. Floating and suspended material, sheen on the surface, discoloration, turbidity, odor, and source of observed pollutants for flowing and contained stormwater systems
      ii. Non-Stormwater discharges and their sources

1.15 Corrective action taken

A. Retain visual monitoring reports at the job site as part of the SWPPP.

1.16 Sampling and Analysis

A. Whenever sampling is required, submit a printed copy and electronic copy of water quality analysis results, and quality assurance and quality control reports within 48 hours of field

sampling, and within 30 days of laboratory analysis. Electronic copies must be in one of the following formats:

1. (1) xls, (2) .txt, (3) .cvs, (4) .dbs, or (5) .mdb. Include an evaluation of whether the downstream samples show levels of the tested parameter that are higher than the control sample. The evaluation must include:
   a. Sample identification number
   b. Contract number
   c. Constituent
   d. Reported value
   e. Analytical method
   f. Method detection limit
   g. Reported limit

1.17 Storm Water Annual Report

A. Submit 2 copies of a storm water annual report that covers the preceding period from September 1st to August 30th. The report must be submitted before September 1st if active construction occurs for more then 3 months.
B. Annual report shall be submitted to SMARTS website.
C. Obtain approval for the format of the storm water annual report. The report must include:
   1. Project information such as description and Work locations
   2. Stormwater monitoring information, including:
      a. Summary and evaluation of sampling and analysis results and laboratory reports
      b. Analytical methods, reporting units, and detections limits for analytical parameters
      c. Summary of corrective actions taken
      d. Identification of corrective actions taken and compliance activities not implemented
      e. Summary of violations
      f. Names of individuals performing stormwater inspections and sampling
      g. Logistical information for inspections and sampling, including location, date, time, and precipitation
      h. Visual observations and sample collection records
   3. Documentation of training for individuals responsible for:
      a. Permit compliance
      b. BMP installation, inspection, maintenance, and repair
      c. Preparing, revising, and amending the SWPPP
D. Submit a revised storm water annual report within 5 Working Days of receiving the Engineer's comments. The Engineer's review resumes when a complete report has been resubmitted.
E. When the storm water annual report is approved, submit 1 electronic copy and 2 printed copies of the report signed by the WPC manager.
F. Information After Storm Event
   1. Within 48 hours after the conclusion of a storm event resulting in a discharge, after a nonstormwater discharge, or after receiving a written notice or an order from the RWQCB or another regulatory agency, the WPC manager must submit the following information:
      a. Date, time, location, and nature of the activity and the cause of the notice or order
      b. Type and quantity of discharge
      c. Water pollution control practices in use before the discharge or before receiving the notice or order
      d. Description of water pollution control practices and corrective actions taken to manage the discharge or cause of the notice

1.18 Quality Control and Assurance

A. Training
   1. Employees must receive initial water pollution control training before starting Work at the job site.
   2. For Contractor’s Project managers, supervisory personnel, subcontractors, and employees involved in water pollution control Work:
      a. Provide stormwater training in the following subjects:
         i. Water pollution control rules and regulations

i. Implementation and maintenance for:
Temporary soil stabilization
Temporary sediment control
Tracking control
Wind erosion control
Material pollution prevention and control
Waste management
Nonstormwater management

A. Conduct weekly training meetings covering:
1. Deficiencies and corrective actions for water pollution control practices
2. Water pollution control practices required for Work activities during the week
3. Spill prevention and control
4. Material delivery, storage, usage, and disposal
5. Waste management
6. Nonstormwater management procedures

B. Training for personnel who collect water quality samples must include:
1. CSMP review
2. Health and safety review
3. Sampling simulations

1.19 Water Pollution Control Manager

A. *General*
1. The Contractor shall designate in writing a Water Pollution Control Manager (WPCM).

B. *Qualifications*
1. The Contractor shall submit a statement of qualifications describing the training, work history, and expertise of the proposed WPCM. The WPCM must have at least one of the following qualifications:
a. Certified Erosion, Sediment and Storm Water Inspector (CESSWI)™ registered through Enviro Cert International, Inc.
b. Certified Inspector of Sediment and Erosion Control (CISEC) registered through CISEC, Inc.
c. Qualifications described in the Permit (Order No. 2009-009-DWQ, NPDES No. CAS000002) for a QSD.
d. Department approved storm water management training described in the Department's "Construction Storm Water and Water Pollution Control" web site

C. *Responsibilities*
1. The WPC manager must:
a. Be responsible for water pollution control work
b. Be the primary contact for water pollution control work
c. Oversee:
i. Maintenance of water pollution control practices
ii. Inspections of water pollution control practices identified in the SWPPP
iii. Inspections and reports for visual monitoring
iv. Preparation and implementation of REAPs
v. Sampling and analysis
vi. Preparation and submittal of:
NAL exceedance reports
NEL violation reports
SWPPP annual certification
Annual reports
BMP status reports
d. Oversee and enforce hazardous waste management practices including spill prevention and control measures
e. Have authority to mobilize crews to make immediate repairs to water pollution control practice.

f. Ensure that all employees have current water pollution control training
g. Implement the approved SWPPP
h. Amend the SWPPP if required
i. Be at the job site within 2 hours of being contacted
j. Have the authority to stop construction activities damaging water pollution control practices or causing water pollution

1.20 Sampling and Analysis

A. Assign trained personnel to collect water quality samples. Document the personnel and training in the SAP.
B. Samples taken by assigned field personnel must comply with the equipment manufacturer's instructions for collection, analytical methods, and equipment calibration.
C. Samples taken for laboratory analysis must comply with water quality sampling procedures and be analyzed by a State-certified laboratory under 40 CFR part 136, Guidelines Establishing Test Procedures for the Analysis of Pollutants.
D. Whenever downstream samples show increased levels of pollutants, assess water pollution control practices, site conditions, and surrounding influences to determine the probable cause for the increase.
E. For multiple discharge points, obtain samples from a single upstream and a single downstream location.

PART 2 – PRODUCTS

2.01 General

A. Provide materials for execution of the Work.

PART 3 – EXECUTION

3.01 General

A. Manage Work activities to reduce the discharge of pollutants to surface waters, groundwater, and municipal separate storm sewer systems.
B. Retain a printed copy of the approved SWPPP at the job site.
C. Install facilities and devices used for water pollution control practices before performing Work activities. Install soil stabilization materials for water pollution control practices in all inactive areas or before storm events.
D. Repair or replace water pollution control practices within 24 hours of discovering any damage, unless a longer period is authorized.
E. The County does not pay for the cleanup, repair, removal, disposal, or replacement of water pollution control practices due to improper installation or from Contractor’s negligence.
F. You may request changes to the water pollution control Work or the Engineer may order changes to water pollution control Work. Changes may include additional or new water pollution control practices. Additional water pollution control Work is paid for as extra Work under Section 4-1.03D, "Extra Work," of the State Standard Specifications.
G. You may request or the Engineer may order laboratory analysis of stormwater samples. If ordered, laboratory analysis of stormwater samples is paid for as extra Work under Section 4-1.03D, "Extra Work," of the State Standard Specifications.
H. Continue SWPPP implementation during any suspension of Work activities.

3.02 Monitoring

A. Monitor the National Weather Service's forecast on a daily basis. For the National Weather Service's forecast, go to the Web site for the National Weather Service.
B. Obtain, install, and maintain a rain gauge at the job site. Observe and record daily precipitation.

3.03 Inspections

A. Use the Stormwater Site Inspection Report form for documenting site inspections.
B. The WPC manager must oversee:
    1. Inspections of water pollution control practices identified in SWPPP:
        a. Before a forecasted storm event
        b. After a qualifying rain event that produces site runoff
        c. At 24-hour intervals during extended storm events
        d. On a predetermined schedule of at least once a week

C. Daily inspections of:
   1. Storage areas for hazardous materials and waste
   2. Hazardous waste disposal and transporting activities
   3. Hazardous material delivery and storage activities
      a. Inspections of:
   i. Vehicle and equipment cleaning facilities:
   i. Daily if vehicle and equipment cleaning occurs daily
   i. Weekly if vehicle and equipment cleaning does not occur daily
   4. Vehicle and equipment maintenance and fueling areas:
      a. Daily if vehicle and equipment maintenance and fueling occurs daily
      b. Weekly if vehicle and equipment maintenance and fueling does not occur daily
   5. Vehicles and equipment at the job site for leaks and spills on a daily schedule. Verify that operators are inspecting vehicles and equipment each day of use.
   6. Demolition sites within 50 feet of storm drain systems and receiving waters daily.
   7. Pile driving areas for leaks and spills:
      a. Daily if pile driving occurs daily
      b. Weekly if pile driving does not occur daily
   8. Temporary concrete washouts:
      a. Daily if concrete Work occurs daily
      b. Weekly if concrete Work does not occur daily
   9. Paved roads at job site access points for street sweeping:
      a. Daily if earthwork and other sediment or debris-generating activities occur daily
      b. Weekly if earthwork and other sediment or debris-generating activities do not occur daily
      c. Within 24 hours of precipitation forecasted by the National Weather Service
   10. Dewatering Work:
      a. Daily if dewatering Work occurs daily
      b. Weekly if dewatering Work does not occur daily
   11. Temporary active treatment system:
      a. Daily if temporary active treatment system activities occur daily
      b. Weekly if temporary active treatment system activities do not occur daily
   12. Work over water:
      a. Daily if Work over water occurs daily
      b. Weekly if Work over water does not occur daily

3.04 Deficiencies

A. Whenever you or the Engineer identify a deficiency in the implementation of the approved SWPPP, correct the deficiency:
   1. Immediately, unless a later date is authorized
   2. Before precipitation occurs
B. The County may correct the deficiency and deduct the cost of correcting the deficiency from payment if you fail to correct the deficiency by the agreed to date or before the onset of precipitation.
   1. Sampling and Analysis
C. Perform sample collection during:
   1. Normal working hours
   2. Each qualifying rain event
   3. First 2 hours of each storm event
D. Do not physically collect samples during dangerous weather conditions, such as flooding or electrical storms.
   1. Document sample collection during precipitation.
   2. Whenever downstream samples show increased levels of pH, turbidity, and other constituents, assess water pollution control practices, site conditions, and surrounding influences to determine the probable cause for the increase.
E. Collect samples:
   1. During a storm event for:

a. Each nonvisible pollutant source and a corresponding uncontaminated control sample
b. All locations identified on the Storm Event Sampling and Analyses Plan form

2. During a qualifying rain event for:
   a. Each nonvisible pollutant source and a corresponding uncontaminated control sample
   b. pH, turbidity, and other constituents as required
   c. At least 3 samples for each day of a qualifying rain event
   d. All locations identified on the Qualifying Rain Event Sampling and Analyses Plan form

F. Retain documentation of water quality sampling and analysis results with the SWPPP at the job site.

G. The County does not pay for the preparation, collection, laboratory analysis, and reporting of stormwater samples for any nonvisible pollutants if water pollution control practices are not implemented before precipitation or if you fail to correct a water pollution control practice before precipitation.

H. Attention is directed to Specification Section 01 5713 Temporary Erosion and Sediment Control, found elsewhere in these technical specifications.

I. The Contractor shall not use any plastic, monofilament, jute or similar erosion control netting with mesh size larger than 0.25 inches that could entangle giant garter snakes at the Project site. Tightly woven erosion control matting (mesh size larger than 0.25 inches) or similar material shall be used for erosion control.

3.05 Payment

A. If you fail to comply with “Water Pollution Control” of these Special Provisions or fail to implement water pollution control practices during each estimate period, the County withholds 25 percent from progress payment.

B. Withholds for failure to perform water pollution control work are in addition to all other withholds provided for in the contract. The County returns performance failure withholds in the progress payment following the correction for noncompliance.

C. Water Pollution Control Program (WPCP) includes preparing the WPCP, obtaining WPCP acceptance, amending, and implementing the WPCP, and installation, maintenance, monitoring, and inspecting water pollution control practices at the job site, except for items listed separately in the bid list, as specified in the Standard Specifications and these Special Provisions, and as directed by the Engineer.

D. The County does not pay for implementation of water pollution control practices in areas outside the right of way not specifically provided for in the drawings or in the Special Provisions.

E. The County does not pay for water pollution control practices installed at construction support facilities as included in other items of work and no separate payment will be made therefore.

F. The County does not share maintenance costs.

END OF SECTION

SECTION 01 60 00 PRODUCT REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. General product requirements.
B. Sustainable design-related product requirements.
C. Transportation, handling, storage and protection.
D. Product option requirements.
E. Substitution limitations and procedures.
F. Procedures for County-supplied products.
G. Maintenance materials, including extra materials, spare parts, tools, and software.

1.02 RELATED REQUIREMENTS

A. Section 01 61 16 - Volatile Organic Compound (VOC) Content Restrictions: Requirements for VOC-restricted product categories.
B. Section 01 74 19 - Construction Waste Management and Disposal: Waste disposal requirements potentially affecting packaging and substitutions.

1.03 REFERENCE STANDARDS

A. NFPA 70 - National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.04 SUBMITTALS

A. Proposed Products List: Submit list of major products proposed for use, with name of manufacturer, trade name, and model number of each product.
    1. Submit within 15 Calendar Days after date of Notice to Proceed.
    2. For products specified only by reference standards, list applicable reference standards.
B. Product Data Submittals: Submit manufacturer's standard published data. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information specific to this Project.
C. Shop Drawing Submittals: Prepared specifically for this Project; indicate utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.
D. Sample Submittals: Illustrate functional and aesthetic characteristics of the product, with integral parts and attachment devices. Coordinate sample submittals for interfacing Work.
    1. For selection from standard finishes, submit samples of the full range of the manufacturer's standard colors, textures, and patterns.

PART 2 PRODUCTS

2.01 NEW PRODUCTS

A. Provide new products unless specifically required or permitted by the Contract Documents.
B. DO NOT USE products having any of the following characteristics:
    2. Made using or containing CFC's or HCFC's.
    3. Contain asbestos or lead-base paint:
        a. No materials shall be used in this Project or in any tools, devices, clothing or equipment used to affect this construction that contain asbestos or lead-based paint. All Work or materials found to contain asbestos or lead-base paint, or material installed with asbestos containing equipment or lead-base paint will be immediately rejected and this Work shall be removed by a certified EPA hazardous material Contractor under the supervision of a certified hazardous material consultant at no additional cost to County.

b. Contractor and Subcontractors shall certify that no asbestos containing materials and no lead-base paint were used in this Project. Certification letter must be addressed to County, including Project and Contractors' information; to be notarized.

C. Where all other criteria are met, Contractor shall give preference to products that:
1. If used on interior, have lower emissions, as defined in Section 01 61 16.
2. If wet-applied, have lower VOC content, as defined in Section 01 61 16.
3. Are extracted, harvested, and/or manufactured closer to the location of the Project.
4. Have longer documented life span under normal use.
5. Result in less construction waste.
6. Have a published Green Screen Chemical Hazard Analysis.

2.02 PRODUCT OPTIONS

A. Products Specified by Reference Standards or by Description Only: Use any product meeting those standards or description.

B. Products Specified by Naming One or More Manufacturers: Use a product of one of the manufacturers named and meeting specifications, no options or substitutions allowed. Where Basis of Design product is identified, it shall establish the level of quality for proposed equal products.

C. Products Specified by Naming One or More Manufacturers with a Provision for Substitutions: Submit a request for substitution for any manufacturer not named.

D. Equivalent Products: For products specified by name and accompanied by the term "equivalent," "or equal," or "or approved equal," or "or approved," comply with requirements in "Comparable Products" Article to obtain approval for use of an unnamed product.

2.03 MAINTENANCE MATERIALS

A. Furnish extra materials, spare parts, tools, and software of types and in quantities specified in individual specification sections.

B. Deliver to Project site; obtain receipt prior to final payment.

PART 3 EXECUTION

3.01 SUBSTITUTION PROCEDURES

A. See Section 01 25 00 Substitution Procedures.

B. Instructions to Bidders specify time restrictions for submitting requests for substitutions during the bidding period. Comply with requirements specified in that section.

3.02 COUNTY-SUPPLIED PRODUCTS

A. County's Responsibilities:
1. Arrange for and deliver County reviewed shop drawings, product data, and samples, to Contractor.
2. Arrange and pay for product delivery to site.
3. On delivery, inspect products jointly with Contractor.
4. Submit claims for transportation damage and replace damaged, defective, or deficient items.
5. Arrange for manufacturers' warranties, inspections, and service.

B. Contractor's Responsibilities:
1. Review County reviewed shop drawings, product data, and samples.
2. Receive and unload products at site; inspect for completeness or damage jointly with County.
3. Handle, store, install and finish products.
4. Repair or replace items damaged after receipt.

3.03 TRANSPORTATION AND HANDLING

A. Coordinate schedule of product delivery to designated prepared areas in order to minimize site storage time and potential damage to stored materials.

B. Transport and handle products in accordance with manufacturer's instructions.
C. Transport materials in covered trucks to prevent contamination of product and littering of surrounding areas.
D. Promptly inspect shipments to ensure that products comply with requirements, quantities are correct, and products are undamaged.
E. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage.
F. Arrange for the return of packing materials, such as wood pallets, where economically feasible.

3.04 STORAGE AND PROTECTION

A. Designate receiving/storage areas for incoming products so that they are delivered according to installation schedule and placed convenient to Work area in order to minimize waste due to excessive materials handling and misapplication.
B. Store and protect products in accordance with manufacturers' instructions.
C. Store with seals and labels intact and legible.
D. Store sensitive products in weather tight, climate controlled, enclosures in an environment favorable to product.
E. For exterior storage of fabricated products, place on sloped supports above ground.
F. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of products.
G. Prevent contact with material that may cause corrosion, discoloration, or staining.
H. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.
I. Arrange storage of products to permit access for inspection. Periodically inspect to verify products are undamaged and are maintained in acceptable condition.

END OF SECTION

SECTION 01 61 16 VOLATILE ORGANIC COMPOUND (VOC) CONTENT RESTRICTIONS

PART 1 GENERAL

1.01 SECTION INCLUDES

1.02 RELATED REQUIREMENTS
- A. Section 01 3000 - Administrative Requirements: Submittal procedures.
- B. Section 01 6000 - Product Requirements: Fundamental product requirements, substitutions and product options, delivery, storage, and handling.

1.03 DEFINITIONS
- A. Interior of Building: Anywhere inside the exterior weather barrier.

1.04 REFERENCE STANDARDS
- A. CAL (CDPH SM) - Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions From Indoor Sources Using Environmental Chambers; California Department of Public Health; v1.1, 2010.
- B. CRI (GLP) - Green Label Plus Testing Program - Certified Products; Carpet and Rug Institute; Current Edition.

1.05 SUBMITTALS
- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: For each VOC-restricted product used in the Project, submit evidence of compliance.

PART 2 PRODUCTS

2.01 MATERIALS
- A. All Products: Comply with the most stringent of Federal, State, and local requirements, or these specifications.

PART 3 EXECUTION

2.02 FIELD QUALITY CONTROL
- A. County reserves the right to reject non-compliant products, whether installed or not, and require their removal and replacement with compliant products at no extra cost to the County.
- B. All additional costs to restore indoor air quality due to installation of non-compliant products shall be borne by Contractor.

END OF SECTION

SECTION 01 70 00 EXECUTION AND CLOSEOUT REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Examination, preparation, and general installation procedures.
B. Pre-installation meetings.
C. Cutting and patching.
D. Surveying for laying out the Work.
E. Cleaning and protection.
F. Starting of systems and equipment.
G. Closeout procedures, including Contractor's Correction Punch List, except payment procedures.
H. General requirements for maintenance service.

1.02 RELATED REQUIREMENTS

A. Section 01 4000 - Quality Requirements: Testing and inspection procedures.
B. Section 01 7419 - Construction Waste Management and Disposal: Additional procedures for trash/waste removal, recycling, salvage, and reuse.
C. Section 01 7800 - Closeout Submittals: Project record documents, operation and maintenance data, warranties and bonds.
D. Section 01 7900 - Demonstration and Training: Demonstration of products and systems to be commissioned and where indicated in specific specification sections.

1.03 REFERENCE STANDARDS

A. NFPA 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations; 2013.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Survey Work:
   1. Submit a copy of site drawing signed by the Land Surveyor, showing that the elevations and locations of the Work are in conformance with Contract Documents.
   2. Submit surveys and survey logs for the Project record.
C. Cutting and Patching: Submit written request in advance of cutting or alteration that affects:
   1. Structural integrity of any element of Project.
   2. Integrity of weather exposed or moisture resistant element.
   3. Efficiency, maintenance, or safety of any operational element.
   4. Visual qualities of sight exposed elements.
   5. Work of County or separate Contractor.
D. Project Record Documents: Accurately record actual locations of capped and active utilities.

1.05 QUALIFICATIONS

A. For survey Work, employ a land surveyor registered in the State of California and acceptable to Engineer. Submit evidence of Surveyor's Errors and Omissions insurance coverage in the form of an Insurance Certificate.
B. For design of temporary shoring and bracing, employ a Professional Engineer experienced in design of this type of Work and licensed in the State of California.

1.06 PROJECT CONDITIONS

A. Use of explosives is not permitted.
B. Grade site to drain. Maintain excavations free of water. Provide, operate, and maintain pumping equipment.

C. Protect site from puddling or running water. Provide water barriers as required to protect site from soil erosion.
D. Ventilate enclosed areas to assist cure of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, or gases.
E. Dust Control: Execute Work by methods to minimize raising dust from construction operations. Provide positive means to prevent air-borne dust from dispersing into atmosphere and over adjacent property.
F. Erosion and Sediment Control: Plan and execute Work by methods to control surface drainage from cuts and fills, from borrow and waste disposal areas. Prevent erosion and sedimentation.
G. Pollution Control: Provide methods, means, and facilities to prevent contamination of soil, water, and atmosphere from discharge of noxious, toxic substances, and pollutants produced by construction operations. Comply with federal, state, and local regulations.

1.07 COORDINATION

A. Coordinate scheduling, submittals, and Work of the various sections of the Specifications to ensure efficient and orderly sequence of installation of interdependent construction elements, with provisions for accommodating items installed later.
B. Notify affected utility companies and comply with their requirements.
C. Verify that utility requirements and characteristics of new operating equipment are compatible with building utilities. Coordinate Work of various sections having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.
D. Coordinate space requirements, supports, and installation of mechanical and electrical Work that are indicated diagrammatically on Drawings. Follow routing shown for pipes, ducts, and conduit, as closely as practicable; place runs parallel with lines of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.
E. In finished areas except as otherwise indicated, conceal pipes, ducts, and wiring within the construction. Coordinate locations of fixtures and outlets with finish elements.
F. Coordinate completion and clean-up of Work of separate sections.
G. After County occupancy of premises, coordinate access to site for correction of defective Work and Work not in accordance with Contract Documents, to minimize disruption of County's activities.

PART 2 PRODUCTS

2.01 PATCHING MATERIALS

A. New Materials: As specified in product sections; match existing products and Work for patching and extending Work.
B. Type and Quality of Existing Products: Determine by inspecting and testing products where necessary, referring to existing Work as a standard.
C. Product Substitution: For any proposed change in materials, submit request for substitution described in Section 01 2500 – Substitution Procedures.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that existing site conditions and substrate surfaces are acceptable for subsequent Work. Start of Work means acceptance of existing conditions.
B. Verify that existing substrate is capable of structural support or attachment of new Work being applied or attached.
C. Examine and verify specific conditions described in individual specification sections.
D. Take field measurements before confirming product orders or beginning fabrication, to minimize waste due to over-ordering or miss-fabrication.

E. Verify that utility services are available, of the correct characteristics, and in the correct locations. Furnish information to local utility and County where necessary to adjust, move, or relocate existing utilities and appurtenances.
F. Prior to Cutting: Examine existing conditions prior to commencing Work, including elements subject to damage or movement during cutting and patching. After uncovering existing Work, assess conditions affecting performance of Work. Beginning of cutting or patching means acceptance of existing conditions.

3.02 PREPARATION

A. Clean substrate surfaces prior to applying next material or substance.
B. Seal cracks or openings of substrate prior to applying next material or substance.
C. Apply manufacturer required or recommended substrate primer, sealer, or conditioner prior to applying any new material or substance in contact or bond.

3.03 PREINSTALLATION MEETINGS

A. When required in individual specification sections, convene a pre-installation meeting at the site prior to commencing Work of the section.
B. Require attendance of parties directly affecting, or affected by, Work of the specific section.
C. Notify Engineer seven Calendar Days in advance of meeting date.
D. Prepare agenda and preside at meeting:
    1. Review conditions of examination, preparation and installation procedures.
    2. Review coordination with related Work.
E. Record minutes and distribute copies within two Calendar Days after meeting to participants, with two copies to Engineer, participants, and those affected by decisions made.

3.04 LAYING OUT THE WORK

A. Verify locations of survey control points prior to starting Work.
B. Promptly notify Engineer of any discrepancies discovered.
C. Contractor shall locate and protect survey control and reference points.
D. Control datum for survey is that indicated on Drawings.
E. Protect survey control points prior to starting site Work; preserve permanent reference points during construction.
F. Promptly report to Engineer the loss or destruction of any reference point or relocation required because of changes in grades or other reasons.
G. Replace dislocated survey control points based on original survey control. Make no changes without prior written notice to Engineer.
H. Utilize recognized Engineering survey practices.
I. Establish elevations, lines and levels. Locate and lay out by instrumentation and similar appropriate means:
    1. Site improvements including pavements; stakes for grading, fill and topsoil placement; utility locations, slopes, and invert elevations.
    2. Grid or axis for structures.
    3. Building foundation, column locations, ground floor elevations.
J. Periodically verify layouts by same means.
K. Maintain a complete and accurate log of control and survey Work as it progresses.
L. On completion of foundation walls and major site improvements, prepare a certified survey illustrating dimensions, locations, angles, and elevations of construction and site Work.
M. Located well abandoned in-place from Well Completion Report provide by County.

3.05 GENERAL INSTALLATION REQUIREMENTS

A. Install products as specified in individual sections, in accordance with manufacturer's instructions and recommendations, and so as to avoid waste due to necessity for replacement.
B. Make vertical elements plumb and horizontal elements level, unless otherwise indicated.
C. Install equipment and fittings plumb and level, neatly aligned with adjacent vertical and horizontal lines, unless otherwise indicated.

D. Make consistent texture on surfaces, with seamless transitions, unless otherwise indicated.
E. Make neat transitions between different surfaces, maintaining texture and appearance.

3.06 CUTTING AND PATCHING

A. Whenever possible, execute the Work by methods that avoid cutting or patching.
B. Perform whatever cutting and patching is necessary to:
   1. Complete the Work.
   2. Fit products together to integrate with other Work.
   3. Provide openings for penetration of mechanical, electrical, and other services.
   4. Match Work that has been cut to adjacent Work.
   5. Repair areas adjacent to cuts to required condition.
   6. Repair new Work damaged by subsequent Work.
   7. Remove samples of installed Work for testing when requested.
   8. Remove and replace defective and non-conforming Work.
C. Execute Work by methods that avoid damage to other Work and that will provide appropriate surfaces to receive patching and finishing. In existing work, minimize damage and restore to original condition.
D. Employ original installer to perform cutting for weather exposed and moisture resistant elements, and sight exposed surfaces.
E. Cut rigid materials using masonry saw or core drill. Pneumatic tools not allowed without prior approval.
F. Restore Work with new products in accordance with requirements of Contract Documents.
G. Fit Work air tight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.
H. Patching:
   1. Finish patched surfaces to match finish that existed prior to patching. On continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.
   2. Match color, texture, and appearance.
   3. Repair patched surfaces that are damaged, lifted, discolored, or showing other imperfections due to patching Work. If defects are due to condition of substrate, repair substrate prior to repairing finish.

3.07 PROGRESS CLEANING

A. Maintain areas free of waste materials, debris, and rubbish. Maintain site in a clean and orderly condition.
B. Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces, and other closed or remote spaces, prior to enclosing the space.
C. Broom and vacuum clean interior areas prior to start of surface finishing, and continue cleaning to eliminate dust.
D. Collect and remove waste materials, debris, and trash/rubbish from site periodically and dispose off-site; do not burn or bury.

3.08 PROTECTION OF INSTALLED WORK

A. Protect installed Work from damage by construction operations.
B. Provide special protection where specified in individual specification sections.
C. Provide temporary and removable protection for installed products. Control activity in immediate Work area to prevent damage.
D. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings.
E. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials.
F. Prohibit traffic or storage upon waterproofed or roofed surfaces. If traffic or activity is necessary, obtain recommendations for protection from waterproofing or roofing material manufacturer.
G. Remove protective coverings when no longer needed; reuse or recycle plastic coverings if possible.

3.09 SYSTEM STARTUP

A. Coordinate schedule for start-up of various equipment and systems.
B. Verify that each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, and for conditions that may cause damage.
C. Verify tests, meter readings, and specified electrical characteristics agree with those required by the equipment or system manufacturer.
D. Verify that wiring and support components for equipment are complete and tested.
E. Execute start-up under supervision of applicable Contractor personnel, County personnel, and manufacturer's representative in accordance with manufacturers' instructions.
F. Submit a written report that equipment or system has been properly installed and is functioning correctly.

3.10 DEMONSTRATION AND INSTRUCTION

A. See Section 01 7900 - Demonstration and Training.

3.11 ADJUSTING

A. Adjust operating products and equipment to ensure smooth and unhindered operation.
B. Testing, adjusting, and balancing HVAC systems: See Section 23 0593 - Testing, Adjusting, and Balancing for HVAC, provide TAB report.

3.12 FINAL CLEANING

A. Execute final cleaning prior to Substantial Completion.
B. Use cleaning materials that are nonhazardous.
C. Clean interior and exterior glass, surfaces exposed to view; remove temporary labels, stains and foreign substances, polish transparent and glossy surfaces, vacuum carpeted and soft surfaces.
D. Remove all labels that are not permanent. Do not paint or otherwise cover fire test labels or nameplates on mechanical and electrical equipment.
E. Clean equipment and fixtures to a sanitary condition with cleaning materials appropriate to the surface and material being cleaned.
F. Clean filters of operating equipment.
G. Clean debris from roofs, gutters, downspouts, scuppers, overflow drains, area drains, and other drainage systems.
H. Clean site; sweep paved areas, rake clean landscaped surfaces.
I. Remove waste, surplus materials, trash/rubbish, and construction facilities from the site; dispose of in legal manner; do not burn or bury.

3.13 CLOSEOUT PROCEDURES

A. Make submittals that are required by governing or other authorities.
    1. Provide copies to Engineer.
B. Substantial Completion
    1. Prepare and submit a list of items to be completed and corrected (punch list), the value of items on the list, and reasons why the Work is not complete.
        a. Advise County of pending insurance changeover requirements.
        b. Submit manufacturers' warranties, Workmanship bonds, maintenance service agreements, final certifications, and similar documents.
        c. Submit data cable test reports.
        d. Obtain and submit releases permitting County unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
        e. Prepare and submit Project Record Documents, operation and maintenance manuals, final completion construction photographic documentation, damage or settlement surveys, property surveys, and similar final record information.
        f. Deliver tools, spare parts, extra materials, and similar items to location designated by County. Label with manufacturer's name and model number where applicable.

g. Make final changeover of permanent locks and deliver keys to County. Advise County's personnel of changeover in security provisions.
h. Complete startup testing of systems.
i. Submit test/adjust/balance records.
j. Complete commissioning requirements.
k. Submit changeover information related to County's occupancy, use, operation, and maintenance.
l. Complete final cleaning requirements, including touchup painting.

2. Notify Engineer when Work is considered ready for Engineer's Substantial Completion review.
3. Submit written certification containing Contractor's Correction Punch List, which Contract Documents have been reviewed, Work has been inspected, and that Work is complete in accordance with Contract Documents and ready for Engineer's Substantial Completion review.

C. Conduct Substantial Completion inspection and create Final Correction Punch List containing Engineer's and Contractor's comprehensive list of items identified to be completed or corrected and submit to Engineer.
D. Correct items of Work listed in Final Correction Punch List and comply with requirements for access to County-occupied areas.

3.14 FINAL ACCEPTANCE

A. Notify Engineer when Work is considered finally complete and ready for Engineer's Substantial Completion final review.
B. Complete items of Work determined by Engineer listed in executed Certificate of Substantial Completion.
C. Before requesting final review for determining final completion, complete the following:
1. Submit a final Application for Payment.
2. Submit copy of Engineer's Substantial Completion review list of items to be completed or corrected (punch list), certified by the Contractor, stating that each item has been completed or otherwise resolved for acceptance. This review list will be reviewed and dated by Engineer.
3. Submit notarized and signed evidence of final, continuing insurance coverage complying with insurance requirements.
4. Submit pest-control final inspection report and signed warranty. Refer to specific warranty requirements elsewhere in Contract Documents.
5. Instruct County's personnel in operation, adjustment, and maintenance of products, equipment, and systems.

D. In accordance with General Conditions, submit a written request for final review for acceptance. On receipt of request, Engineer will either proceed with review or notify Contractor of unfulfilled requirements. Engineer will notify Contractor of construction that must be completed or corrected.
1. Re-review: Request re-review when the Work identified in previous reviews as incomplete is completed or corrected.
2. Following completion of all final review items, Contactor shall prepare and submit a final Certificate for Payment.

3.15 MAINTENANCE

A. Provide service and maintenance of components indicated in specification sections.
B. Maintenance Period: As indicated in specification sections or, if not indicated, not less than one year from the Date of Substantial Completion or the length of the manufacturer’s warranty, whichever is greater.
C. Examine system components at a frequency consistent with reliable operation. Clean, adjust, and lubricate as required.
D. Include systematic examination, adjustment, and lubrication of components. Repair or replace parts whenever required. Use parts produced by the manufacturer of the original component.

E. Maintenance service shall not be assigned or transferred to any agent or Subcontractor without prior written consent of the County.

END OF SECTION

SECTION 01 74 19 CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 GENERAL

1.01 WASTE MANAGEMENT REQUIREMENTS

A. The Contractor shall review, understand and comply with the requirements of all applicable County Codes and requirements concerning waste management and disposal
B. County requires that this Project generate the least amount of trash and waste possible.
C. Comply with Section 5.408 Construction Waste Reduction, Disposal and Recycling of the 2016 California Green Building Standards Code.
D. Employ processes that ensure the generation of as little waste as possible due to error, poor planning, breakage, mishandling, contamination, or other factors.
E. Minimize trash/waste disposal in landfills; reuse, salvage, or recycle as much waste as economically feasible.
F. Required Recycling, Salvage, and Reuse: The following may not be disposed of in landfills or by incineration:
    1. Aluminum and plastic containers.
    2. Corrugated cardboard and paper.
    3. Wood pallets.
    4. Clean dimensional wood.
    5. Land clearing debris, including brush, branches, logs, and stumps; see Section 31 1000 - Site Clearing for use options.
    6. Concrete.
    7. Bricks.
    8. Concrete masonry units.
    9. Precast concrete panels.
    10. Asphalt paving.
    11. Metals, including packaging banding, metal studs, sheet metal, structural steel, piping, reinforcing bars, door frames, and other items made of steel, iron, galvanized steel, stainless steel, aluminum, copper, zinc, lead, brass, and bronze.
    12. Glass.
    13. Gypsum drywall and plaster.
    14. Plastic buckets.
    15. Carpet, carpet cushion, carpet tile, and carpet remnants, both new and removed.
    16. Asphalt roofing shingles.
    17. Paint, solvents, cleaners, lubricants, adhesives and all other waste considered to be hazardous under State or Federal Regulations.
    18. Plastic sheeting.
    19. Rigid foam insulation.
    20. Vinyl siding.
    21. Windows, doors, and door hardware.
    22. Plumbing fixtures.
    23. Mechanical and electrical equipment.
    24. Fluorescent and LED lamps (light bulbs).
    25. Acoustical ceiling tile and panels.
    26. Batteries
G. Contractor shall submit Waste Disposal Reports along with every payment application; all landfill disposal, recycling, salvage, and reuse must be reported regardless of to whom the cost or savings accrues; use the same units of measure on all reports.
H. Methods of trash/waste disposal that are not acceptable are:
    1. Burning on the Project site.
    2. Burying on the Project site.
    3. Dumping or burying on other property, public or private.
    4. Other illegal dumping or burying.
I. Regulatory Requirements: Contractor is responsible for knowing and complying with regulatory requirements, including but not limited to Federal, State and local requirements.

1.02 RELATED REQUIREMENTS

A. Section 01 3000 - Administrative Requirements 01 3000: Additional requirements for Project meetings, reports, submittal procedures, and Project documentation.
B. Section 01 5000 - Temporary Facilities and Controls: Additional requirements related to trash/waste collection and removal facilities and services.
C. Section 01 6000 - Product Requirements: Waste prevention requirements related to delivery, storage, and handling.
D. Section 01 7000 - Execution and Closeout Requirements: Trash/waste prevention procedures related to demolition, cutting and patching, installation, protection, and cleaning.

1.03 DEFINITIONS

A. Clean: Untreated and unpainted; not contaminated with oils, solvents, caulk, or the like.
B. Construction and Demolition Waste: Solid wastes typically including building materials, packaging, trash, debris, and rubble resulting from construction, remodeling, repair and demolition operations.
C. Hazardous: Exhibiting the characteristics of hazardous substances, i.e., ignitibility, corrosively, toxicity or reactivity.
D. Nonhazardous: Exhibiting none of the characteristics of hazardous substances, i.e., ignitibility, corrosively, toxicity, or reactivity.
E. Nontoxic: Neither immediately poisonous to humans nor poisonous after a long period of exposure.
F. Recyclable: The ability of a product or material to be recovered at the end of its life cycle and remanufactured into a new product for reuse by others.
G. Recycle: To remove a waste material from the Project site to another site for remanufacture into a new product for reuse by others.
H. Recycling: The process of sorting, cleansing, treating and reconstituting solid waste and other discarded materials for the purpose of using the altered form. Recycling does not include burning, incinerating, or thermally destroying waste.
I. Return: To give back reusable items or unused products to vendors for credit.
J. Reuse: To reuse a construction waste material in some manner on the Project site.
K. Salvage: To remove a waste material from the Project site to another site for resale or reuse by others.
L. Sediment: Soil and other debris that has been eroded and transported by storm or well production run-off water.
M. Source Separation: The act of keeping different types of waste materials separate beginning from the first time they become waste.
N. Toxic: Poisonous to humans either immediately or after a long period of exposure.
O. Trash: Any product or material unable to be reused, returned, recycled, or salvaged.
P. Waste: Extra material or material that has reached the end of its useful life in its intended use. Waste includes salvageable, returnable, recyclable, and reusable material.

1.04 SUBMITTALS

A. Submit Waste Management Plan within 21 Calendar Days after receipt of Notice of Award of Bid, or prior to any trash or waste removal, whichever occurs sooner; submit projection of all trash and waste that will require disposal and alternatives to landfilling.
B. Waste Disposal Reports: Submit at specified intervals, with details of quantities of trash and waste, means of disposal or reuse, and costs; show both totals to date and since last report.
    1. Submit updated Report with each Application for Progress Payment; failure to submit Report will delay payment.
    2. Submit Report on a form acceptable to County.
    3. Landfill Disposal: Include the following information:
    a. Identification of material.
    b. Amount, in tons or cubic yards (cubic meters), of trash/waste material from the Project disposed of in landfills.

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

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 WASTE MANAGEMENT PROCEDURES
A. See Section 01 5000 for additional requirements related to trash/waste collection and removal facilities and services.
B. See Section 01 6000 for waste prevention requirements related to delivery, storage, and handling.
C. See Section 01 7000 for trash/waste prevention procedures related to cutting and patching, installation, protection, and cleaning.

3.02 WASTE MANAGEMENT PLAN IMPLEMENTATION
A. Manager: Designate an on-site person or persons responsible for instructing Workers and overseeing and documenting results of the Waste Management Plan.
B. Communication: Distribute copies of the Waste Management Plan to job site foreman, each Subcontractor, and Engineer.
C. Instruction: Provide on-site instruction of appropriate separation, handling, and recycling, salvage, reuse, and return methods to be used by all parties at the appropriate stages of the Project.
D. Meetings: Discuss trash/waste management goals and issues at Project meetings.
1. Pre-construction meeting.
2. Regular job-site meetings.
E. Facilities: Provide specific facilities for separation and storage of materials for recycling, salvage, reuse, return, and trash disposal, for use by all Contractors and installers.
1. As a minimum, provide:
a. Separate area for storage of materials to be reused on-site, such as wood cut-offs for blocking.
b. Separate dumpsters for each category of recyclable.
c. Recycling bins at Worker lunch area.

2. Provide containers as required.
3. Provide temporary enclosures around piles of separated materials to be recycled or salvaged.
4. Provide materials for barriers and enclosures that are nonhazardous, recyclable, or reusable to the maximum extent possible; reuse Project construction waste materials if possible.
5. Locate enclosures out of the way of construction traffic.
6. Provide adequate space for pick-up and delivery and convenience to Subcontractors.
7. If an enclosed area is not provided, clearly lay out and label a specific area on-site.
8. Keep recycling and trash/waste bin areas neat and clean and clearly marked in order to avoid contamination of materials.

F. Hazardous Wastes: Separate, store, and dispose of hazardous wastes according to applicable regulations.

G. Recycling: Separate, store, protect, and handle at the site identified recyclable waste products in order to prevent contamination of materials and to maximize recyclability of identified materials. Arrange for timely pickups from the site or deliveries to recycling facility in order to prevent contamination of recyclable materials.

H. Reuse of Materials On-Site: Set aside, sort, and protect separated products in preparation for reuse.

I. Salvage: Set aside, sort, and protect products to be salvaged for reuse off-site.

END OF SECTION

SECTION 01 78 00 CLOSEOUT SUBMITTALS

PART 1 GENERAL

1.01 SECTION INCLUDES
- A. Project Record Documents.
- B. Operation and Maintenance Data.
- C. Warranties and bonds.

1.02 RELATED REQUIREMENTS
- A. General Conditions and Supplementary Conditions requirements.
- B. Section 01 30 00 - Administrative Requirements: Submittals procedures, shop drawings, product data, and samples.
- C. Individual Product Sections: Specific requirements for operation and maintenance data.
- D. Individual Product Sections: Warranties required for specific products or Work.

1.03 SUBMITTALS
- A. Project Record Documents: Submit documents to Engineer with Final Payment application.
- B. Operation and Maintenance Data:
  1. For equipment, or component parts of equipment put into service during construction and operated by County, submit completed documents within 10 Calendar Days after acceptance.
  2. Submit one copy of completed documents 15 Calendar Days prior to final inspection. This copy will be reviewed and returned after final inspection, with Engineer comments. Revise content of all document sets as required prior to final submission.
  3. Submit two sets of revised final documents in final form within 10 Calendar Days after final inspection.
- C. Warranties and Bonds:
  1. For equipment or component parts of equipment put into service during construction with County's permission, submit documents within 10 Calendar Days after acceptance.
  2. Make other submittals within 10 Calendar Days after Date of Substantial Completion, prior to final Application for Payment.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 PROJECT RECORD DOCUMENTS
- A. Maintain on site one set of the following record documents; record actual revisions to the Work:
  1. Drawings.
  2. Specifications.
  3. Addenda.
  4. Change Orders and other modifications to the Contract.
  5. Reviewed shop drawings, product data, and samples.
- B. Ensure entries are complete and accurate, enabling future reference by County.
- C. Store record documents separate from documents used for construction.
- D. Record information concurrent with construction progress.
- E. Specifications: Legibly mark and record at each product section description of actual products installed, including the following:
  1. Manufacturer's name and product model and number.
  2. Product substitutions or alternates utilized.
  3. Changes made by Addenda and modifications.
- F. Record Drawings and Shop Drawings: Legibly mark each item to record actual construction including:
  1. Measured depths of foundations in relation to finish first floor datum.

2. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
3. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the Work.
4. Field changes of dimension and detail.
5. Details not on original Contract drawings.

G. Provide two hard copies and a digital copy, on two USB thumb drives, of all documents above (A-F) in high resolution PDF format.

3.02 OPERATION AND MAINTENANCE DATA

A. Source Data: For each product or system, list names, addresses and telephone numbers of Sub-Contractors and suppliers, including local source of supplies and replacement parts.
B. Product Data: Mark each sheet to clearly identify specific products and component parts, and data applicable to installation. Delete inapplicable information.
C. Drawings: Supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams. Do not use Project Record Documents as maintenance drawings.
D. Typed Text: As required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions.
E. Provide two hard copies and a digital copy, on two USB thumb drives, of all documents above (A-D) in high resolution PDF format.

3.03 OPERATION AND MAINTENANCE DATA FOR MATERIALS AND FINISHES

A. For Each Product, Applied Material, and Finish:
    1. Product data, with catalog number, size, composition, and color and texture designations.
B. Instructions for Care and Maintenance: Manufacturer's recommendations for cleaning agents and methods, precautions against detrimental cleaning agents and methods, and recommended schedule for cleaning and maintenance.
C. Additional information as specified in individual product specification sections.
D. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.

3.04 OPERATION AND MAINTENANCE DATA FOR EQUIPMENT AND SYSTEMS

A. For Each Item of Equipment and Each System:
    1. Description of unit or system, and component parts.
    2. Identify function, normal operating characteristics, and limiting conditions.
    3. Include performance curves, with Engineering data and tests.
    4. Complete nomenclature and model number of replaceable parts.
B. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.
C. Panelboard Circuit Directories: Provide electrical service characteristics, controls, and communications; typed.
D. Operating Procedures: Include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and any special operating instructions.
E. Maintenance Requirements: Include routine procedures and guide for preventative maintenance and troubleshooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.
F. Provide servicing and lubrication schedule, and list of lubricants required.
G. Include manufacturer's printed operation and maintenance instructions.
H. Include sequence of operation by controls manufacturer.
I. Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.
J. Provide Contractor's coordination drawings, with color coded piping diagrams as installed.

K. Provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.
L. Include test and balancing reports.
M. Additional Requirements: As specified in individual product specification sections.

3.05 ASSEMBLY OF OPERATION AND MAINTENANCE MANUALS

A. Assemble operation and maintenance data into durable manuals for County's personnel use, with data arranged in the same sequence as, and identified by, the specification sections.
B. Where systems involve more than one specification section, provide separate tabbed divider for each system.
C. Cover: Identify each binder with typed or printed title OPERATION AND MAINTENANCE INSTRUCTIONS; identify title of Project; identify subject matter of contents.
D. Project Directory: Title and address of Project; names, addresses, and telephone numbers of Engineer, Consultants, Contractor and subcontractors, with names of responsible parties.
E. Tables of Contents: List every item separated by a divider, using the same identification as on the divider tab; where multiple volumes are required, include all volumes Tables of Contents in each volume, with the current volume clearly identified.
F. Dividers: Provide tabbed dividers for each separate product and system; identify the contents on the divider tab; immediately following the divider tab include a description of product and major component parts of equipment.
G. Text: Manufacturer's printed data, or typewritten data on 24 pound paper.
H. Drawings: Provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.
I. Arrangement of Contents: Organize each volume in parts as follows:
    1. Project Directory.
    2. Table of Contents, of all volumes, and of this volume.
    3. Operation and Maintenance Data: Arranged by system, then by product category.
        a. Source data.
        b. Product data, shop drawings, and other submittals.
        c. Operation and maintenance data.
        d. Field quality control data.
        e. Photocopies of warranties and bonds.
J. Provide two hard copies and a digital copy, on two USB thumb drives, of all documents above (A-I) in high resolution PDF format.

3.06 WARRANTIES AND BONDS

A. Obtain manufacturer’s written warranties and bonds, executed in duplicate by responsible Subcontractors, suppliers, and manufacturers, within 10 Calendar Days after completion of the applicable item of Work. Except for items put into use with County's permission, leave date of beginning of time of warranty until the date of Acceptance of Completion of the Project by the County.
B. Verify that documents are in proper form, contain full information, and are notarized.
C. Co-execute submittals when required.
D. Retain warranties and bonds until time specified for submittal.
E. Include originals of each in operation and maintenance manuals, indexed separately on Table of Contents.
F. Provide two hard copies and a digital copy, on two USB thumb drives, of all documents above (A-E) in high resolution PDF format.

END OF SECTION

SECTION 01 79 00 DEMONSTRATION AND TRAINING

PART 1 GENERAL

1.01 SUMMARY

A. Demonstration of products and systems to be commissioned and where indicated in specific specification sections.

B. Training of County personnel or County designated Contractor that will be utilizing the below listed items, in operation and maintenance is required for:
   1. All software-operated systems.
   2. HVAC systems and equipment.
   3. Plumbing equipment.
   4. Electrical systems and equipment.
   5. Landscape irrigation.
   6. Items specified in individual product Sections.

C. Training of County personnel, or County designated Contractor, in care, cleaning, maintenance, and repair is required for:
   1. Roofing, waterproofing, and other weather-exposed or moisture protection products.
   2. Finishes, including flooring, wall finishes, ceiling finishes.
   3. Fixtures and fittings.
   4. Items specified in individual product Sections.

1.02 RELATED REQUIREMENTS

A. Section 01 7800 - Closeout Submittals: Operation and maintenance manuals.

B. Other Specification Sections: Additional requirements for demonstration and training.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures; except:
   1. Make all submittals specified in this section, and elsewhere where indicated for commissioning purposes, directly to the Commissioning Authority.
   2. Submit one copy to the Commissioning Authority, not to be returned.
   3. Make commissioning submittals on time schedule specified by Commissioning Authority.
   4. Submittals indicated as "Draft" are intended for the use of the Commissioning Authority in preparation of overall Training Plan; submit in editable electronic format, Microsoft Word 2003 or later version.

B. Draft Training Plans: County will designate personnel to be trained; tailor training to the needs and skill-level of attendees.
   1. Submit to Engineer for transmittal to County and Commissioning Authority.
   2. Submit not less than four weeks prior to start of training.
   3. Revise and resubmit until acceptable.
   4. Provide an overall schedule showing all training sessions.
   5. Include at least the following for each training session:
      a. Identification, date, time, and duration.
      b. Description of products and/or systems to be covered.
      c. Name of firm and person conducting training; include qualifications.
      d. Intended audience, such as job description.
      e. Objectives of training and suggested methods of ensuring adequate training.
      f. Methods to be used, such as classroom lecture, live demonstrations, hands-on, and similar methods used in trainings.
      g. Media to be used, such a slides, hand-outs, and similar materials used in trainings.
      h. Training equipment required, such as projector, projection screen, and similar equipment used in trainings to be provided by the Contractor.

C. Training Manuals: Provide training manual for each attendee; allow for minimum of two attendees per training session.
   1. Include applicable portion of O&M manuals.

2. Include copies of all hand-outs, slides, overheads, video presentations, or similar that are not included in O&M manuals.
3. Provide one extra copy of each training manual to be included with operation and maintenance data.

1.04 QUALITY ASSURANCE

A. Instructor Qualifications: Familiar with design, operation, maintenance and troubleshooting of the relevant products and systems.
   1. Provide as instructors the most qualified trainer of those Contractors and/or installers who actually supplied and installed the systems and equipment.
   2. Where a single person is not familiar with all aspects, provide specialists with necessary qualifications.

PART 2 PRODUCTS

2.01 VIDEO RECORDING

A. Coordinate with the County for format of video files and means to provide files.
B. The Contractor shall video record demonstration and training with full sound and close ups to clearly show complete functions of the systems.
C. Sound quality shall be clear and understandable. If any parts are not understandable, edit with voiceover or subtitles.
D. Images are to be steady and clear and clearly show the required operations. Reshoot images if images are not clear.

PART 3 EXECUTION

3.01 DEMONSTRATION - GENERAL

A. Demonstrations conducted during system start-up do not qualify as demonstrations for the purposes of this section, unless approved in advance by County.
B. Demonstrations conducted during Functional Testing need not be repeated unless County personnel training is specified.
C. Demonstration may be combined with County personnel training if applicable.
D. Demonstration shall be video recorded and edited and to be clear and clearly show the complete required elements and functions of the demonstration and training.
E. Operating Equipment and Systems: Demonstrate operation in all modes, including start-up, shut-down, seasonal changeover, emergency conditions, and troubleshooting, and maintenance procedures, including scheduled and preventive maintenance.
   1. Perform demonstrations not less than two weeks prior to Substantial Completion.
   2. For equipment or systems requiring seasonal operation, perform demonstration for other season within six months.
F. Non-Operating Products: Demonstrate cleaning, scheduled and preventive maintenance, and repair procedures.
   1. Perform demonstrations not less than two weeks prior to Substantial Completion.
G. Video Recording.
   1. Provide personnel that is proficient at recording the training for future reference.
   2. Provide the necessary equipment to clearly record the training for future reference.
   3. Provide microphones to clearly record the training for future reference.
   4. Edit the footage to be succinct, to the point and organized.
   5. Include pertinent questions and answers.
   6. Refer to 2.1.

3.02 TRAINING - GENERAL

A. Conduct training on-site unless otherwise indicated.
B. County will provide classroom and seating at no cost to Contractor.

C. Do not start training until Functional Testing is complete, unless otherwise specified or approved by the Commissioning Authority.

D. Provide training in minimum two hour segments.

E. The Commissioning Authority is responsible for determining that the training was satisfactorily completed and will provide approval forms.

F. Training schedule will be subject to availability of County's personnel to be trained; re-schedule training sessions as required by County; once schedule has been approved by County failure to conduct sessions according to schedule will be cause for County to charge Contractor for personnel "show-up" time.

G. Review of Facility Policy on Operation and Maintenance Data: During training discuss:
   1. The location of the O&M manuals and procedures for use and preservation; backup copies.
   2. Typical contents and organization of all manuals, including explanatory information, system narratives, and product specific information.
   3. Typical uses of the O&M manuals.

H. Product- and System-Specific Training:
   1. Review the applicable O&M manuals.
   2. For systems, provide an overview of system operation, design parameters and constraints, and operational strategies.
   3. Review instructions for proper operation in all modes, including start-up, shut-down, seasonal changeover and emergency procedures, and for maintenance, including preventative maintenance.
   4. Provide hands-on training on all operational modes possible and preventive maintenance.
   5. Emphasize safe and proper operating requirements; discuss relevant health and safety issues and emergency procedures.
   6. Discuss common troubleshooting problems and solutions.
   7. Discuss any peculiarities of equipment installation or operation.
   8. Discuss warranties and guarantees, including procedures necessary to avoid voiding coverage.
   9. Review recommended tools and spare parts inventory suggestions of manufacturers.
   10. Review spare parts and tools required to be furnished by Contractor.
   11. Review spare parts suppliers and sources and procurement procedures.

I. Be prepared to answer questions raised by training attendees; if unable to answer during training session, provide written response within three (3) Calendar Days.

END OF SECTION

SECTION 03 30 00 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

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

1. Footings.
2. Slabs-on-grade.
3. Concrete fill on metal deck.
4. Hardscape, sidewalks, and gutters.

B Related Sections include the following:
1. Section 03 35 00 Concrete Finishing

1.03 DEFINITIONS

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

1.04 SUBMITTALS

A Product Data: For each type of product indicated.

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

1. Indicate amounts of mixing water to be withheld for later addition at Project site.

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

D Samples: Vapor barrier.

E Welding certificates.

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

1. Cementitious materials.
2. Admixtures.
3. Steel reinforcement and accessories.
4. Curing compounds.
5. Adhesives.

6. Vapor barriers.
7. Repair materials.

1.05 QUALITY ASSURANCE

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

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

C Welding: Qualify procedures and personnel according to AWS D1.4, "Structural Welding Code--Reinforcing Steel."

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

1. ACI 301, "Specification for Structural Concrete, "Sections 1 through 5.
2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."

E Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination."

1. Before submitting design mixtures, review concrete design mixture and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:

a) Contractor's superintendent.
b) Independent testing agency responsible for concrete design mixtures.
c) Ready-mix concrete manufacturer.
d) Concrete subcontractor.

2. Review special inspection and testing and inspecting agency procedures for field quality control, concrete finishes and finishing, cold- and hot-weather concreting procedures, curing procedures, anchor rod and anchorage device installation tolerances, steel reinforcement installation, floor and slab flatness and levelness measurement, and concrete protection.

F Moisture Vapor Emission and pH Content for Interior Slab-on-Grade:

1. Concrete slabs shall meet the moisture-vapor-emission rate and pH level requirements defined in sections 09 30 00, 09 65 43, and 09 68 00 and as also defined by the finish floor manufacturer.

2. In the event the slab does not meet the moisture-vapor-emission rate and pH level the Contractor, at their expense, shall install a barrier coat and moisture sealer, “ARDEX MC RAPID”.

1.06 DELIVERY, STORAGE, AND HANDLING

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

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.

2. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

2.02 FORM-FACING MATERIALS

A Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.

1. Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1, and as follows:

B Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.

C Forms for Cylindrical Columns, Pedestals, and Supports: Metal, glass-fiber-reinforced plastic, paper, or fiber tubes that will produce surfaces with gradual or abrupt irregularities not exceeding specified formwork surface class. Provide units with sufficient wall thickness to resist plastic concrete loads without detrimental deformation.

D Pan-Type Forms: Glass-fiber-reinforced plastic or formed steel, stiffened to resist plastic concrete loads without detrimental deformation.

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

F Rustication Strips: Wood, metal, PVC, or rubber strips, kerfed for ease of form removal.

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

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

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

1. Furnish units that will leave no corrodible metal closer than 1 inch to the plane of exposed concrete surface.

2.03 STEEL REINFORCEMENT

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

B Low-Alloy-Steel Reinforcing Bars: ASTM A 706/A 706M, deformed.

C Steel Bar Mats: ASTM A 184/A 184M, fabricated from ASTM A 615/A 615M, Grade 60.

D Plain-Steel Wire: ASTM A 82, as drawn.

E Deformed-Steel Wire: ASTM A 496.

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

G Deformed-Steel Welded Wire Reinforcement: ASTM A 497, flat sheet.

H Galvanized-Steel Welded Wire Reinforcement: ASTM A 185, plain, fabricated from galvanized steel wire into flat sheets.

2.04 REINFORCEMENT ACCESSORIES

A Joint Dowel Bars: ASTM F 1554, Grade 36 plain-steel bars, cut bars true to length with ends square and free of burrs.

B Zinc Repair Material: ASTM A 780, zinc-based solder, paint containing zinc dust, or sprayed zinc.

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

1. For concrete surfaces exposed to view where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainless-steel bar supports.

2.05 CONCRETE MATERIALS

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

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

a) Fly Ash: ASTM C 618, Class F.

B Normal-Weight Aggregates: ASTM C 33, Class 4S coarse aggregate or better, graded. Provide aggregates from a single source with documented service record data of at least 10 years' satisfactory service in similar applications and service conditions using similar aggregates and cementitious materials.

1. Maximum Coarse-Aggregate Size:

a) Foundations: 1 inch
b) Slab-on-grade: 1 inch
c) Concrete fill on metal deck: 1 inch
d) Hardscape, curbs, and gutters: 1 inch

2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

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

2.06 ADMIXTURES

A Air-Entraining Admixture: ASTM C 260.

B Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.

1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
2. Retarding Admixture: ASTM C 494/C 494M, Type B.
3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
6. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.

2.07 VAPOR BARRIERS

A Plastic Vapor Barrier: ASTM E 1745, Class A not less than 15 mils thick. Include manufacturer's recommended adhesive or pressure-sensitive joint tape.

1. Available Products:
   a) Stego Industries, LLC; Stego Wrap Vapor Barrier, 15 mils, or approved equal

2.08 CURING MATERIALS

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

1. Available Products:

   a) Axim Concrete Technologies; Cimfilm.
   b) Burke by Edoco; BurkeFilm.
   c) ChemMasters; Spray-Film.
   d) Conspec Marketing & Manufacturing Co., Inc., a Dayton Superior Company; Aquafilm.
   e) Dayton Superior Corporation; Sure Film.
   f) Euclid Chemical Company (The); Eucobar.
   g) Kaufman Products, Inc.; Vapor Aid.
   h) Lambert Corporation; Lambco Skin.
   i) L&M Construction Chemicals, Inc.; E-Con.
   j) MBT Protection and Repair, Div. of ChemRex; Confilm.
   k) Meadows, W. R., Inc.; Sealtight Evapre.
   l) Metalcrete Industries; Waterhold.
   m) Nox-Crete Products Group, Kinsman Corporation; Monofilm.
   n) Sika Corporation, Inc.; SikaFilm.
   o) Symons Corporation, a Dayton Superior Company; Finishing Aid.
   p) Unitex; Pro-Film.
   q) US Mix Products Company; US Spec Monofilm ER.
   r) Vexcon Chemicals, Inc.; Certi-Vex EnvioAssist.

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

C Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

D Water: Potable.

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

1. Available Products:

a) Burke by Edoco; Cureseal 1315 WB.
b) ChemMasters; Polyseal WB.
c) Conspec Marketing & Manufacturing Co., Inc., a Dayton Superior Company; Sealcure 1315 WB.
d) Euclid Chemical Company (The); Super Diamond Clear VOX.
e) Kaufman Products, Inc.; Sure Cure 25 Emulsion.
f) Lambert Corporation; UV Safe Seal.
g) L&M Construction Chemicals, Inc.; Lumiseal WB Plus.
h) Meadows, W. R., Inc.; Vocomp-30.
i) Metalcrete Industries; Metcure 30.
j) Symons Corporation, a Dayton Superior Company; Cure & Seal 31 Percent E.
k) Tamms Industries, Inc.; LusterSeal WB 300.
l) Unitex; Hydro Seal 25.
m) US Mix Products Company; US Spec Radiance UV-25.
n) Vexcon Chemicals, Inc.; Vexcon Starseal 1315.

2.09 RELATED MATERIALS

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

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

1. Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

C Reglets: Fabricate reglets of not less than 0.0217 inch thick, galvanized steel sheet. Temporarily fill or cover face opening of reglet to prevent intrusion of concrete or debris.

D Dovetail Anchor Slots: Hot-dip galvanized steel sheet, not less than 0.0336 inch thick, with bent tab anchors. Temporarily fill or cover face opening of slots to prevent intrusion of concrete or debris.

2.10 REPAIR MATERIALS

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

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

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

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

2.11 CONCRETE MIXTURES, GENERAL

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

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

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

1. Fly Ash: 15 percent.

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

1. Use water-reducing admixture in concrete, as required, for placement and workability.
2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
3. Use water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs and parking structure slabs, concrete required to be watertight, and concrete with a water-cementitious materials ratio below 0.50.

D Color Pigment – where indicated: Add color pigment to concrete mixture according to manufacturer's written instructions and to result in hardened concrete color consistent with approved mockup.

2.12 CONCRETE MIXTURES FOR BUILDING ELEMENTS

A Footings and Interior Slabs-on-Grade: Proportion normal-weight concrete mixture as follows:

1. Minimum Compressive Strength 3000 psi at 28 days.

2. Maximum Water-Cementitious Materials Ratio: 0.50.
3. Minimum Cementitious Materials Content: 5.75 sacks per cubic yard.
4. Slump Limit: 4 inches plus or minus 1 inch.

B Exterior Slab on Grade, Curbs, and Gutters

1. Minimum Compressive Strength 2500 psi at 28 days.
2. Maximum Water-Cementitious Materials Ratio: 0.60.
3. Minimum Cementitious Materials Content: 5.00 sacks per cubic yard.
4. Slump Limit: 4 inches plus or minus 1 inch

2.13 FABRICATING REINFORCEMENT

A Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

2.14 CONCRETE MIXING

A Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M and ASTM C 1116, and furnish batch ticket information.

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

PART 3 - EXECUTION

3.01 FORMWORK

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

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

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

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

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

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

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

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

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

H Chamfer exterior corners and edges of permanently exposed concrete.

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

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

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

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

3.02 EMBEDDED ITEMS

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

1. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC's "Code of Standard Practice for Steel Buildings and Bridges."
2. Install reglets to receive waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.

3.03 REMOVING AND REUSING FORMS

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

1. Leave formwork for beam soffits, joists, slabs, and other structural elements that supports weight of concrete in place until concrete has achieved its 28-day design compressive strength.
2. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.

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

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

3.04 SHORES AND RESHORES

A Comply with ACI 318 and ACI 301 for design, installation, and removal of shoring and reshoring.

1. Do not remove shoring or reshoring until measurement of slab tolerances is complete.

B In multistory construction, extend shoring or reshoring over a sufficient number of stories to distribute loads in such a manner that no floor or member will be excessively loaded or will induce tensile stress in concrete members without sufficient steel reinforcement.

C Plan sequence of removal of shores and reshore to avoid damage to concrete. Locate and provide adequate reshoring to support construction without excessive stress or deflection.

3.05 VAPOR BARRIERS

A Plastic Vapor Barrier: Place, protect, and repair vapor retarders according to ASTM E 1643 and manufacturer's written instructions.

1. Lap joints 6 inches and seal with manufacturer's recommended tape.

B Bituminous Vapor Retarders: Place, protect, and repair vapor retarders according to manufacturer's written instructions.

3.06 STEEL REINFORCEMENT

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

1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.

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

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

1. Weld reinforcing bars according to AWS D1.4, where indicated.

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

E Install welded wire reinforcement in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.

3.07 JOINTS

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

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

1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints, unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.
2. Form keyed joints as indicated. Embed keys at least 1-1/2 inches into concrete.
3. Locate joints for beams, slabs, joists, and girders in the middle third of spans. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
4. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
5. Space vertical joints in walls as indicated. Locate joints beside piers integral with walls, near corners, and in concealed locations where possible.
6. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

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

1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint to a radius of 1/4 inch. Repeat grooving of contraction joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- (3.2-mm-) wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.

D Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt coat one-half of dowel length to prevent concrete bonding to one side of joint.

3.08 CONCRETE PLACEMENT

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

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

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

1. Deposit concrete in horizontal layers of depth to not exceed formwork design pressures and in a manner to avoid inclined construction joints.
2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.
3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of

vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.

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

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

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

1. When average high and low temperature is expected to fall below 40 deg F for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.

F Hot-Weather Placement: Comply with ACI 301 and as follows:

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

3.09 FINISHING FORMED SURFACES

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

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

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

1. Apply to concrete surfaces exposed to public view.

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

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

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

3.10 FINISHING FLOORS AND SLABS

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

B Scratch Finish: While still plastic, texture concrete surface that has been screeded and bull-floated or darbied. Use stiff brushes, brooms, or rakes to produce a profile amplitude of 1/4 inch in 1 direction.

1. Apply scratch finish to surfaces to receive mortar setting beds for bonded cementitious floor finishes.

C Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture.

1. Apply float finish to surfaces to receive trowel finish.

D Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.

1. Apply a trowel finish to surfaces exposed to view or to be covered with resilient flooring, carpet, and ceramic or quarry tile set over a cleavage membrane, paint, or another thin-film-finish coating system.
2. Finish surfaces to the following tolerances, according to ASTM E 1155, for a randomly trafficked floor surface:

E Trowel and Fine-Broom Finish: Apply a first trowel finish to surfaces where ceramic or quarry tile is to be installed by either thickset or thin-set method. While concrete is still plastic, slightly scarify surface with a fine broom.

1. Comply with flatness and levelness tolerances for trowel finished floor surfaces.

F Broom Finish: Apply a broom finish to exterior concrete platforms, steps, and ramps, and elsewhere as indicated.

1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.

G Slip-Resistive Finish: Before final floating, apply slip-resistive aluminum granule finish where indicated and to concrete stair treads, platforms, and ramps. Apply according to manufacturer's written instructions and as follows:

1. Uniformly spread 25 lb/100 sq. ft. of dampened slip-resistive aluminum granules over surface in 1 or 2 applications. Tamp aggregate flush with surface, but do not force below surface.
2. After broadcasting and tamping, apply float finish.
3. After curing, lightly work surface with a steel wire brush or an abrasive stone and water to expose slip-resistive aluminum granules.

3.11 MISCELLANEOUS CONCRETE ITEMS

A Filling In: Fill in holes and openings left in concrete structures, unless otherwise indicated, after work of other trades is in place. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete the Work.

B Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.

C Equipment Bases and Foundations: Provide machine and equipment bases and foundations as shown on Drawings. Set anchor bolts for machines and equipment at correct elevations, complying with diagrams or templates from manufacturer furnishing machines and equipment.

D Steel Pan Stairs: Provide concrete fill for steel pan stair treads, landings, and associated items. Cast-in inserts and accessories as shown on Drawings. Screed, tamp, and trowel-finish concrete surfaces.

3.12 CONCRETE PROTECTING AND CURING

A General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 301 for hot-weather protection during curing.

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

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

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

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

1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:

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

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

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

3.13 CONCRETE SURFACE REPAIRS

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

B Patching Mortar: Mix dry-pack patching mortar, consisting of one part portland cement to two and one-half parts fine aggregate passing a No. 16 sieve, using only enough water for handling and placing.

C Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.

1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch in any dimension in solid concrete, but not less than 1 inch in depth. Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement so that, when dry, patching mortar will match surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.
3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Architect.

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

1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
2. After concrete has cured at least 14 days, correct high areas by grinding.

3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.
4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.
5. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
6. Repair defective areas, except random cracks and single holes 1 inch or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least a 3/4-inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mixture as original concrete except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
7. Repair random cracks and single holes 1 inch or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.

E Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar.

F Repair materials and installation not specified above may be used, subject to Architect's approval.

3.14 FIELD QUALITY CONTROL

A Testing and Inspecting: Owner will engage a qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.

B Inspections:

1. Steel reinforcement placement.
2. Steel reinforcement welding.
3. Headed bolts and studs.
4. Verification of concrete strength before removal of shores and forms from beams and slabs.

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

1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd., but less than 25 cu. yd., plus one set for each additional 50 cu. yd. (38 cu. m) or fraction thereof.

2. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.

3. Concrete Temperature: ASTM C 1064/C 1064M; one test hourly when air temperature is 40 deg F (4.4 deg C) and below and when 80 deg F and above, and one test for each composite sample.
4. Compression Test Specimens: ASTM C 31/C 31M.

5. Compressive-Strength Tests: ASTM C 39/C 39M; test one set laboratory-cured specimen at 7 days and one set of two specimens at 28 days. Hold one cylinder in reserve.
6. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.
7. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.
8. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
9. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42/C 42M or by other methods as directed by Architect.
10. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
11. Correct deficiencies in the Work that test reports and inspections indicate dos not comply with the Contract Documents.

D Measure floor and slab flatness and levelness according to ASTM E 1155 within 48 hours of finishing.

END OF SECTION

SECTION 03 35 00 – CONCRETE FINISHING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section includes the following:
   1. Sealer-hardener for new concrete floors
   2. Precautions for avoiding staining concrete before and after application

1.03 REFERENCES

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

1.04 SUBMITTALS

A. General: Submit listed submittals in accordance with Conditions of the Contract and Section [01 33 00 - Submittal Procedures].

B. Product Data: Submit product data, including manufacturer's Spec-Data® sheet, installation instructions and technical bulletins for specified products.

C. Certificates: Manufacturer's certification that the installer is acceptable.

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

1.05 QUALITY ASSURANCE

A. Install Qualifications: Acceptable to the manufacturer

1.05 DELIVERY, STORAGE, AND HANDLING

A. General: Comply with Division 01 Product Requirements sections

B. Delivery: Delivery materials in manufacturer's original, unopened, undamaged containers with identification labels intact

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

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

PART 2 - PRODUCTS

2.01 MATERIAL

A. Manufacturer: Curecrete Distribution, Inc.

1. Contact: 1203 W. Spring Creek Place, Springville, UT 84663-0551; Telephone: (800) 998-5664, (801) 489-5663; Fax: (801) 489-3307; Email: info@ashfordformula.com; Website: www.ashfordformula.com.

B. Cure-Seal Hardener: Ashford Formula, a water-based, chemically reactive penetrating sealer and hardener that densifies concrete to seal against water molecules, but allows air and water vapor to pass, so that concrete can achieve full compressive strength for minimized surface crazing and elimination of dusting.

1. Abrasion Resistance to Revolving Disks: At least a 32.5% improvement over untreated samples when tested in accordance with ASTM C779.

2. Surface Adhesion: At least a 22% increase in adhesion for epoxy when tested in accordance with ASTM D3359.

3. Hardening: As follows when tested in accordance with ASTM C39:

a) After 7 days: An increase of at least 40% over untreated samples.

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

4. Coefficient of Friction: 0.86 dry, 0.69 wet when tested in accordance with ASTM C1028.

5. Rebound Number: An increase of at least 13.3% over untreated samples when tested in accordance with ASTM C805.

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

C. Location: Install at all exposed concrete floors.

PART 3 - EXECUTION

3.01 MANUFACTURER'S INSTRUCTIONS

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

3.02 EXAMINATION

A. Do not begin installation until substrates have been properly prepared and are suitable for application of product.
B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.03 PREPARATION

A. Clean surfaces thoroughly prior to installation.
B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
C. Do not use frozen material. Thaw and agitate prior to use.
D. If construction equipment must be used for application, diaper all components that might drip oil, hydraulic fluid or other liquids.

3.04 INSTALLATION

A. New Concrete: Apply cure-seal hardener to new concrete as soon as the concrete is firm enough to work on after troweling; with colored concrete, wait a minimum of 30 days before application.
   1. Spray on at rate of 200 ft2/gal (5 m2/L).
   2. Keep surface wet with cure-seal-hardener for a minimum soak-in period of 30 minutes without allowing it to dry or become slippery. If slipperiness occurs before the 30 minute time period has elapsed, apply additional cure-seal-hardener, as needed, to keep the entire surface in a non-slippery state for the first 15 minutes; for the remaining 15 minutes, mist the surface as needed with water to keep the material in a non-slippery state. In hot weather conditions, follow manufacturer's special application procedures.
   3. When the treated surface becomes slippery after this period, lightly mist with water until slipperiness disappears.
   4. Wait for surface to become slippery again, and then flush entire surface with water to remove all cure-seal-hardener residue.
   5. Squeegee surface completely dry, flushing any remaining slippery areas until no residue remains.
   6. Wet vacuum or scrubbing machines can be used in accordance with manufacturer's instructions to remove residue.

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

3.05 PROTECTION

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

END OF SECTION

SECTION 04 22 00 - CONCRETE UNIT MASONRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Concrete masonry units.
2. Decorative concrete masonry units.
3. Mortar and grout.
4. Steel reinforcing bars.
5. Masonry joint reinforcement.
6. Ties and anchors.
7. Liquid polymeric admixture added to the concrete masonry units at the time of manufacture.
8. Liquid polymeric water-repellent admixture added to the mortar at the time of mixing for use in the construction of water-repellent concrete masonry.
9. Embedded flashing.
10. Miscellaneous masonry accessories.

B. Related Sections:
1. Section 05 12 00 "Structural Steel Framing" for installing anchor sections of adjustable masonry anchors for connecting to structural-steel frame.
2. Section 07 60 00 "Sheet Metal Flashing and Trim" for exposed sheet metal flashing and for furnishing manufactured reglets installed in masonry joints.

1.3 DEFINITIONS

A. CMU(s): Concrete masonry unit(s).

B. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.

1.4 PERFORMANCE REQUIREMENTS

A. Provide structural unit masonry that develops indicated net-area compressive strengths at 28 days.

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

B. Water-Repellent CMU Admixture,

1. Water Permeance of Masonry, ASTM E514: Capable of achieving a Class E Rating when evaluated using ASTM E514 with the test extended to 72 hours, using the rating criteria specified in ASTM E514-74
2. Flexural Bond Strength of Masonry, ASTM C1072: No statistically lower masonry flexural bond strength shall occur as a result of adding integral water repellent CMU and mortar admixtures when compared to a control (containing no admixtures) CMU and mortar tested in accordance with ASTM C1072 as directed by ASTM C1384.
3. Water Repellent Mortar Admixture Classification: Capable of meeting all of the requirements for a Water Repellent Classification when evaluated in accordance with ASTM C1384.

1.5 PRECONSTRUCTION TESTING

A. Preconstruction Testing Service: Owner will engage a qualified independent testing agency to perform preconstruction testing indicated below. Retesting of materials that fail to comply with specified requirements shall be done at Contractor's expense.

1. Prism Test: For each type of construction required, according to ASTM C 1314.

1.6 ACTION SUBMITTALS

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

B. Shop Drawings: For the following:

1. Masonry Units: Show sizes, profiles, coursing, and locations of special shapes.
2. Reinforcing Steel: Detail bending and placement of unit masonry reinforcing bars. Comply with ACI 315, "Details and Detailing of Concrete Reinforcement." Show elevations of reinforced walls]
3. Fabricated Flashing: Detail corner units, end-dam units, and other special applications.

C. Samples for Initial Selection:

1. Decorative CMUs, in the form of small-scale units.
2. Colored mortar.
3. Weep holes/vents.

D. Samples for Verification: For each type and color of the following:

1. Exposed CMUs.
2. Pigmented and colored-aggregate mortar. Make Samples using same sand and mortar ingredients to be used on Project.
3. Accessories embedded in masonry.

E. Certificates;
1. From CMU producer stating that the concrete masonry units supplied to Project for construction of exterior walls contain integral CMU water-repellent admixture added at the appropriate dosage rate and that they comply with the water-repellent admixture manufacturer’s requirements.
2. From masonry Installer stating that only CMUs containing integral CMU water-repellent admixture have been placed where required.

F. Test and Evaluation Reports

1. Prepared by qualified independent laboratory indicating compliance with performance requirements for water-repellent CMU admixture

1.7 INFORMATIONAL SUBMITTALS

A. List of Materials Used in Constructing Mockups: List generic product names together with manufacturers, manufacturers' product names, model numbers, lot numbers, batch numbers, source of supply, and other information as required to identify materials used. Include mix proportions for mortar and grout and source of aggregates.

1. Submittal is for information only. Neither receipt of list nor approval of mockup constitutes approval of deviations from the Contract Documents unless such deviations are specifically brought to the attention of Architect and approved in writing.

B. Qualification Data: For testing agency.

C. Material Certificates: For each type and size of the following:

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

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

1. Include test reports for mortar mixes required to comply with property specification. Test according to ASTM C 109/C 109M for compressive strength, ASTM C 1506 for water retention, and ASTM C 91 for air content.
2. Include test reports, according to ASTM C 1019, for grout mixes required to comply with compressive strength requirement.

E. Cold-Weather and Hot-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with requirements.

1.8 QUALITY ASSURANCE

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

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

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

D. Certification: CMU producer shall be certified by the manufacturer of the integral CMU water-repellent admixture

E. Sample Panel: Construct sample masonry panel to verify compatibility of materials and effects of materials and construction procedures on final appearance of masonry work. Incorporate range of CMU and mortar textures and colors permissible. Comply with requirements in Section 014000 "Quality Requirements" for mockups.
   1. Construct panel using jobsite materials to construct sample panel, including specified water-repellent CMU and mortar containing water-repellent mortar admixture.
   2. Build sample panels for each type of exposed unit masonry construction in sizes approximately 48 inches long by 48 inches] high by full thickness.
   3. Prepare more than one sample batch of mortar, especially when coloring pigments are added to the mortar, to establish acceptable visual and performance characteristics.
   4. Perform specified construction procedures on sample panel, including cleaning of one-half of panel, and application of specified coatings, if any, and joint sealants.
   5. Construct additional sample panels as necessary to obtain Architect approval.
   6. Retain approved sample panel during construction as standard for judging completed masonry work
   7. Where masonry is to match existing, erect panels adjacent and parallel to existing surface.
   8. Protect approved sample panels from the elements with weather-resistant membrane.
   9. Approval of sample panels is for color, texture, and blending of masonry units; relationship of mortar and sealant colors to masonry unit colors; tooling of joints; aesthetic qualities of workmanship; and other material and construction qualities specifically approved by Architect in writing.

      a. Approval of sample panels does not constitute approval of deviations from the Contract Documents contained in sample panels unless such deviations are specifically approved by Architect in writing.

F. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Section 013100 "Project Management and Coordination." At least two weeks prior to commencing above-grade masonry work, schedule pre-installation conference at the jobsite. Attendees shall include Contractor, masonry installer, flashing installer, CMU supplier and/or integral water-repellent admixture manufacturer's representative, and related subcontractors. Give at least two weeks' notice to the participants and advise the architect of the scheduled meeting date. Include as agenda items the following:
   1. Interface of flashing, waterproofing, and air barrier work with masonry installation.
   2. Preparation of mortar mix including water-repellent mortar admixture.
   3. Mortar handling and tooling techniques to increase water resistance of completed masonry work.

1.9 DELIVERY, STORAGE, AND HANDLING

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

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

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

D. Deliver preblended, dry mortar mix in moisture-resistant containers designed for use with dispensing silos. Store preblended, dry mortar mix in delivery containers on elevated platforms, under cover, and in a dry location or in covered weatherproof dispensing silos.

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

F. Store integral water-repellent mortar admixture in an area where temperature is maintained between 40 to 110 ºF (4 to 43 ºC).

G. Do not allow integral water-repellent mortar admixture to freeze; discard any frozen admixture.

1.10 PROJECT CONDITIONS

A. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.

1. Extend cover a minimum of 24 inches down both sides of walls and hold cover securely in place.

B. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least three days after building masonry walls or columns.

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

1. Protect base of walls from rain-splashed mud and from mortar splatter by spreading coverings on ground and over wall surface.
2. Protect sills, ledges, and projections from mortar droppings.
3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.

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

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

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

PART 2 - PRODUCTS

2.1 MASONRY UNITS, GENERAL

A. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated in the standard. Do not use units where such defects will be exposed in the completed Work.

2.2 CONCRETE MASONRY UNITS

A. Regional Materials: CMUs shall be manufactured within 500 miles of Project site from aggregates and cement that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles (800 km) of Project site.

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

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

C. CMUs: ASTM C 90.
1. Density Classification: Medium weight unless otherwise indicated.
2. Size (Width): Manufactured to dimensions 3/8 inch less than nominal dimensions.

3. Exposed Faces: Provide color and texture matching the range represented by Architect's sample.

D. Decorative CMUs: ASTM C 90.

1. Density Classification: Medium weight.
2. Size: Manufactured to dimensions specified in "CMUs" Paragraph.
3. Pattern and Texture: as indicated
4. Colors: As selected by Architect from manufacturer's full range.

E. Water-Repellent Mortar Admixture: Integral liquid polymeric water-repellent admixture for mortar added to the concrete masonry unit (CMU) at the time of manufacture.

1. Product: RainBloc® Admixture for Water-Repellent Concrete Masonry Unit Production, an integral liquid water-repellent admixture manufactured by ACM Chemistries, Inc.

2.3 MORTAR AND GROUT MATERIALS

A. Regional Materials: Aggregate for mortar and grout**,** cement, and lime shall be extracted, harvested, or recovered, as well as manufactured, within 500 miles of Project site.

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

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

D. Portland Cement-Lime Mix: Packaged blend of portland cement and hydrated lime containing no other ingredients.

E. Masonry Cement: ASTM C 91.

1. Products: Subject to compliance with requirements available products that may be incorporated into the Work include, but are not limited to, the following:

a. Capital Materials Corporation.
b. Cemex S.A.B. de C.V.
c. Essroc, Italcementi Group.

d. Holcim (US) Inc
e. Lafarge North America Inc.
f. Lehigh Cement Company].
g. National Cement Company, Inc.; Coosa Masonry Cement.

F. Mortar Cement: ASTM C 1329.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Lafarge North America Inc.

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

1. Products: Subject to compliance with requirements available products that may be incorporated into the Work include, but are not limited to, the following:

a. Davis Colors; True Tone Mortar Colors.
b. Lanxess Corporation; Bayferrox Iron Oxide Pigments.
c. Solomon Colors, Inc.; SGS Mortar Colors.

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

1. Colored Portland Cement-Lime Mix:

a. Products: Subject to compliance with requirements available products that may be incorporated into the Work include, but are not limited to, the following:

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

2. Colored Masonry Cement:

a. Products: Subject to compliance with requirements available products that may be incorporated into the Work include, but are not limited to, the following:

1) Capital Materials Corporation; Flamingo Color Masonry Cement.
2) Cemex S.A.B. de C.V.; Richcolor Masonry Cement.
3) Essroc, Italcementi Group; Brixment-in-Color.
4) Holcim (US) Inc.; Rainbow Mortamix Custom Color Masonry Cement.
5) Lafarge North America Inc.; U.S. Cement Custom Color Masonry Cement.
6) Lehigh Cement Company; Lehigh Custom Color Masonry Cement.
7) National Cement Company, Inc.; Coosa Masonry Cement.

3. Formulate blend as required to produce color indicated or, if not indicated, as selected from manufacturer's standard colors.

I. Aggregate for Mortar: ASTM C 144.

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

J. Aggregate for Grout: ASTM C 404.

K. Cold-Weather Admixture: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C 494/C 494M, Type C, and recommended by manufacturer for use in masonry mortar of composition indicated.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Euclid Chemical Company (The); Accelguard 80.
b. Grace Construction Products, W. R. Grace & Co. - Conn.; Morset.
c. Sonneborn Products, BASF Aktiengesellschaft; Trimix-NCA.

L. Water-Repellent Mortar Admixture: Integral liquid polymeric water-repellent admixture for mortar added to the mortar at the time of mixing for use in the construction of water-repellent concrete masonry.
1. Product: RainBloc® for Mortar, an integral liquid polymeric water-repellent admixture manufactured by ACM Chemistries, Inc. or approved equal.

M. Water: Potable.

2.4 REINFORCEMENT

A. Uncoated Steel Reinforcing Bars: ASTM A 615, Grade 60.

B. Masonry Joint Reinforcement, General: ASTM A 951/A 951M.

1. Interior Walls: Hot-dip galvanized, carbon steel.
2. Exterior Walls: Hot-dip galvanized, carbon steel.
3. Wire Size for Side Rods: minimum of .148- diameter.
4. Wire Size for Cross Rods: minimum of 0.148-inch diameter.
5. Wire Size for Veneer Ties: minimum of 0.148-inch diameter.
6. Spacing of Cross Rods, Tabs, and Cross Ties: Not more than 16 inches o.c.
7. Provide in lengths of not less than 10 feet**,** with prefabricated corner and tee units.

C. Masonry Joint Reinforcement for Single-Wythe Masonry: Either ladder or truss type with single pair of side rods.

2.5 MISCELLANEOUS ANCHORS

A. Anchor Bolts: Headed steel bolts complying with ASTM A 307, Grade A; with ASTM A 563 hex nuts and, where indicated, flat washers; hot-dip galvanized to comply with ASTM A 153/A 153M, Class C; of dimensions indicated.

2.6 EMBEDDED FLASHING MATERIALS

A. Metal Flashing: Provide metal flashing complying with Section 076000 "Sheet Metal Flashing and Trim**"** and as follows:

1. Fabricate continuous flashings in sections 96 inches long minimum, but not exceeding 12 feet. Provide splice plates at joints of formed, smooth metal flashing.
2. Fabricate through-wall flashing with drip edge where indicated. Fabricate by extending flashing 1/2 inch out from wall, with outer edge bent down 30 degrees and hemmed.
3. Fabricate through-wall flashing with sealant stop where indicated. Fabricate by bending metal back on itself 3/4 inch at exterior face of wall and down into joint 1/4 inch to form a stop for retaining sealant backer rod.
4. Fabricate metal drip edges and sealant stops for ribbed metal flashing from plain metal flashing of same metal as ribbed flashing and extending at least 3 inches into wall with hemmed inner edge to receive ribbed flashing and form a hooked seam. Form hem on upper surface of metal so that completed seam will shed water.
5. Metal Drip Edge: Fabricate from stainless steel. Extend at least 3 inches into wall and 1/2 inch out from wall, with outer edge bent down 30 degrees and hemmed.
6. Metal Sealant Stop: Fabricate from stainless steel. Extend at least 3 inches into wall and out to exterior face of wall. At exterior face of wall, bend metal back on itself for 3/4 inch and down into joint 1/4 inch to form a stop for retaining sealant backer rod.
7. Metal Expansion-Joint Strips: Fabricate from stainless steel to shapes indicated.

B. Application: Unless otherwise indicated, use the following:

1. Where flashing is indicated to receive counterflashing, use metal flashing.
2. Where flashing is indicated to be turned down at or beyond the wall face, use metal flashing.
3. Where flashing is partly exposed and is indicated to terminate at the wall face, use metal flashing with a drip edge with a sealant stop
4. Where flashing is fully concealed, use metal flashing.

C. Solder and Sealants for Sheet Metal Flashings: As specified in Section 076000 "Sheet Metal Flashing and Trim."

D. Adhesives, Primers, and Seam Tapes for Flashings: Flashing manufacturer's standard products or products recommended by flashing manufacturer for bonding flashing sheets to each other and to substrates.

2.7 MISCELLANEOUS MASONRY ACCESSORIES

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

B. Preformed Control-Joint Gaskets: Made from styrene-butadiene-rubber compound, complying with ASTM D 2000, Designation M2AA-805 or PVC, complying with ASTM D 2287, Type PVC-65406 and designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.

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

D. Reinforcing Bar Positioners: Wire units designed to fit into mortar bed joints spanning masonry unit cells and hold reinforcing bars in center of cells. Units are formed from 0.148-inch steel wire, hot-dip galvanized after fabrication. Provide units designed for number of bars indicated.

1. Products: Subject to compliance with requirements available products that may be incorporated into the Work include, but are not limited to, the following:

a. Dayton Superior Corporation, Dur-O-Wal Division; D/A 810, D/A 812 or D/A 817.
b. Heckmann Building Products Inc.; No. 376 Rebar Positioner.
c. Hohmann & Barnard, Inc.; #RB or #RB-Twin Rebar Positioner.
d. Wire-Bond; O-Ring or Double O-Ring Rebar Positioner.

2.8 MORTAR AND GROUT MIXES

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

1. Do not use calcium chloride in mortar or grout.
2. Use portland cement-lime masonry cement or mortar cement mortar unless otherwise indicated.
3. Add cold-weather admixture (if used) at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.
4. Add integral liquid polymeric water-repellent admixture to mortar mix in accordance with manufacturer's printed instructions.

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

C. Mortar for Unit Masonry: Comply with ASTM C 270, Proportion Specification. Provide the following types of mortar for applications stated unless another type is indicated.

1. Type S.

D. Pigmented Mortar: Use colored cement product or select and proportion pigments with other ingredients to produce color required.

1. Pigments shall not exceed 10 percent containing metal oxides and 2 percent containing carbon black of portland cement by weight.
2. Pigments shall not exceed 5 percent containing metal oxides and 1 percent containing carbon black of masonry cement or mortar cement by weight.
3. Application: Use pigmented mortar for exposed mortar joints with the following units:

a. Decorative CMUs.

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

1. Use coarse grout that will comply with Table 1.15.1 in ACI 530.1/ASCE 6/TMS 602 for dimensions of grout spaces and pour height.
2. Proportion grout in accordance with ASTM C 476, coarse grout.
3. Provide grout with a slump of 8 to 11 inches as measured according to ASTM C 143/C 143M.

PART 3 - EXECUTION

3.1 EXAMINATION

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

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

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

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

3.2 INSTALLATION, GENERAL

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

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

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

3.3 TOLERANCES

A. Dimensions and Locations of Elements:

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

B. Lines and Levels:

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

5. For lines and surfaces do not vary from straight by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2 inch maximum.
6. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 feet, or 1/2 maximum.

C. Joints:

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

3.4 LAYING MASONRY WALLS

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

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

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

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

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

F. Grout solid all CMU cells with reinforcement and as noted.

3.5 MORTAR BEDDING AND JOINTING

A. Water-Repellent CMU Masonry:
1. Installer shall use only concrete masonry units containing integral water-repellent admixture added to the concrete masonry units (CMU) at the time of manufacture for construction of water-repellent masonry walls.
2. Installer shall use only mortar containing compatible integral liquid polymeric water-repellent admixture at the manufacturer’s recommended addition rate and mixed according to the manufacturer’s recommended instructions for construction of water-repellent masonry walls.

B. Lay hollow CMUs as follows:

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

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

C. Installing Units:
1. Use face shell bedding to provide the greatest resistance to water penetration.
2. Lay solid masonry units with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.

D. Mortar Joint Tooling:
1. Tool mortar joints to concave to provide the greatest resistance to water penetration.
2. Do not use raked, flush, extruded, struck, beaded weathered, or other joint profiles due to their reduced water-resistance.
3. Tool the mortar joints when they are thumbprint hard to provide the greatest resistance to water penetration and to help minimize hairline crack between the mortar and the CMU

E. In-Progress Cleaning: Promptly remove excess wet mortar containing integral water-repellent mortar admixture from face of masonry as work progresses by dry brushing.

F. Protection of Work: Cover top of unfinished masonry work to protect it from the weather and to prevent accumulation of water in CMU cores.

3.6 MASONRY JOINT REINFORCEMENT

A. General: Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch on exterior side of walls, 1/2 inch elsewhere. Lap reinforcement a minimum of 6 inches.

1. Space reinforcement not more than 16 inches o.c.
2. Space reinforcement not more than 8 inches o.c. in foundation walls and parapet walls.
3. Provide reinforcement not more than 8 inches above and below wall openings and extending 12 inches beyond openings in addition to continuous reinforcement.

B. Interrupt joint reinforcement at control and expansion joints unless otherwise indicated.

C. Provide continuity at wall intersections by using prefabricated T-shaped units.

D. Provide continuity at corners by using prefabricated L-shaped units.

E. Cut and bend reinforcing units as directed by manufacturer for continuity at corners**,** returns, offsets, column fireproofing, pipe enclosures, and other special conditions.

3.7 CONTROL AND EXPANSION JOINTS

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

B. Form control joints in concrete masonry as follows:
1. Install preformed control-joint gaskets designed to fit standard sash block.
2. Install interlocking units designed for control joints. Install bond-breaker strips at joint. Keep head joints free and clear of mortar or rake out joint for application of sealant.

3.8 LINTELS

A. Provide masonry lintels where shown and where openings of more than 12 inches for brick-size units and 24 inches for block-size units are shown without structural steel or other supporting lintels.

B. Provide minimum bearing of 8 inches at each jamb unless otherwise indicated.

3.9 FLASHING

A. General: Install embedded flashing in masonry at lintels, ledges, other obstructions to downward flow of water in wall, and where indicated.

B. Install flashing as follows unless otherwise indicated:

1. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Where flashing is within mortar joint, place through-wall flashing on sloping bed of mortar and cover with mortar. Before covering with mortar, seal penetrations in flashing with adhesive, sealant, or tape as recommended by flashing manufacturer.
2. At lintels, extend flashing a minimum of 6 inches into masonry at each end. At heads and sills, extend flashing 6 inches at ends and turn up not less than 2 inches to form end dams.
3. Interlock end joints of ribbed sheet metal flashing by overlapping ribs not less than 1-1/2 inches or as recommended by flashing manufacturer, and seal lap with elastomeric sealant complying with requirements in Section 079200 "Joint Sealants" for application indicated.
4. Install metal drip edges and sealant stops with ribbed sheet metal flashing by interlocking hemmed edges to form hooked seam. Seal seam with elastomeric sealant complying with requirements in Section 079200 "Joint Sealants" for application indicated.

C. Install reglets and mailers for flashing and other related construction where they are shown to be built into masonry.

3.10 REINFORCED UNIT MASONRY INSTALLATION

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

1. Construct formwork to provide shape, line, and dimensions of completed masonry as indicated. Make forms sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.
2. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and other loads that may be placed on them during construction.

B. Placing Reinforcement: Comply with requirements in ACI 530.1/ASCE 6/TMS 602.

C. Grouting – all cells with reinforcement are to be grouted solid and as noted: Do not place grout until entire height of masonry to be grouted has attained enough strength to resist grout pressure.

1. Comply with requirements in ACI 530.1/ASCE 6/TMS 602 for cleanouts and for grout placement, including minimum grout space and maximum pour height.

3.11 FIELD QUALITY CONTROL

A. Testing and Inspecting: Owner will engage special inspectors to perform tests and inspections and prepare reports. Allow inspectors access to scaffolding and work areas, as needed to perform tests and inspections. Retesting of materials that fail to meet specified requirements shall be done at Contractor's expense.

B. Inspections: Level 2 special inspections according to the "International Building Code."

1. Begin masonry construction only after inspectors have verified proportions of site-prepared mortar.
2. Place grout only after inspectors have verified compliance of grout spaces and of grades, sizes, and locations of reinforcement.
3. Place grout only after inspectors have verified proportions of site-prepared grout.

C. Testing Prior to Construction: One set of tests.

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

E. Concrete Masonry Unit Test: For each type of unit provided, according to ASTM C 140 for compressive strength.

F. Mortar Aggregate Ratio Test (Proportion Specification): For each mix provided, according to ASTM C 780.

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

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

I. Prism Test: For each type of construction provided, according to ASTM C 1314 at 7 days and at 28 days.

3.12 PARGING

A. Parge exterior faces of below-grade masonry walls, where indicated, in 2 uniform coats to a total thickness of 3/4 inch. Dampen wall before applying first coat and scarify first coat to ensure full bond to subsequent coat.

B. Use a steel-trowel finish to produce a smooth, flat, dense surface with a maximum surface variation of 1/8 inch per foot. Form a wash at top of parging and a cove at bottom.

C. Damp-cure parging for at least 24 hours and protect parging until cured.

3.13 REPAIRING, POINTING, AND CLEANING

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

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

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

D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:

1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
2. Remove dirt or stains from masonry walls exposed in the finished work in accordance with the manufacturer’s recommendations and NCMA TEK 08-02A
3. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
4. Protect adjacent stone and nonmasonry surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
5. Do not clean using strong acids, overaggressive sandblasting, or high-pressure cleaning methods.
6. Clean in accordance with manufacturer’s recommendation and NCMA TEK 08-04A.
7. Comply with environmental laws and restrictions of authorities having jurisdiction.

3.14 MASONRY WASTE DISPOSAL

A. Salvageable Materials: Unless otherwise indicated, excess masonry materials are Contractor's property. At completion of unit masonry work, remove from Project site.

B. Waste Disposal as Fill Material: Dispose of clean masonry waste, including excess or soil-contaminated sand, waste mortar, and broken masonry units, by crushing and mixing with fill material as fill is placed.

1. Crush masonry waste to less than 4 inches in each dimension.
2. Mix masonry waste with at least two parts of specified fill material for each part of masonry waste. Fill material is specified in Section 312000 "Earth Moving."
3. Do not dispose of masonry waste as fill within 18 inches of finished grade.

C. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above, and other masonry waste, and legally dispose of off Owner's property.

END OF SECTION

SECTION 05 12 00 - STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Structural steel.
2. Grout.

B. Related Requirements:
1. Section 05 50 00 "Metal Fabrications" for not defined as structural steel.

1.3 DEFINITIONS

A. Structural Steel: Elements of the structural frame indicated on Drawings and as described in AISC 303, "Code of Standard Practice for Steel Buildings and Bridges."

B. Seismic-Load-Resisting System: Elements of structural-steel frame designated as "SLRS" or along grid lines designated as "SLRS" on Drawings, including columns, beams, and braces and their connections.

1.4 COORDINATION

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

B. Coordinate installation of anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, sheet metal templates, instructions, and directions for installation.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Show fabrication of structural-steel components.

1. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
2. Include embedment Drawings.

3. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld. Show backing bars that are to be removed and supplemental fillet welds where backing bars are to remain.
4. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical, high-strength bolted connections.
5. Identify members and connections of the Seismic-Load-Resisting System.
6. Identify demand critical welds.

C. Welding Procedure Specifications (WPSs) and Procedure Qualification Records (PQRs): Provide according to AWS D1.1/D1.1M, "Structural Welding Code - Steel," for each welded joint, including the following:

1. Power source (constant current or constant voltage).
2. Electrode manufacturer and trade name, for demand critical welds.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For installer and fabricator. [

B. Welding certificates.

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

D. Mill test reports for structural steel, including chemical and physical properties.

E. Product Test Reports: For the following:

1. Bolts, nuts, and washers including mechanical properties and chemical analysis.
2. Direct-tension indicators.
3. Tension-control, high-strength, bolt-nut-washer assemblies.
4. Shop primers.
5. Non-shrink/non-metallic grout.

F. Survey of existing conditions.

G. Source quality-control reports.

H. Field quality-control.

1.7 QUALITY ASSURANCE

A. Fabricator Qualifications: a. Minimum of 5 years experience in fabrication of structural steel and shall be certified under AISC Quality Certification Program Category STD.

B. Installer Qualifications: a. Minimum of 5 years of experience in erection of structural steel with an active and enforced quality assurance program in place, as described in the Building Code.

C. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

1. Welders and welding operators performing work on bottom-flange, demand-critical welds shall pass the supplemental welder qualification testing, as required by AWS D1.8/D1.8M.

FCAW-S and FCAW-G shall be considered separate processes for welding personnel qualification.

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

1. AISC 303.
2. AISC 341 and AISC 341s1.
3. AISC 360.
4. RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

1.8 DELIVERY, STORAGE, AND HANDLING

A. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from corrosion and deterioration.

1. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.

B. Store fasteners in a protected place in sealed containers with manufacturer's labels intact.

1. Fasteners may be repackaged provided Owner's testing and inspecting agency observes repackaging and seals containers.
2. Clean and relubricate bolts and nuts that become dry or rusty before use.
3. Comply with manufacturers' written recommendations for cleaning and lubricating ASTM F 1852 fasteners and for retesting fasteners after lubrication.

PART 2 - PRODUCTS

2.1 STRUCTURAL-STEEL MATERIALS

A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

B. W-Shapes: ASTM A 992.

C. Channels, Angles: ASTM A 36.

D. Plate and Bar: ASTM A 36

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

F. Steel Pipe: ASTM A 53, Type E or Type S, Grade B.

G. Welding Electrodes: Comply with AWS requirements.

2.2 BOLTS, CONNECTORS, AND ANCHORS

A. High-Strength Bolts, Nuts, and Washers: ASTM A 325, Type 1, heavy-hex steel structural bolts; ASTM A 563, Grade C, heavy-hex carbon-steel nuts; and ASTM F 436, Type 1, hardened carbon-steel washers; all with plain finish.

1. Direct-Tension Indicators: ASTM F 959, Type 325, compressible-washer type with plain finish.

B. Tension-Control, High-Strength Bolt-Nut-Washer Assemblies: ASTM F 1852, Type 1, heavy-hex head assemblies consisting of steel structural bolts with splined ends, heavy-hex carbon-steel nuts, and hardened carbon-steel washers.

1. Finish: Plain.

C. Unheaded Anchor Rods: ASTM F 1554, Grade 36, or Grade 55.

1. Configuration: Straight and hooked as indicated.
2. Nuts: ASTM A 563 hex carbon steel.
3. Plate Washers: ASTM A 36 carbon steel.
4. Finish: Plain.

D. Threaded Rods: ASTM A 36.

1. Nuts: ASTM A 563 heavy-hex carbon steel.
2. Finish: Plain

2.3 PRIMER

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

B. Galvanizing Repair Paint: MPI#18, MPI#19, or SSPC-Paint 20] [ASTM A 780.

2.4 GROUT

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

2.5 FABRICATION

A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate according to AISC 303, "Code of Standard Practice for Steel Buildings and Bridges," and to AISC 360.

1. Camber structural-steel members where indicated.
2. Fabricate beams with rolling camber up.
3. Identify high-strength structural steel according to ASTM A 6/A 6M and maintain markings until structural steel has been erected.
4. Mark and match-mark materials for field assembly.
5. Complete structural-steel assemblies, including welding of units, before starting shop-priming operations.

B. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.

1. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1/D1.1M.

C. Bolt Holes: Cut, drill, or punch standard bolt holes perpendicular to metal surfaces.

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

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

1. Cut, drill, or punch holes perpendicular to steel surfaces
2. Baseplate Holes: Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces.
3. Weld threaded nuts to framing and other specialty items indicated to receive other work.

2.6 SHOP CONNECTIONS

A. High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.

1. Joint Type: Snug tightened and as noted on drawings.

B. Weld Connections: Comply with AWS D1.1 **and** AWS D1.8 for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

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

2.7 SHOP PRIMING

A. Shop prime steel surfaces except the following:

1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches.
2. Surfaces to be field welded.
3. Surfaces of high-strength bolted, slip-critical connections.
4. Galvanized surfaces.
5. Surfaces enclosed in interior construction.

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

1. SSPC-SP 2, "Hand Tool Cleaning."
2. SSPC-SP 3, "Power Tool Cleaning."

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

2.8 GALVANIZING

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

1. Fill vent and drain holes that are exposed in the finished Work unless they function as weep holes, by plugging with zinc solder and filing off smooth.

2.9 SOURCE QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform shop tests and inspections.

1. Provide testing agency with access to places where structural-steel work is being fabricated or produced to perform tests and inspections.

B. Bolted Connections: Inspect and test shop-bolted connections according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

C. Welded Connections: Visually inspect shop-welded connections according to AWS D1.1 and the following inspection procedures, at testing agency's option:

1. Liquid Penetrant Inspection: ASTM E 165.
2. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration are not accepted.
3. Ultrasonic Inspection: ASTM E 164.
4. Radiographic Inspection: ASTM E 94.

D. In addition to visual inspection, test and inspect shop-welded shear connectors according to requirements in AWS D1.1/D1.1M for stud welding and as follows:

1. Perform bend tests if visual inspections reveal either a less-than-continuous 360-degree flash or welding repairs to any shear connector.
2. Conduct tests according to requirements in AWS D1.1 on additional shear connectors if weld fracture occurs on shear connectors already tested.

E. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify, with certified steel erector present, elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments for compliance with requirements.

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

3.2 PREPARATION

A. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place unless otherwise indicated.

3.3 ERECTION

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

B. Baseplates Bearing Plates and Leveling Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.

1. Set plates for structural members on wedges, shims, or setting nuts as required.
2. Snug-tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
3. Promptly pack grout solidly between bearing surfaces and plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure.
4. **Gout is non-shrink/non-metallic.**

C. Maintain erection tolerances of structural steel within AISC 303, "Code of Standard Practice for Steel Buildings and Bridges."

D. Align and adjust various members that form part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that are in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.

1. Level and plumb individual members of structure.
2.

E. Splice members only where indicated.

F. Do not use thermal cutting during erection unless approved by Architect. Finish thermally cut sections within smoothness limits in AWS D1.1.

G. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.

3.4 FIELD CONNECTIONS

A. High-Strength Bolts: Install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.

1. Joint Type: Snug tightened and as noted on drawings.

B. Weld Connections: Comply with AWS D1.1 and AWS D1.8 for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

1. Comply with AISC 303 and AISC 360 for bearing, alignment, adequacy of temporary connections, and removal of paint on surfaces adjacent to field welds.
2. Remove backing bars or runoff tabs, back gouge, and grind steel smooth.
3. Assemble and weld built-up sections by methods that maintain true alignment of axes without exceeding tolerances in AISC 303, "Code of Standard Practice for Steel Buildings and Bridges," for mill material.

3.5 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:

1. Verify structural-steel materials and inspect steel frame joint details.
2. Verify weld materials and inspect welds.
3. Verify connection materials and inspect high-strength bolted connections.

B. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

C. Bolted Connections: Inspect bolted connections according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

D. Welded Connections: Visually inspect field welds according to AWS D1.1/D1.1M.

1. In addition to visual inspection, test and inspect field welds according to AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:

a. Liquid Penetrant Inspection: ASTM E 165.
b. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration are not accepted.
c. Ultrasonic Inspection: ASTM E 164.
d. Radiographic Inspection: ASTM E 94.

E. In addition to visual inspection, test and inspect field-welded shear connectors according to requirements in AWS D1.1/D1.1M for stud welding and as follows:

1. Perform bend tests if visual inspections reveal either a less-than-continuous 360-degree flash or welding repairs to any shear connector.
2. Conduct tests according to requirements in AWS D1.1 on additional shear connectors if weld fracture occurs on shear connectors already tested.

3.6 REPAIRS AND PROTECTION

A. Galvanized Surfaces: Clean areas where galvanizing is damaged or missing and repair galvanizing to comply with ASTM A 780.

B. Touchup Painting: Immediately after erection, clean exposed areas where primer is damaged or missing and paint with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

1. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.

END OF SECTION

SECTION 05 31 00 - STEEL DECKING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Roof deck.

2. Composite floor deck

B. Related Requirements:
1. Section 05 50 00 "Metal Fabrications" for framing deck openings with miscellaneous steel shapes.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of deck, accessory, and product indicated.

B. Shop Drawings:

1. Include layout and types of deck panels, anchorage details, reinforcing channels, pans, cut deck openings, special jointing, accessories, and attachments to other construction.

1.4 INFORMATIONAL SUBMITTALS

A. Welding certificates.

B. Product Certificates: For each type of steel deck.

C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, indicating that each of the following complies with requirements:

1. Power-actuated mechanical fasteners.

D. Evaluation Reports: For steel deck.

E. Field quality-control reports.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.

B. Welding Qualifications: Qualify procedures and personnel according to AWS D1.3, "Structural Welding Code - Sheet Steel."

C. FM Global Listing: Provide steel roof deck evaluated by FM Global and listed in its "Approval Guide, Building Materials" for Class 1 fire rating and Class 1-90 windstorm ratings.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect steel deck from corrosion, deformation, and other damage during delivery, storage, and handling.

B. Stack steel deck on platforms or pallets and slope to provide drainage. Protect with a waterproof covering and ventilate to avoid condensation.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. AISI Specifications: Comply with calculated structural characteristics of steel deck according to AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members."

2.2 ROOF DECK

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. ASC Profiles, Inc.; a Blue Scope Steel company.
2. Canam United States; Canam Group Inc.
3. CMC Joist & Deck.
4. Consolidated Systems, Inc.; Metal Dek Group.
5. Cordeck.
6. DACS, Inc.
7. Epic Metals Corporation.
8. Marlyn Steel Decks, Inc.
9. New Millennium Building Systems, LLC.
10. Nucor Corp.; Vulcraft Group.
11. Roof Deck, Inc.
12. Valley Joist; Subsidiary of EBSCO Industries, Inc.
13. Verco Manufacturing Co.
14. Wheeling Corrugating Company; Div. of Wheeling-Pittsburgh Steel Corporation.

B. Roof Deck: Fabricate panels, without top-flange stiffening grooves, to comply with "SDI Specifications and Commentary for Steel Roof Deck," in SDI Publication No. 31, and with the following:

1. Galvanized-Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grade 33] G60 zinc coating.

2. Deck Profile: As indicated
3. Profile Depth: As indicated.
4. Design Uncoated-Steel Thickness: As indicated.
5. Span Condition: As indicated.
6. Side Laps: Overlapped or interlocking seam at Contractor's option.

2.3 COMPOSITE FLOOR DECK

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. ASC Profiles, Inc.; a Blue Scope Steel company.
2. Canam United States; Canam Group Inc.
3. CMC Joist & Deck.
4. Consolidated Systems, Inc.; Metal Dek Group.
5. Cordeck.
6. DACS, Inc.
7. Epic Metals Corporation.
8. Marlyn Steel Decks, Inc.
9. New Millennium Building Systems, LLC.
10. Nucor Corp.; Vulcraft Group.
11. Roof Deck, Inc.
12. Verco Manufacturing Co.
13. Wheeling Corrugating Company; Div. of Wheeling-Pittsburgh Steel Corporation.

B. Composite Floor Deck: Fabricate panels, with integrally embossed or raised pattern ribs and interlocking side laps, to comply with "SDI Specifications and Commentary for Composite Steel Floor Deck," in SDI Publication No. 31, with the minimum section properties indicated, and with the following:
1. Galvanized-Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grade 38, G60 zinc coating.
2. Profile Depth: As indicated.
3. Design Uncoated-Steel Thickness: As indicated.
4. Span Condition: As indicated.

2.4 ACCESSORIES

A. General: Provide manufacturer's standard accessory materials for deck that comply with requirements indicated.

B. Mechanical Fasteners: Corrosion-resistant, low-velocity, power-actuated or pneumatically driven carbon-steel fasteners; or self-drilling, self-threading screws.

C. Side-Lap Fasteners: Corrosion-resistant, hexagonal washer head; self-drilling, carbon-steel screws, No. 10 minimum diameter.

D. Flexible Closure Strips: Vulcanized, closed-cell, synthetic rubber.

E. Miscellaneous Sheet Metal Deck Accessories: Steel sheet, minimum yield strength of 33,000 psi, not less than 0.0359-inch design uncoated thickness, of same material and finish as deck; of profile indicated or required for application.

F. Pour Stops and Girder Fillers: Steel sheet, minimum yield strength of 33,000 psi, of same material and finish as deck, and of thickness and profile indicated for overhang and slab depth.

G. Column Closures, End Closures, Z-Closures, and Cover Plates: Steel sheet, of same material, finish, and thickness as deck unless otherwise indicated.

H. Piercing Hanger Tabs: Piercing steel sheet hanger attachment devices for use with floor deck.

I. Flat Sump Plates: Single-piece steel sheet, 0.0747 inch thick, of same material and finish as deck. For drains, cut holes in the field.

J. Galvanizing Repair Paint**:** ASTM A 780] [SSPC-Paint 20 or MIL-P-21035B, with dry film containing a minimum of 94 percent zinc dust by weight.

K. Repair Paint: Manufacturer's standard rust-inhibitive primer of same color as primer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine supporting frame and field conditions for compliance with requirements for installation tolerances and other conditions affecting performance.

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

3.2 INSTALLATION, GENERAL

A. Install deck panels and accessories according to applicable specifications and commentary in SDI Publication No. 31, manufacturer's written instructions, and requirements in this Section.

B. Install temporary shoring before placing deck panels if required to meet deflection limitations.

C. Locate deck bundles to prevent overloading of supporting members.

D. Place deck panels on supporting frame and adjust to final position with ends accurately aligned and bearing on supporting frame before being permanently fastened. Do not stretch or contract side-lap interlocks.

E. Place deck panels flat and square and fasten to supporting frame without warp or deflection.

F. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to deck.

G. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of deck, and support of other work.

H. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used for correcting welding work.

I. Mechanical fasteners may be used in lieu of welding to fasten deck. Locate mechanical fasteners and install according to deck manufacturer's written instructions.

3.3 ROOF-DECK INSTALLATION

A. Fasten roof-deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated or arc seam welds with an equal perimeter that is not less than 1-1/2 inches long, and as follows:

1. Weld Diameter: 5/8 inch**,** nominal.
2. Weld Spacing: as indicated.

B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals as indicated
1.

C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches , with end joints as follows:

1. End Joints: Lapped 2 inches minimum or butted at Contractor's option.

D. Roof Sump Pans and Sump Plates: Install over openings provided in roof deck and weld or mechanically fasten flanges to top of deck. Space welds or mechanical fasteners not more than 12 inches apart with at least one weld or fastener at each corner.

1. Install reinforcing channels or zees in ribs to span between supports and weld or mechanically fasten.

E. Miscellaneous Roof-Deck Accessories: Install ridge and valley plates, finish strips, end closures, and reinforcing channels according to deck manufacturer's written instructions. Weld or mechanically fasten to substrate to provide a complete deck installation.

1. Weld cover plates at changes in direction of roof-deck panels unless otherwise indicated.

3.4 FLOOR-DECK INSTALLATION

A. Fasten floor-deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated and as follows:

1. Weld Diameter: 5/8" diameter nominal.
2. Weld Spacing: Space and locate welds as indicated.

B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals not exceeding the lesser of half of the span or 36 inches, and as follows:

1. Mechanically fasten with self-drilling, No. 10 diameter or larger, carbon-steel screws.
2. Mechanically clinch or button punch.
3. Fasten with a minimum of 1-1/2-inch- long welds.

C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches, with end joints as follows:

1. End Joints: Lapped or butted at Contractor's option.

D. Pour Stops and Girder Fillers: Weld steel sheet pour stops and girder fillers to supporting structure according to SDI recommendations unless otherwise indicated.

E. Floor-Deck Closures: Weld steel sheet column closures, cell closures, and Z-closures to deck, according to SDI recommendations, to provide tight-fitting closures at open ends of ribs and sides of deck.

F. Install piercing hanger tabs at 14 inches apart in both directions, within 9 inches of walls at ends, and not more than 12 inches from walls at sides unless otherwise indicated.

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Field welds will be subject to inspection.

C. Testing agency will report inspection results promptly and in writing to Contractor and Architect.

D. Remove and replace work that does not comply with specified requirements.

E. Additional inspecting, at Contractor's expense, will be performed to determine compliance of corrected work with specified requirements.

3.6 PROTECTION

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on both surfaces of deck with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

END OF SECTION

SECTION 05 40 00 - COLD-FORMED METAL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
1. Exterior and interior Load-bearing wall framing.
2. Ceiling joist framing.
3. Soffit framing.

B. Related Requirements:

1. Section 05 55 00 Metal Fabrications.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of cold-formed steel framing product and accessory.

B. Shop Drawings:

1. Include layout, spacings, sizes, thicknesses, and types of cold-formed steel framing; fabrication; and fastening and anchorage details, including mechanical fasteners.
2. Indicate reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing agency.

B. Welding certificates.

C. Research Reports: ICC-ES or IAMPO-ER.

1. Framing members.
2. Expansion anchors.
3. Power-actuated anchors.
4. Mechanical fasteners.
5. Vertical deflection clips.
6. Horizontal drift deflection clips
7. Miscellaneous structural clips and accessories.

1.5 QUALITY ASSURANCE

A. Product Tests: Mill certificates or data from a qualified independent testing agency indicating steel sheet complies with requirements, including base-metal thickness, yield strength, tensile strength, total elongation, chemical requirements, and metallic-coating thickness.

B. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect cold-formed steel framing from corrosion, moisture staining, deformation, and other damage during delivery, storage, and handling.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Clark Western Building Systems, Inc.
2. Dietrich Metal Framing; a Worthington Industries Company.
3. SCAFCO Corporation.
4. Steel Network, Inc. (The).
5. Steeler, Inc.

2.2 COLD-FORMED STEEL FRAMING, GENERAL

A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

B. Steel Sheet: ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of grade and coating weight as follows:

1. Grade: ST33H and ST50H.
2. Coating: G60, or equivalent.

C. Steel Sheet for Vertical Deflection Drift Clips: ASTM A 653/A 653M, structural steel, zinc coated, of grade and coating as follows:

1. Grade: 33 and 50, Class 1.
2. Coating: G60.

2.3 WALL FRAMING

A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: as indicated
2. Flange Width: as indicated.
3. Section Properties: as indicated.

B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with straight flanges, and as follows:

1. Minimum Base-Metal Thickness: as indicated.
2. Flange Width: as indicated.

C. Steel Box or Back-to-Back Headers: Manufacturer's standard C-shapes used to form header beams, of web depths indicated, unpunched, with stiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: as indicated.
2. Flange Width: as indicated.
3. Section Properties: as indicated.

2.4 CEILING JOIST FRAMING

A. Steel Ceiling Joists: Manufacturer's standard C-shaped steel sections, of web depths indicated, unpunched, or punched with standard holes with stiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: as indicated.
2. Flange Width: as indicated.
3. Section Properties: as indicated.

2.5 SOFFIT FRAMING

A. Exterior Soffit Frame: Manufacturer's standard C-shaped steel sections, of web depths indicated, with stiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: as indicated.
2. Flange Width: as indicated.
3. Section Properties: as indicated.

2.6 FRAMING ACCESSORIES

A. Fabricate steel-framing accessories from steel sheet, ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of same grade and coating weight used for framing members.

B. Provide accessories of manufacturer's standard thickness and configuration, unless otherwise indicated, as follows:

1. Supplementary framing.
2. Bracing, bridging, and solid blocking.
3. Web stiffeners.
4. Anchor clips.
5. End clips.
6. Hole reinforcing plates.
7. Backer plates.

2.7 ANCHORS, CLIPS, AND FASTENERS

A. Expansion Anchors: Fabricated from corrosion-resistant materials, with allowable load or strength design capacities calculated according to ICC-ES AC193 and ACI 318 greater than or equal to the design load, as determined by testing per ASTM E 488 conducted by a qualified testing agency.

B. Power-Actuated Anchors: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with allowable load capacities calculated according to ICC-ES AC70, greater than or equal to the design load, as determined by testing per ASTM E 1190 conducted by a qualified testing agency.

C. Mechanical Fasteners: ASTM C 1513, corrosion-resistant-coated, self-drilling, self-tapping, steel drill screws.

1. Head Type: Low-profile head beneath sheathing, manufacturer's standard elsewhere.

D. Welding Electrodes: Comply with AWS standards.

2.8 MISCELLANEOUS MATERIALS

A. Galvanizing Repair Paint: SSPC-Paint 20 , MIL-P-21035B, or ASTM A 780

B. Shims: Load bearing, high-density multimonomer plastic, and nonleaching; or of cold-formed steel of same grade and coating as framing members supported by shims.

C. Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch thick, selected from manufacturer's standard widths to match width of bottom track or rim track members.

2.9 FABRICATION

A. Fabricate cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened, according to referenced AISI's specifications and standards, manufacturer's written instructions, and requirements in this Section.

1. Fabricate framing assemblies using jigs or templates.
2. Cut framing members by sawing or shearing; do not torch cut.
3. Fasten cold-formed steel framing members by welding, screw fastening, clinch fastening, pneumatic pin fastening, or riveting as standard with fabricator. Wire tying of framing members is not permitted.

a. Comply with AWS D1.3/D1.3M requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
b. Locate mechanical fasteners and install according to Shop Drawings, with screw penetrating joined members by no fewer than three exposed screw threads.

4. Fasten other materials to cold-formed steel framing by welding, bolting, pneumatic pin fastening, or screw fastening, according to Shop Drawings.

B. Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery, and erection stresses. Lift fabricated assemblies to prevent damage or permanent distortion.

C. Fabrication Tolerances: Fabricate assemblies level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:

1. Spacing: Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.
2. Squareness: Fabricate each cold-formed steel framing assembly to a maximum out-of-square tolerance of 1/8 inch.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine supporting substrates and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

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

3.2 PREPARATION

A. Install sealer gaskets at the underside of wall bottom track or rim track and at the top of foundation wall or slab at stud or joist locations.

3.3 INSTALLATION, GENERAL

A. Cold-formed steel framing may be shop or field fabricated for installation, or it may be field assembled.

B. Install cold-formed steel framing according to AISI S200 and to manufacturer's written instructions unless more stringent requirements are indicated.

C. Install shop- or field-fabricated, cold-formed framing and securely anchor to supporting structure.

1. Screw, bolt, or weld wall panels at horizontal and vertical junctures to produce flush, even, true-to-line joints with maximum variation in plane and true position between fabricated panels not exceeding 1/16 inch.

D. Install cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened.

1. Cut framing members by sawing or shearing; do not torch cut.
2. Fasten cold-formed steel framing members by welding, screw fastening, clinch fastening, or riveting. Wire tying of framing members is not permitted.

a. Comply with AWS D1.3/D1.3M requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
b. Locate mechanical fasteners and install according to Shop Drawings, and complying with requirements for spacing, edge distances, and screw penetration.

E. Install framing members in one-piece lengths unless splice connections are indicated for track or tension members.

F. Install temporary bracing and supports to secure framing and support loads comparable in intensity to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.

G. Do not bridge building expansion joints with cold-formed steel framing. Independently frame both sides of joints.

H. Install insulation, specified in Section 072100 "Thermal Insulation," in built-up exterior framing members, such as headers, sills, boxed joists, and multiple studs at openings, that are inaccessible on completion of framing work.

I. Fasten hole reinforcing plate over web penetrations that exceed size of manufacturer's approved or standard punched openings.

J. Erection Tolerances: Install cold-formed steel framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:

1. Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

3.4 WALL INSTALLATION

A. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure as indicated.

B. Fasten both flanges of studs to top and bottom track unless otherwise indicated. Space studs as follows:

1. Stud Spacing As indicated.

C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar requirements.

D. Isolate non-load-bearing steel framing from building structure to prevent transfer of vertical loads while providing lateral support.

1. Install single deep-leg deflection tracks and anchor to building structure.
2. Connect vertical deflection clips to studs and anchor to building structure.
3. Connect drift clips to cold-formed metal framing and anchor to building structure.

E. Install horizontal bridging in wall studs, spaced vertically in rows indicated on Shop Drawings but not more than 60 inches apart. Fasten at each stud intersection.

1. Top Bridging for Single Deflection Track: Install row of horizontal bridging within 12 inches of single deflection track. Install a combination of bridging and stud or stud-track solid blocking of width and thickness matching studs, secured to stud webs or flanges.
2. Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs.
3. Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and stud-track solid blocking of width and thickness to match studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.

4. Bridging: Proprietary bridging bars installed according to manufacturer's written instructions.

F. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.

3.5 FIELD QUALITY CONTROL

A. Testing: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Field and shop welds will be subject to testing and inspecting.

C. Testing agency will report test results promptly and in writing to Contractor and Architect.

D. Remove and replace work where test results indicate that it does not comply with specified requirements.

E. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.6 REPAIRS AND PROTECTION

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed steel framing with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer that ensure that cold-formed steel framing is without damage or deterioration at time of Substantial Completion.

END OF SECTION

SECTION 05 50 00 - METAL FABRICATIONS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section includes the following:
   1. Steel fabrications for exterior canopy.
   2. Steel pipe guardrails and gates.

1.03 SUBMITTALS

A. Shop Drawings: Detail fabrication and erection of each metal fabrication indicated. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.
   1. Provide templates for anchors and bolts specified for installation under other Sections.

1.04 QUALITY ASSURANCE

A. Fabricator Qualifications: A firm experienced in producing metal fabrications 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.

B. Welding: Qualify procedures and personnel according to the following:
   1. AWS D1.1, "Structural Welding Code--Steel."
   2. AWS D1.3, "Structural Welding Code--Sheet Steel."
   3. Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.

1.05 PROJECT CONDITIONS

A. Field Measurements: Where metal fabrications are indicated to fit walls and other construction, verify dimensions by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
   1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating metal fabrications without field measurements. Coordinate construction to ensure that actual dimensions correspond to established dimensions. Allow for trimming and fitting.

1.06 COORDINATION

A. Coordinate installation of anchorages for metal fabrications. 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.

PART 2 - PRODUCTS

2.01 METALS, GENERAL

A. Metal Surfaces, General: For metal fabrications exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.

2.02 FERROUS METALS

A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

B. Steel Pipe: ASTM A 53, standard weight (Schedule 40), unless another weight is indicated or required by structural loads.

C. Malleable-Iron Castings: ASTM A 47, Grade 32510 (ASTM A 47M, Grade 22010).

D. Cast-in-Place Anchors in Concrete: Anchors of type indicated below, fabricated from corrosion-resistant materials capable of sustaining, without failure, the load imposed within a safety factor of 4, as determined by testing per ASTM E 488, conducted by a qualified independent testing agency.
   1. Threaded or wedge type; galvanized ferrous castings, either ASTM A 47 (ASTM A 47M) malleable iron or ASTM A 27/A 27M cast steel. Provide bolts, washers, and shims as needed, hot-dip galvanized per ASTM A 153/A 153M.

E. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

2.03 PAINT

A. Shop Primers: Provide primers that comply with Division 9 Section "Painting."

2.04 FASTENERS

A. General: Provide Type 304 or 316 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633, Class Fe/Zn 5, where built into exterior walls. Select fasteners for type, grade, and class required.

B. Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6); with hex nuts, ASTM A 563 (ASTM A 563M); and, where indicated, flat washers.

C. Anchor Bolts: ASTM F 1554, Grade 36.

D. Machine Screws: ASME B18.6.3 (ASME B18.6.7M).

E. Lag Bolts: ASME B18.2.1 (ASME B18.2.3.8M).

F. Wood Screws: Flat head, carbon steel, ASME B18.6.1.

G. Plain Washers: Round, carbon steel, ASME B18.22.1 (ASME B18.22M).

H. Lock Washers: Helical, spring type, carbon steel, ASME B18.21.1 (ASME B18.21.2M).

I. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry and equal to four times the load imposed when installed in concrete, as determined by testing per ASTM E 488, conducted by a qualified independent testing agency.
   1. Material: Carbon-steel components zinc-plated to comply with ASTM B 633, Class Fe/Zn 5.

2. Material: Alloy Group 1 or 2 stainless-steel bolts complying with ASTM F 593 (ASTM F 738M) and nuts complying with ASTM F 594 (ASTM F 836M).

J. Toggle Bolts: FS FF-B-588, tumble-wing type, class and style as needed.

2.05 GROUT

A. Nonshrink, Metallic Grout: Factory-packaged, ferrous-aggregate grout complying with ASTM C 1107, specifically recommended by manufacturer for heavy-duty loading applications.

B. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.

2.06 FABRICATION, GENERAL

A. Shop Assembly: Preassemble items in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

B. Shear and punch metals cleanly and accurately. Remove burrs.

C. Ease exposed edges to a radius of approximately 1/32 inch (1 mm), unless otherwise indicated. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

D. Weld corners and seams continuously to comply with the following:
1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

E. Provide for anchorage of type indicated; coordinate with supporting structure. Fabricate and space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.

F. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.

G. Fabricate joints that will be exposed to weather in a manner to exclude water, or provide weep holes where water may accumulate.

H. Allow for thermal movement resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening up of joints, overstressing of components, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

I. Form exposed work true to line and level with accurate angles and surfaces and straight sharp edges.

J. Remove sharp or rough areas on exposed traffic surfaces.

K. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Use exposed fasteners of type indicated or, if not indicated, Phillips flat-head (countersunk) screws or bolts. Locate joints where least conspicuous.

2.07 MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Provide steel framing and supports that are not a part of structural-steel framework as necessary to complete the Work.

B. General: Provide steel framing and supports indicated and as necessary to complete the Work.

C. Fabricate units from structural-steel shapes, plates, and bars of welded construction, unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction retained by framing and supports. Cut, drill, and tap units to receive hardware, hangers, and similar items.
   1. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors 1-1/4 inches (32 mm) wide by 1/4 inch (6 mm) thick by 8 inches (200 mm) long at 24 inches (600 mm) o.c., unless otherwise indicated.
   2. Furnish inserts if units must be installed after concrete is placed.

D. Fabricate steel pipe columns for supporting wood frame construction from steel pipe with steel baseplates and top plates as indicated. Drill baseplates and top plates for anchor and connection bolts and weld to pipe with fillet welds all around. Make welds the same size as pipe wall thickness, unless otherwise indicated.
   1. Unless otherwise indicated, provide 1/2-inch (12-mm) baseplates with four 5/8-inch (16-mm) anchor bolts and 1/4-inch (6-mm) top plates.

2.08 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Finish metal fabrications after assembly.

2.09 STEEL AND IRON FINISHES

A. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with minimum requirements indicated below for SSPC surface-preparation specifications and environmental exposure conditions of installed metal fabrications:
   1. Exteriors (SSPC Zone 1B): SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
   2. Interiors (SSPC Zone 1A): SSPC-SP 3, "Power Tool Cleaning."

B. Apply shop primer to uncoated surfaces of metal fabrications, except those with galvanized finishes and those to be embedded in concrete, sprayed-on fireproofing, or masonry, unless otherwise indicated. Comply with SSPC-PA 1, "Paint Application Specification No. 1," for shop painting.
   1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

PART 3 - EXECUTION

3.01 INSTALLATION, GENERAL

A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing metal fabrications to in-place construction. Include threaded fasteners for concrete and masonry inserts, toggle bolts, through-bolts, lag bolts, wood screws, and other connectors.

B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

C. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

D. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

E. Field Welding: Comply with the following requirements:
   1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
   2. Obtain fusion without undercut or overlap.
   3. Remove welding flux immediately.
   4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

3.02 SETTING BEARING AND LEVELING PLATES

A. Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of plates.

B. Set bearing and leveling plates on wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with grout.
   1. Use nonshrink grout, either metallic or nonmetallic, in concealed locations where not exposed to moisture; use nonshrink, nonmetallic grout in exposed locations, unless otherwise indicated.
   2. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.03 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings, if any.

B. Install pipe columns on concrete footings with grouted baseplates. Position and grout column baseplates as specified above for setting and grouting bearing and leveling plates.

3.04 ADJUSTING AND CLEANING

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
   1. Apply by brush or spray to provide a minimum 2.0-mil (0.05-mm) dry film thickness.

B. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Division 9 Section "Painting."

END OF SECTION

SECTION 05 71 00 - ORNAMENTAL STAIRS AND RAILINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Monumental stair framing.

B. Ornamental railing system.

C. Cladding for monumental stair.

D. Handrails.

1.02 RELATED SECTIONS

A. Section 033000 - Cast-in-Place Concrete.

B. Section 055000 - Metal Fabrications.

C. Section 057300 - Ornamental Handrails and Railings.

D. Section 051000 - Structural Steel.

E. Section 099000 - Painting.

1.03 REFERENCES

A. Aluminum Association (AA): Designation System for Aluminum Finishes.

B. American Institute of Steel Construction (AISC): Manual of Steel Construction.

C. American Iron and Steel Institute (AISI): Specification for Design of Cold Formed Steel Structural Members.

D. American National Standards Institute (ANSI): Z97.1 - Safety Glazing Materials used in Buildings - Safety Performance Specifications and Methods of Test.

E. AWS D 1.1 - Structural Welding Code - Steel; 2002.

F. NAAMM AMP 510 - Metal Stairs Manual; 1992, Fifth Edition.

G. American Society for Testing and Materials (ASTM):
1. A36 - Structural Steel.
2. A167 - Seamless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
3. A307 - Low-Carbon Steel Externally and Internally Threaded Fasteners.
4. A526 - Steel Sheet, Zinc Coated (Galvanized) by the Hot-Dip Process, Commercial Quality.
5. A569 - Steel, Sheet and Strip, Carbon (0.15 Maximum Percent), Hot Rolled, Commercial Quality.
6. A570 - Steel, Sheet and Strip, Carbon, Hot-Rolled, Structural Quality.
7. B221 - Aluminum and Aluminum-Alloy Extruded Bar, Rod, Wire, Shape and Tube.
8. C1048 - Heat Treated Flat Glass, Coated and Uncoated Glass.

H. Architectural Woodwork Institute (AWI): Quality Standards for Architectural Woodwork.

I. National Association of Architectural Metal Manufacturers (NAAMM): Metal Finishes Manual.

1.04 PERFORMANCE REQUIREMENTS

A. Structural Design: Comply with AISC and ANSI requirements.

B. Stair: Design stair assembly to support the following loads:

1. Uniform Live Load: 100 pounds (45 kg) minimum per square foot of projected plan area.
2. Concentrated Live Load: 300 pounds (136 kg) minimum applied anywhere on tread.
3. Dead Load: Weight of stair, railing system, concrete fill, and finishes.
4. Use defection limits appropriate for types of applied finish materials.

C. Railing: Design railing assemblies to withstand the following loads:

1. Minimum uniform lateral loading of 50 pounds (23 kg) per linear foot (8,8 kN/m).
2. Minimum concentrated lateral load of 200 pounds (91 kg) at any point 42 inches (1067 mm) above finished floor.

D. Live Load Deflection: Use span measured at horizontal projection of outside stringer. Tread finishes may require higher deflection limits.

1.05 SUBMITTALS

A. Submit under provisions of Section 01300.

B. ["Product Data] substantiating compliance with Contract Documents. Include manufacturer's installation instructions.

C. Shop Drawings: Submit Shop Drawings for stairs and railings.
1. Include plans, elevations, and details.
2. Show connection and accessory items and locations for anchor and bolt installation.
3. Include design loads, structural calculations, and material properties.
4. Provide Shop Drawings signed and sealed by structural engineer licensed in the state and jurisdiction in which Project is located.

D. Maintenance Instructions: Provide cleaning and maintenance instructions for each type of finish material.

1.06 QUALITY ASSURANCE

A. Single Source Responsibility: Work of this section shall be designed, fabricated, shipped and installed by a single source company which has specialized in ornamental handrails and railings with ten years minimum experience.

B. Installer Qualifications: Installation shall be performed by the fabricator or a company acceptable to the fabricator.

C. Templates: Supply installation templates, required reinforcing, and recessed anchorage devices in timely fashion to installers of related work that will receive products of this section.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Store in a weathertight location and protect from corrosion, distortion, and other damage during delivery storage and handling.

1.08 SCHEDULING

A. Coordinate delivery and installation of stair on project schedule as specified in section 01310.

B. Allow sufficient time for fabrication, delivery, and erection of stair after building structure is in place and field dimensions are taken.

C. Allow sufficient time for closing in of building after delivery of stair and for installation of finishes and related work.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Acceptable Manufacturer: Couturier Iron Craft, Inc., which is located at: P. O. Box 308 5050 West River Dr. ; Comstock Park, MI 49321-0308; Toll Free Tel: 800-670-6123; Tel: 616-784-6780; Fax: 616-784-5077

B. Requests for substitutions will be considered in accordance with provisions of Section 01600.

2.02 MATERIALS

A. Steel:
1. Shapes, Plate, and Bar: ASTM A 36.
2. Sheet: ÅSTM A569 or ÅSTM A 570.
3. Pipe: Welded and seamless steel pipe. ASTM A 53.
4. Tubing: Cold formed. ASTM A 500; hot rolled, ASTM a 501.
5. Iron Castings: Malleable ASTM A 47.

B. Galvanized Steel: ÅSTM A 526, G 90 coating.

C. Material: Stainless steel tubing.
1. Tubing Diameter: 1.9 inches (48 mm).
2. Thickness: 16 gage; 0.065 inches (1.7 mm).
3. Elbows and Tees: Flush design.
4. Dimensions and Configurations: As indicated on Drawings.
5. Assembly: Welded.
6. Decorative Flanges for Embedded Posts:
   a. Circular, collard cover plate, no screw holes, for setting in concrete.
7. Wall Mounted Components: Components necessary to support railing with 1-1/2 inch (38 mm) clearance from wall, and as follows:
   a. Underslung support brackets: Supports at maximum 60 inches (1524 mm).
   b. Wall return without support: Terminates 1/4 inch (6 mm) from side wall.
   c. Fasteners: Exposed.
   d. Fasteners: Concealed.
8. Picket Rail Components: Pickets of 5/8 inch (15 mm) stainless steel, shape and lengths as indicated.
9. Finish: Stainless No. 4 satin.

10. Finish: Stainless No. 8 polished.

2.03 ACCESSORIES

A. Primer: Corrosion resistant metal primer.

B. Anchors and Bolts: ÅSTM A307.

C. Fasteners: Type best suited for application.

D. Welding Material: Comply with AWS D1.1.

E. Grout: Non-shrink, high strength.

F. Clear sealer: Clear, tarnish resistant, acrylic lacquer.

2.04 FABRICATI0N

A. Manufacturer shall verify site dimensions prior to shop fabrication.

B. Fabricate items with joints tightly fitted, flush, and secure.

C. Fit and fabricate assembled sections in largest practical sizes, for handling through building openings.

D. Grind exposed edges flush and smooth with adjacent finished surface. Ease exposed edges to small uniform radius.

E. Stair Components:
1. Stringers: 2 stringers, 1 on each side of stair.
   a. Construction: Structural steel channel section.
2. Treads: Steel plate prepared to receive finish specified in Section 09900.
3. Riser: Open type.
4. Soffit: Leave underside of stair open.

F. Railings and Handrails:
1. Stainless Steel Tubing: ASTM A554, Type 304.

G. Cladding:
1. General: Provide cladding with smooth, flat surfaces free from damage or disfiguration, of premium quality workmanship.
2. Material: Use material thickness that will provide required appearance as recommended by manufacturer.
   a. Painted steel.
   b. Stainless steel.
3. Attachment: Provide sub-framing, retainers, and supports as required for proper installation of cladding without exposed fasteners.
4. Locations: Clad exposed surfaces of stringers, railing base members and fascia at floor openings.

2.05 FINISHES

A. Exposed Stainless Steel: NAMM No. 4 Satin finish.

B. Steel:
1. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.
2. Do not prime surfaces where field welding is required.
3. Concealed Surfaces: Prime paint with one coat.

4. Exposed Surfaces: Prime paint and field finish as specified in section 09900.

C. Provide protection against galvanic action between dissimilar metals, and between metal and concrete.

PART 3 EXECUTION

3.01 EXAMINATION

D. Verify that field measurements are acceptable to suit stair assembly tolerances.

E. Verify supports and anchors are correctly and securely positioned.

F. Start of installation indicates installer's acceptance of substrate and conditions.

3.02 INSTALLATION

A. Install stair assembly in accordance with manufacturer's instructions and approved Shop Drawings.

B. Anchor components rigidly and securely to building structure, plumb and level, accurately fitted, and free from distortion or defects.

C. Fit exposed connections to form tight hairline joints.

D. Weld connections that cannot be shop welded because of size limitations.

1. Perform field welding of steel in accordance with AWS D 1.1. Field bolt and weld to match shop bolting and welding.

2. Clean field welds, bolted connections and abraded areas.

3. Touch up shop primer.

4. Repair galvanizing with galvanizing repair paint to comply with ASTM A780.

3.03 ERECTION TOLERANCES

A. Maximum Variation from Plumb: 1/4 inch (6 mm) for full height of stair.

B. Maximum Variation from Level: 1/8 inch (3 mm) in 10 feet (3000 mm).

C. Maximum Angular Variation of the Tread from True Position: 3 degrees.

3.04 CLEANING AND PROTECTION

A. Remove manufacturer's protective coverings from exposed surfaces after installation.

B. Clean surfaces using materials and methods as recommended by manufacturer.

C. Protect finishes from damage during construction period with temporary protective coverings acceptable to the manufacturer.

D. After installation of system is complete, advise General Contractor of methods necessary for protection until Substantial Completion.

END OF SECTION 05 71 00

SECTION 06 40 23 - INTERIOR ARCHITECTURAL WOODWORK

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A Section includes:

1 Plastic-laminate cabinets.
2 Plastic-laminate countertops
3 Solid surface countertops

B Related Requirements:

1 Wood blocking for anchoring casework.
2 Section 09111 "Non-Load-Bearing Steel Framing" for reinforcements in metal-framed partitions for anchoring casework.
3 Section 09653 "Resilient Wall Base and Accessories" for resilient base applied to plastic-laminate-faced casework.

1.03 DEFINITIONS

A Definitions in the WI's "Architectural Woodwork Standards" apply to the work of this Section.

B MDF: Medium-density fiberboard.

C Hardwood Plywood: A panel product composed of layers or plies of veneer, or of veneers in combination with lumber core, hardboard core, MDF core, or particleboard core, joined with adhesive, and faced both front and back with hardwood veneers.

1.04 PREINSTALLATION MEETINGS

A Preinstallation Conference: Conduct conference at Project site.

1.05 COORDINATION

A Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that casework can be supported and installed as indicated.

1.06 ACTION SUBMITTALS

A Product Data: For each type of product.

B Shop Drawings: Include plans, elevations, sections, details, and attachments to other work. Show fabrication details, including types and locations of hardware. Show installation details, including field joints and filler panels. Indicate manufacturer's catalog numbers for casework.

C Retain "Samples" Paragraph below for single-stage Samples. Retain "Samples for Initial Selection" and "Samples for Verification" paragraphs for two-stage Samples.

D Samples: For cabinet finishes.

E Samples for Initial Selection: For cabinet finishes.

F Samples for Verification: 8-by-10-inch (200-by-250-mm) Samples for each type of finish and the following:

1 One full-size finished base cabinet complete with hardware, doors, and drawers.
2 One full-size finished wall cabinet complete with hardware, doors, and adjustable shelves.
3 Maintain full-size Samples at Project site during construction in an undisturbed condition as a standard for judging the completed Work. Unless otherwise indicated, approved sample units may become part of the completed Work if in undisturbed condition at time of Substantial Completion. Notify Architect of their exact locations.

1.07 INFORMATIONAL SUBMITTALS

A Qualification Data: For Installer.

B Quality Standard Compliance Certificates: WI Quality Certification Program certificates.

C Sample Warranty: For special warranty.

1.08 QUALITY ASSURANCE

A Quality Assurance: Woodwork Institute (WI) Architectural Woodwork Standards & Quality Assurance Program.
1 All millwork and the installation thereof for this project shall be certified for compliance to the contract documents by a Woodwork Institute Director of Architectural Services.
2 Review and certification of Shop drawings prior to issuance to Architect
3 Issuance of WI Certified Compliance Certificate by WI
4 Certified Compliance stamp on cover of shop drawings by WI
5 Inspection of fabrication of millwork by WI personnel at casework/millwork shop
6 Inspection of installation of casework/millwork by WI personnel at project site.
7 Comply with inspection reports as supplied by WI personnel.
8 Millwork and/or installation found to be non-compliant (and not corrected) will be rejected.
9 All fees charged by the Woodwork Institute for their quality assurance compliance program are the responsibility of the millwork manufacturer and/or installer and shall be included in their Contract proposal.

B Manufacturer Qualifications:
1 Submit WI compliance certificate. Provide original and one (1) copy to be submitted to the Architect.
2 Firm (woodwork manufacturer) with not less than 5 years of production experience similar to this Project, whose qualifications indicate the ability to comply with the requirements of this section.

3 The woodwork manufacturer must have at least one project in the past five (5) years where the value of the woodwork is within twenty percent (20%) of the cost of woodwork for this Project.
4 A manufacturer that is certified for chain of custody by an FSC-accredited certification body.

C Installer Qualifications:

1 Submit WI compliance certificate. Provide original and one (1) copy to be submitted to the Architect.
2 Arrange for installation of finish carpentry by a firm that can demonstrate successful experience in installing finish cabinetry item similar in type and quality to those required for this Project.
3 An authorized representative who is trained and approved by manufacturer for installation of units required for this Project and who is a certified participant in WI's Quality Certification Program.

1.09 DELIVERY, STORAGE, AND HANDLING

A Deliver casework only after painting, utility roughing-in, and similar operations that could damage, soil, or deteriorate casework have been completed in installation areas. If casework must be stored in other than installation areas, store only in areas where environmental conditions meet requirements specified in "Project Conditions" Article.

B Keep finished surfaces covered with polyethylene film or other protective covering during handling and installation.

1.10 FIELD CONDITIONS

A Environmental Limitations: Do not deliver or install casework until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period. Maintain temperature and relative humidity during the remainder of the construction period in range recommended for Project location by the AWI's, AWMAC's, and WI's "Architectural Woodwork Standards."

B Established Dimensions: Where casework is indicated to fit to other construction, establish dimensions for areas where woodwork is to fit. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

C Locate concealed framing, blocking, and reinforcements that support casework by field measurements before being enclosed, and indicate measurements on Shop Drawings.

1.11 WARRANTY

1 Special Warranty: Manufacturer agrees to repair or replace components of casework that fail in materials or workmanship within specified warranty period.

1 Failures include, but are not limited to, the following:

1 Delamination of components or other failures of glue bond.
2 Warping of components.

3 Failure of operating hardware.

2 Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A Provide materials that comply with requirements of the WIC quality standard for each type of woodwork and quality grade specified, unless otherwise indicated.

B Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1 Manufacturer as shown on drawings
2 Formica
3 Nevamar
4 Pionite
5 Wilsonart
6 Or approved equal

C Basis of Design: Subject to compliance with requirements, provide product indicated on Drawings.

D Source Limitations: Obtain plastic-laminate-faced cabinets from single manufacturer of each color option.

E Adhesive for Bonding Plastic Laminate: Unpigmented contact cement.

F Adhesive for Bonding Plastic Laminate: PVA.

2.02 CASEWORK, GENERAL

A Quality Standard: Unless otherwise indicated, comply with the WI's "Architectural Woodwork Standards" for grades of casework indicated for construction, finishes, installation, and other requirements.

1 Grade: Premium.
2 Provide labels and certificates from WI certification program indicating that casework, including installation, complies with requirements of grades specified.

B Product Designations: Drawings indicate sizes, configurations, and finish materials of manufactured plastic-laminate-faced cabinets by referencing designated manufacturer's catalog numbers. Other manufacturers' casework of similar sizes and door and drawer configurations, of same finish materials, and complying with the Specifications may be considered. See Section 01600 "Product Requirements."

C Product Designations: Drawings indicate configurations of manufactured plastic-laminate-faced cabinets by referencing designations of Casework Design Series numbering system in Appendix A WI's "Architectural Woodwork Standards."

2.03 CASEWORK

A Design:
1 Flush overlay.

B Grain Direction for Wood Grain Plastic Laminate:

1 Horizontal on both doors and drawer fronts.
2 Horizontal on doors, horizontal on drawer fronts.
3 Horizontal on face frame members.
4 Horizontal on end panels.
5 Horizontal on bottoms and tops of units.
6 Horizontal on knee-space panels.
7 Horizontal on aprons.
8 Vertical on full height cabinets

C Exposed Materials:

1 Plastic Laminate: Grade HGS.

a Colors and Patterns: As selected by Architect from manufacturer's full range.

2 Unless otherwise indicated, provide specified edgebanding on all exposed edges.

D Semi-Exposed Materials:

1 Plastic Laminate: Grade VGS unless otherwise indicated. Provide plastic laminate for semi exposed surfaces unless otherwise indicated.

1 Provide plastic laminate of same grade as exposed surfaces for interior faces of doors and drawer fronts and other locations where opposite side of component is exposed.

2 Thermoset Decorative Panels: Provide thermoset decorative panels for semiexposed surfaces unless otherwise indicated.

1 Provide plastic laminate of same grade as exposed surfaces for interior faces of doors and drawer fronts and other locations where opposite side of component is exposed.

3 Hardboard: Use only for cabinet backs where exterior side of back is not exposed.
4 Metal for Steel Drawer Pans: Cold-rolled, carbon-steel sheet complying with ASTM A 1008/A 1008M; matte finish; suitable for exposed applications.
5 Unless otherwise indicated, provide specified edgebanding on all semiexposed edges.

E Concealed Materials:

1 Solid Wood: Any hardwood or softwood species, with no defects affecting strength or utility.
2 Plywood: Hardwood plywood.
3 Plastic Laminate: Grade BKL.

4 Particleboard.
5 MDF.
6 Hardboard.

F MATERIALS

1 Low-Emitting Materials: Fabricate casework, including countertops, with adhesives and composite wood products containing no urea formaldehyde.

2 Low-Emitting Materials: Adhesives and composite wood products shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

3 Maximum Moisture Content for Lumber: 7 percent for hardwood and 12 percent for softwood.

4 Hardwood Plywood: HPVA HP-1, particleboard core except where veneer core is indicated.; made without urea formaldehyde.; that complies with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

5 Softwood Plywood: DOC PS 1.

6 Particleboard: ANSI A208.1, Grade M-2.; made with binder containing no urea formaldehyde.; that complies with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

7 Particleboard: Straw-based particleboard complying with ANSI A208.1, Grade M-2, except for density.

8 MDF: ANSI A208.2, Grade 130.; made with binder containing no urea formaldehyde.; that complies with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

9 Hardboard: ANSI A135.4, Class 1 Tempered.

10 Plastic Laminate: High-pressure decorative laminate complying with NEMA LD 3.

1 Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Manufacturer as shown on drawings

b. ABET Inc.
c. Arborite; a division of ITW Canada.
d. Formica Corporation.
e. Lamin-Art, Inc.
f. Nevamar
g. Pionite

h. Panolam Industries International Inc.
i. Wilsonart International.

11 Edgebanding for Plastic Laminate: Plastic laminate matching adjacent surfaces.

E. COLORS AND FINISHES

1 Plastic-Laminate Colors, Patterns, and Finishes: As selected by Architect from casework manufacturer's full range.

2 PVC Edgebanding Color: As selected from casework manufacturer's full range.

F. FABRICATION

1 Plastic-Laminate-Faced Cabinet Construction: As required by referenced quality standard, but not less than the following:
a Bottoms and Ends of Cabinets, and Tops of Wall Cabinets and Tall Cabinets: 3/4-inch (19-mm) particleboard.
b Shelves: 3/4-inch- (19-mm-) thick particleboard.
c Backs of Cabinets: 1/2-inch- (12.7-mm-) thick particleboard or MDF where exposed, 1/4-inch (6.4-mm) veneer-core hardwood plywood dadoed into sides, bottoms, and tops where not exposed.
d Drawer Fronts: 3/4-inch (19-mm) particleboard.
e Drawer Sides and Backs: 1/2-inch (12.7-mm) particleboard or MDF, with glued dovetail or multiple-dowel joints.
f Drawer Bottoms: 1/4-inch (6.4-mm) particleboard or MDF glued and dadoed into front, back, and sides of drawers. Use 1/2-inch (12.7-mm) material for drawers more than 24 inches (600 mm) wide.
g Drawer Bodies: Steel drawer pans formed from 0.0359-inch- (0.9-mm-) thick metal, metallic phosphate treated, and finished with manufacturer's standard two-coat, baked-enamel finish consisting of prime coat and thermosetting topcoat with a minimum dry film thickness of 1 mil (0.025 mm) for topcoat and 2 mils (0.05 mm) for system.
h Doors 48 Inches (1200 mm) High or Less: 3/4 inch (19 mm) thick, with particleboard or MDF cores.
i Doors More Than 48 Inches (1200 mm) High: 1-1/16 inches (27 mm) thick, with honeycomb cores and solid hardwood stiles and rails.
j Doors More Than 48 Inches (1200 mm) High: 1-1/8 inches (29 mm) thick, with particleboard cores.
k Filler Strips: Provide as needed to close spaces between cabinets and walls, ceilings, and indicated equipment. Fabricate from same material and with same finish as cabinets.

G. CASEWORK HARDWARE AND ACCESSORIES

1 Hardware, General: Unless otherwise indicated, provide manufacturer's standard satin-finish , commercial-quality, heavy-duty hardware.

a Use threaded metal or plastic inserts with machine screws for fastening to particleboard except where hardware is through-bolted from back side.

2 Butt Hinges: Stainless-steel, semiconcealed, five-knuckle hinges complying with BHMA A156.9, Grade 1, with antifriction bearings and rounded tips. Provide two hinges for doors less than 48 inches (1220 mm) high, and provide three hinges for doors more than 48 inches (1220 mm) high.

3 Pulls: Solid stainless-steel wire pulls, fastened from back with two screws. Provide two pulls for drawers more than 24 inches (600 mm) wide.

4 Door Catches: Zinc-plated,. Provide two catches on doors more than 48 inches (1220 mm) high.

5 Drawer Slides: BHMA A156.9, Type B05091.

a Standard Duty (Grades 1, 2, and 3): Side mounted and extending under bottom edge of drawer; full-extension type; epoxy-coated steel with polymer rollers.
b Heavy Duty (Grade 1HD-100 and Grade 1HD-200): Side mounted; full-extension type; zinc-plated, steel ball-bearing slides.
c Box Drawer Slides: Grade 1, for drawers not more than 6 inches (150 mm) high and 24 inches (600 mm) wide.
d Trash Bin Slides: Grade 1HD-100, for trash bins not more than 20 inches (500 mm) high and 16 inches (400 mm) wide.

6 Sliding-Door Hardware Sets: Manufacturer's standard, to suit type and size of sliding-door units.

7 Adjustable Shelf Supports: Single-pin metal shelf rests complying with BHMA A156.9, Type B04013.

9 Adjustable Shelf Supports: Mortise-type, zinc-plated steel standards and shelf rests complying with BHMA A156.9, Types B04071 and B04091.

H. PLASTIC-LAMINATE COUNTERTOPS

1 Quality Standard: Comply with WI Section 16.
2 High-Pressure Decorative Laminate Grade: HGS.

2 Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:

a Match color, pattern, and finish as indicated by manufacturer's designations for these characteristics.
b Match Architect's sample.
c Provide Architect's selections from manufacturer's full range of colors and finishes in the following categories:
  a. Solid colors.
  b. Solid colors with core same color as surface.
  c. Wood grains.
  d. Patterns.

3 Grain Direction: Parallel to cabinet fronts.

4 Edge Treatment: Same as laminate cladding on horizontal surfaces .

5 Core Material: Particleboard or medium-density fiberboard .

6 Core Material at Sinks: Particleboard made with exterior glue, medium-density fiberboard made with exterior glue, or exterior-grade plywood.

I SOLID SURFACE COUNTERTOPS

1 Quality Standard: Comply with WI Section 16.
2 Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed surfaces complying with the following requirements:
a Match color, pattern, and finish as indicated by manufacturer's designations for these characteristics.
b Match Architect's sample.
c Provide Architect's selections from manufacturer's full range of colors and finishes in the following categories:
a. Solid colors.
b. Solid colors with core same color as surface.
c. Wood grains.
d. Patterns.

3 Grain Direction: Parallel to cabinet fronts.

4 Edge Treatment: Same as countertop surfaces .
5 Core Material: Particleboard or medium-density fiberboard .

6 Core Material at Sinks: Particleboard made with exterior glue, medium-density fiberboard made with exterior glue, or exterior-grade plywood.

PART 3 - EXECUTION

3.01 PREPARATION

A Condition woodwork to average prevailing humidity conditions in installation areas before installation.

B Before installing architectural woodwork, examine shop-fabricated work for completion and complete work as required, including removal of packing and backpriming.

3.02 INSTALLATION

A Quality Standard: Install woodwork to comply with WIC Section 26 for the same grade specified in Part 2 of this Section for type of woodwork involved.

B Install woodwork level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb (including tops) to a tolerance of 1/8 inch in 96 inches.

C Scribe and cut woodwork to fit adjoining work, and refinish cut surfaces and repair damaged finish at cuts.
D Fire-Retardant-Treated Wood: Handle, store, and install fire-retardant-treated wood to comply with recommendations of chemical treatment manufacturer, including those for adhesives used to install woodwork.

E Anchor woodwork to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing as required for complete installation. Use fine finishing nails or finishing screws for exposed fastening, countersunk and filled flush with woodwork and matching final finish if transparent finish is indicated.

F Cabinets: Install without distortion so doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.

1 Install cabinets with no more than 1/8 inch in 96-inch sag, bow, or other variation from a straight line.

2 Maintain veneer sequence matching of cabinets with transparent finish.

3 Fasten wall cabinets through back, near top and bottom, at ends and not more than 16 inches o.c. with No. 10 wafer-head sheet metal screws through metal backing or metal framing behind wall finish.

G Countertops: Anchor securely by screwing through corner blocks of base cabinets or other supports into underside of countertop.

1 Install countertops with no more than 1/8 inch in 96-inch sag, bow, or other variation from a straight line.

2 Secure backsplashes to tops with concealed metal brackets at 16 inches o.c. and to walls with adhesive.

3 Calk space between backsplash and wall with sealant specified in Division 7 Section "Joint Sealants."

3.03 ADJUSTING AND CLEANING

A Repair damaged and defective woodwork, where possible, to eliminate functional and visual defects; where not possible to repair, replace woodwork. Adjust joinery for uniform appearance.

B Clean, lubricate, and adjust hardware.

C Clean woodwork on exposed and semi-exposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.

END OF SECTION

SECTION 07 21 00 - BUILDING INSULATION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

A This Section includes the following:
1. Exterior cavity wall thermal insulation.
2. Interior cavity wall insulation.
3. Underside of roof deck thermal insulation. (Above suspended ceiling tiles)
4. Recycled Cotton Insulation

B Related Sections include the following:
1. Division 9 Sections "Gypsum Board Assemblies" for installation in metal-framed assemblies of insulation specified by reference to this Section.

1.03 SUBMITTALS

A Product Data: For each type of product indicated.

1.04 QUALITY ASSURANCE

A Source Limitations: Obtain each type of building insulation through one source.

B Fire-Test-Response Characteristics: Provide insulation and related materials with the fire-test-response characteristics indicated, as determined by testing identical products per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency.
1. Surface-Burning Characteristics: ASTM E 84.

1.05 DELIVERY, STORAGE, AND HANDLING

A Protect insulation materials from physical damage and from deterioration by moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Glass-Fiber Insulation, Cotton batt where indicated:
a) CertainTeed Corporation.
b) Johns Manville Corporation.
c) Owens Corning.

2.02 INSULATING MATERIALS

A Basis of Design Product: Products are based on the named manufacturer or an approved comparable product and manufacturer.
1. Exterior cavity wall thermal insulation: Thermal Batt Insulation, foil faced, R-19.
2. Interior cavity wall insulation: Sound Attentuation Batt Insulation, unfaced.(R-13). All interior walls are insulated.
3. Thermal insulation at underside of roof deck: Owens Corning, Thermal Batt Insulation, foil faced, Refer to Mechanical drawings for R-value. Default to R-38 if no R-value given.
4. Rigid Insulation Board: 5" thick at membrane roof locations. 1 ½" at resilient channel locations at walls.

2.03 INSULATION FASTENERS

A Products: Subject to compliance with requirements, provide one of the following:
1. Adhesively Attached, Spindle-Type Anchors:
   a) AGM Industries, Inc.; Series T TACTOO Insul-Hangers.
   b) Gemco; Spindle Type.
2. Anchor Adhesives: -
   a) AGM Industries, Inc.; TACTOO Adhesive.
   b) Gemco; Tuff Bond Hanger Adhesive.

B Insulation-Retaining Washers: Install at bottom of roof decking, self-locking washers formed from 0.016-inch- (0.41-mm-) thick galvanized steel sheet, with beveled edge for increased stiffness, sized as required to hold insulation securely in place, but not less than 1-1/2 inches (38 mm) square or in diameter.

C Anchor Adhesive: Product with demonstrated capability to bond insulation anchors securely to substrates indicated without damaging insulation, fasteners, and substrates.

PART 3 - EXECUTION

3.01 EXAMINATION

A Examine substrates and conditions, with Installer present, for compliance with requirements for Sections in which substrates and related work are specified and other conditions affecting performance.

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

3.02 PREPARATION

A Clean substrates of substances harmful to insulations or vapor retarders, including removing projections capable of puncturing vapor retarders or of interfering with insulation attachment.

3.03 INSTALLATION, GENERAL

A Comply with insulation manufacturer's written instructions applicable to products and application indicated.

B Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed at any time to ice and snow.

C Extend insulation in thickness indicated to envelop entire area to be insulated. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.

D Water-Piping Coordination: If water piping is located on inside of insulated exterior walls, coordinate location of piping to ensure that it is placed on warm side of insulation and insulation encapsulates piping.

E Apply single layer of insulation to produce thickness indicated, unless multiple layers are otherwise shown or required to make up total thickness.

3.04 INSTALLATION OF GENERAL BUILDING INSULATION

A Apply insulation units to substrates by method indicated, complying with manufacturer's written instructions. If no specific method is indicated, bond units to substrate with adhesive or use mechanical anchorage to provide permanent placement and support of units.

B Set vapor-retarder-faced units with vapor retarder to warm side of construction, unless otherwise indicated. Do not obstruct ventilation spaces, except for firestopping.
1. Tape joints and ruptures in vapor retarder, and seal each continuous area of insulation to surrounding construction to ensure airtight installation.

C Install insulation on roof decking substrates by adhesively attached, spindle-type insulation anchors as follows:
1. Fasten insulation anchors to substrates with insulation anchor adhesive according to anchor manufacturer's written instructions. Space anchors according to insulation manufacturer's written instructions for insulation type, thickness, and application indicated.
2. After adhesive has dried, install insulation by pressing insulation into position over spindles and securing it tightly in place with insulation-retaining washers, taking care not to compress insulation below indicated thickness.

3.05 PROTECTION

A Protect installed insulation and vapor retarders from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION

SECTION 07 22 00 – FOAM BOARD INSULATION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

A Includes: Provide THERMAPINK® 25 extruded polystyrene roof board insulation. Provide tapered THERMAPINK where required.

1.03 SUBMITTALS

A Product Data: Submit data on product characteristics, performance criteria, and limitations, including installation instructions.

B Sustainable Design: Submit manufacturer's sustainable design certifications as specified.

1.04 QUALITY ASSURANCE

A Source Installer Qualifications: The installation work of this Section shall be performed by an experienced roofing contractor approved and certified by the roofing system manufacturer.

B Each insulation board must be labeled with manufacturer's name, product brand name, ASTM material specification reference, and identification of the third party inspection agency used for building code qualification.

C Each tapered panel shall be labeled with a code letter to identify its slope and to identify its proper position on the roof. Each panel shall also be marked with an arrow to identify direction of slope.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in manufacturer's original packaging.

B. Store and protect products in accordance with manufacturer's instructions. Store in a dry area and protect from water, direct sunlight, flame, and ignition sources. Do not install insulation that has been damaged or wet.
1. In the event the board insulation becomes wet, wipe dry prior to installation.

1.06 PROJECT CONDITIONS

A. Roof deck shall be free of ponded water, ice or snow. This precaution is to discourage potential future condensation on the underside of the membrane.

B. Do not expose Tapered [THERMAPINK®, FOAMULAR®] insulation to surfaces such as vent stacks, pipes or other rooftop appurtenances whose constant temperature is in excess of 165°F. If temperature cycling conditions are anticipated near the maximum recommended use temperature, consult an Owens Corning representative for recommendations regarding system components.

C. When insulation is to be exposed to sunlight for prolonged periods due to job site delays, protect the insulation with a light colored opaque covering. Provisions should be made to prevent wind loss of insulation materials at the job site when partially open units of Tapered [THERMAPINK®, FOAMULAR®] are on hand.

D. Dark membrane ballasted systems must have ballast installed immediately after installation of membrane. This precaution is required to prevent potential damage to the insulation from excessive heat due to prolonged exposure to sunlight.

E. Roofs exposed to chemical discharge, or to reflective vertical surfaces adjacent to the roof, require special consideration. Consult this specification for recommendations regarding system components.

F. Any deteriorated decking shall be repaired or replaced. Existing roof drains must be verified to be open and adequate to promote proper roof drainage.

1.07 WARRANTY

A. A thermal performance warranty shall be issued to the Owner upon completion of the work. Insulation shall be warranted to retain all physical properties and a minimum of 90% of its published R-value for the lifetime of the product.

1. A single source full roof covering system warranty shall be issued to the Owner upon completion of the work.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Glass-Fiber Insulation, Cotton batt where indicated:
   a) CertainTeed Corporation.
   b) Johns Manville Corporation.
   c) Owens Corning.

2.02 INSULATING MATERIALS

A Basis of Design Product: Owens Corning THERMAPINK FOAMULAR Extruded Polystyrene (XPS) Insulation. Products are based on the named manufacturer or an approved comparable product and manufacturer.
1. Physical Properties:
   a) Tapered Materials: Tapered [THERMAPINK®, FOAMULAR®] closed-cell foam panels with continuous as-extruded skin on the face and back surfaces, conforming to the minimum physical requirements of ASTM C-578, Type IV.
   b) Fill Materials: THERMAPINK® 25 closed-cell foam panels with continuous as-extruded skin on the face and back surfaces, conforming to the minimum physical requirements of ASTM C-578, Type X, IV, VI, VII.
   c) Thickness: 5 inches at roof deck, 1 ½” at resilient wall channels.
   d) Panel size:4ft wide by 8ft long
   e) Taper: Match drawings

B Insulation Fasteners and Stress Plates: Furnished by membrane manufacturer. FM approved. Fastener head shall be designed to inhibit damage to the membrane. Minimum 3" diameter or square insulation stress plates shall provide for countersunk fastener heads.

C Thermal Barrier Material:

1. Cover board: ½" minimum thickness

D Overlayment: For dark mechanically attached, or any color fully adhered, or chemically incompatible membranes, provide the following:

1. Flexible glass fiber, nonwoven, non-flammable, corrosion and mildew resistant or other suitable separator (overlayment) sheets shall be used under PVC membranes and other such membranes which contain plasticizing agents. Separator sheet shall have been evaluated and approved by the membrane manufacturer for adequacy as a separator.

2. Membrane Fastening or Adhesion System: Per manufacturer specifications.

PART 3 - EXECUTION

3.01 EXAMINATION

A Examine the areas and conditions under which work of this section will be installed. Verify that adjacent materials are dry and ready to receive insulation.

1. Verify that the roof deck drains completely free of water within 48 hours following rainfall.

2. Verify that the dead load carrying capability of the deck is sufficient to support code mandated live loads and dead loads incident on the roof, including the entire roof covering/insulation system.

3. Verify that the roof deck provides adequate support for the insulation.

B Provide written report listing conditions detrimental to performance of work in this section. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.02 PREPARATION

A Clean substrates of substances harmful to insulations or vapor retarders, including removing projections capable of puncturing vapor retarders or of interfering with insulation attachment.

3.03 INSTALLATION, GENERAL

A Any deteriorated roof decking shall be repaired or replaced

B A thorough inspection should be required in the case of total tear off.

C Steel Roof Decking: Install a thermal barrier between Tapered [THERMAPINK®, FOAMULAR®]/fill layers and the steel deck in accordance with construction drawings.

1. Tapered/Fill Thermapink layers may be installed directly over steel roof deck in accordance with the details of UL Roof Deck Construction #457.

2. Tapered/Fill FOAMULAR® layers in a steel deck application must be underlaid with a thermal barrier as specified by the building code, or, classified by assembly in accordance with UL 1256 or FM 4450. Thermal barriers may be loose-laid or secured to the deck by mechanical fastening depending on design or code requirements.

3.04 INSTALLATION OF GENERAL BUILDING INSULATION

A Install tapered roof insulation in accordance with the manufacturer's approved shop drawings.

B Total roof insulation aged thermal resistance shall be R-27, achieved in the thicknesses and number of layers as shown in the construction documents. R-value chosen is to be specified based on the intended use of each project and design criteria of each project, and applicable energy conservation codes. Contact an Owens Corning representative for information regarding ASHRAE 90.1 Energy Code minimum requirements for roof insulation if needed.

C Install thicknesses of fill in accordance with shop drawings prepared by supplier or manufacturer and approved by the roofing contractor. Install Tapered [THERMAPINK®, FOAMULAR®] over the required base layers, following the directional arrow printed on each panel which indicates direction of slope. Note that Tapered [THERMAPINK®, FOAMULAR®] panels also have a letter code printed on their surface which corresponds with panel layout shown on the approved shop drawings.

D Insulation joints shall not exceed 1/4” in width. Joints wider than 1/4” shall be filled with the same insulation.

E Insulation shall be field trimmed to fit tightly around roof protrusions and terminations.

F Apply only as much Tapered [THERMAPINK®, FOAMULAR®] and fill roof insulation as can be covered by the roofing membrane on the same day. Apply roof insulation in parallel rows with end joints staggered. Install side and end joints closely but do not force together. In a two layer application, apply second layer panels parallel to the first layer but with side and end joints staggered in relation to the first layer.

G Place the [THERMAPINK®, FOAMULAR®] board with the printed logo surface down so that the black lettering is not exposed to potential solar heat gain.

H For mechanically attached and fully adhered roofing systems,] in areas where black/dark membranes are used and where "reflected solar energy" is expected to be present, THERMAPINK® and FOAMULAR® insulation need protection in addition to normally specified cover boards. For example, roof areas adjacent to higher walls, particularly walls with reflective surfaces, or near large rooftop HVAC units, or near or in between clusters of mechanical equipment, or near other structures with reflective cladding (metal or glass); or near higher reflective parapets, all such areas should be considered for additional heat protection. Such roof areas must be covered with pavers or ballast. Black/dark (non-white) membranes must be coated with white reflective topping, and maintained white, to avoid damage due to the intensified heat exposure from reflected sun in such areas.

I Insulation shall secured in accordance with membrane manufacturer’s requirements. The insulation below the membrane is to be held in place with mechanical fasteners in conjunction with the overlayment and/or membrane system. Mechanical fasteners shall be of sufficient number and adequate pattern to resist displacement of insulation by wind uplift forces. When adhering or exposing Tapered/fill THERMAPINK® or FOAMULAR® insulation to hot bitumen, the bitumen must be allowed to cool to between 200°F and 250°F.

3.05 OVERLAYMENT

A Only dry overlayment materials shall be used. If overlayment materials become wet, allow them to fully dry before proceeding with roofing application. Requirements for overlayment materials and thickness may vary. Contact membrane manufacturer for their individual requirements.

B Rigid overlayment shall be mechanically attached per manufacturer’s recommendations. Mechanical fastening of insulation and rigid overlayment may coincide so that fastener penetrates

overlayment and THERMAPINK® or FOAMULAR® into the structural substrate the minimum distance prescribed for adequate wind uplift resistance by the fastener manufacturer.

C When cleaning agents and seam adhesives used are solvent based and capable of causing cavitation of the underlying [THERMAPINK®, FOAMULAR®] insulation, use care when preparing membrane edges for in-field seam splicing.

3.06 FASTENERS

A Fasteners/stress plate assemblies shall be driven to tightly secure the insulation board and seat the plate but shall not be overdriven so that the Tapered [THERMAPINK®, FOAMULAR®] board is crushed beneath the plate.

B Fasteners which are improperly installed shall be removed or corrected. Improper installation may include overdriving such that the stress plate is concave and cuts a significant depression in the insulation; underdriving such that the fastener head is not properly seated in the stress plate and may puncture the membrane; broken or bent shanks; improper location; or insufficient length.

C Fasteners shall be embedded in the deck per manufacturer's recommendations to insure adequate withdrawal resistance.

D Tapered THERMAPINK®, FOAMULAR® shall be secured with 4 fasteners and 3" diameter stress plates per 2' x 8' board.

1. Four fasteners minimum, (install 2 to 4 more to insure greater flatness) one 6" in from the edges of each corner, are required when THERMAPINK® or FOAMULAR® insulation is installed under white membranes with or without a slip-sheet. Four fasteners, 6" from each corner, are also required when FOAMULAR® insulation is installed under a rigid coverboard. The coverboard and THERMAPINK® or FOAMULAR® may be fastened concurrently. The rigid coverboard may require more than 4 fasteners to meet the recommendation of its manufacturer.

END OF SECTION

SECTION 07 26 19 - TOPICAL MOISTURE VAPOR EMISSION SYSTEM

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings, general provisions of the Contract, and other related construction documents such as Division 01, Division 03, and Division 09 specifications that apply to this Section

1.02 SUMMARY

A. **THIS SPECIFICATION SECTION IS ONLY APPLICABLE AS NECESSARY TO ACHIEVE THE RECOMMENDED INTERIOR CONRETE SLAB-ON-GRADE MOISTURE-VAPOR-EMISSIONS RATE AND pH LEVEL CONTENT FOR FINISH FLOORING INSTALLATION LOCATIONS (NON-EXPOSED CONCRETE SPACES). Refer to specification sections 09 30 00, 09 65 36, 09 68 00. If the Contractor believes these requirements can be met without a topical moisture vapor emission system, the cost should not be included in the bid amount.**

B. This Section includes a single-coat, fast-curing, 100% solids epoxy moisture management system formulated to suppress excessive moisture vapor emissions in new or existing concrete prior to installing an ARDEX Underlayment.

1. ARDEX MC™ RAPID One-Coat Moisture Control System

1.03 REFERENCES

A. ASTM 109M, Compressive Strength Air-Cure Only

B. ASTM C348, Flexural Strength of Hydraulic-Cement MortarsPROJECT CONDITIONS

C. ASTM E84, Surface Burning Characteristics of Building Materials

D. ASTM F2170 - Relative Humidity in Concrete Floor Slabs Using in situ Probes

E. ASTM F1869 - Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride

F. ASTM 710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring

G. ASTM C1708 – 12 Standard Test Methods for Self-Leveling Mortars Containing Hydraulic Cements

H. ASTM C1583 - Standard Test Method for Tensile Strength of Concrete Surfaces and the Bond Strength or Tensile Strength of Concrete Repair and Overlay Materials by Direct Tension

I. ASTM E96 - Standard Test Methods for Water Vapor Transmission of Materials

J. ASTM D1308 - Chemical Resistance of Finishes

1.04 SUBMITTALS

A. Product Data: Submit manufacturer's product data and installation instructions for each material and product used. Include manufacturer's Material Safety Data Sheets.

B. Qualification Data: For Installer

1.05 QUALITY ASSURANCE

A. Installation of the ARDEX product must be completed by a certified applicator, such as an ARDEX LevelMaster® Elite or Choice Contractor, using mixing equipment and tools approved by the manufacturer. Please contact ARDEX Engineered Cements (724) 203-5000 for a list of recommended installers.

B. Manufacturer Experience: Products used for work in this section shall be manufactured by companies which have successfully specialized in production of this type of work for not less than 10 years. Contact Manufacturer Representative prior to installation.

1.06 WARRANTY

A. Certified applicator must file a pre-installation checklist with the manufacturer and receive written confirmation of the approval to proceed in order to obtain the extended 10-year ARDEX MC™ RAPID Warranty.

B. ARDEX HC 100™ and ARDEX V1200™ Underlayments installed as part of a floor system, shall be installed in conjunction with the recommended ARDEX Tile & Stone Installation Materials or WW Henry Flooring Adhesive, as appropriate, to provide the ARDEX SystemOne 10-year comprehensive warranty.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver products in original packaging, labeled with product identification, manufacturer, batch number and shelf life.

B. Store products in a dry area with temperature maintained between 50° and 85° F (10° and 29° C) and Protect from direct sunlight.

C. Handle products in accordance with manufacturer's printed recommendations.

1.08 PROJECT CONDITIONS

A. Do not install material below 50° F (10° C) surface and air temperatures. These temperatures must also be maintained during and for 48 hours after the installation of products included in this section. Install quickly if substrate is warm and follow warm weather instructions available from the ARDEX Technical Service Department.

PART 2 – PRODUCTS

2.01 TOPICAL MOISTURE VAPOR EMMISION SYSTEM

A. One-Coat Moisture Control System for Concrete to Receive ARDEX Underlayments and Toppings

B. Acceptable Products:

1. ARDEX MC™ RAPID; Manufactured by ARDEX Engineered Cements: 400 Ardex Park Drive, Aliquippa, Pa 15001 USA 724-203-5000

C. Performance and Physical Properties: Meet or exceed the following values for material cured at 70° F+/-3°F (21° C+/-3°C) and 50% +/-5%relative humidity:

1. Application: Manual
2. Material Requirements on CSP 3 Prepared Concrete: Max 190 sq. ft. per mixed unit for 10 mils
3. Permeability (ASTM E96): <0.06 perms
4. 14 pH solution (ASTM D1308): No effect
5. Working Time: 20 minutes
6. Pot Life: 20 minutes
7. VOC: 0g/L, calculated SCAQMD 1168
8. Walkable: Minimum of 4 hours
9. Install Underlayment: Minimum 4 hours, maximum 24 hours

2.02 HYDRAULIC CEMENT UNDERLAYMENT

A. Hydraulic Cement-based Self-Leveling Underlayment

B. Acceptable Products:

1. Ardex HC 100 High Capacity Self-Leveling Underlayment
2. Ardex V1200 Self-Leveling Flooring Underlayment

C. Performance and Physical Properties: Meet or exceed the following values for material cured at 70° F+/-3°F (21° C+/-3°C) and 50% +/-5% relative humidity:

1. Application: ARDEX ARDIFLO™ Pump System
2. Flow Time: 10 minutes
3. Initial Set: Approx. 30 minutes
4. Final Set: Approx. 90 minutes
5. Compressive Strength: Minimum 4000 psi at 28 days, ASTM C109M
6. Flexural Strength: 1000 psi at 28 days, ASTM C78
7. VOC: 0g/L, calculated SCAQMD 1168

2.03 WATER: Water shall be clean, potable, and sufficiently cool (not warmer than 70° F)

PART 3 – PRODUCTS

3.01 PREPARATION

A. Concrete Subfloors: Prepare substrate in accordance with manufacturer’s instructions.

1. Prior to proceeding please refer to ASTM F710 Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring. All concrete subfloors must be sound, solid, clean, and free of all oil, grease, dirt, curing compounds and any substance that might act as a bond breaker before application.

2. Mechanical preparation of the surface is required to obtain a minimum ICRI concrete surface profile of 3 (CSP 3).

3. Prior to beginning the installation, measure the relative humidity within the concrete (ASTM F2170). For these relative humidity methods, the RH shall not exceed 100%.

3.02 APPLICATION OF ARDEX MC RAPID

A. Examine substrates and conditions under which materials will be installed. Do not proceed with installation until unsatisfactory conditions are corrected.

B. Coordinate installation with adjacent work to ensure proper sequence of construction. Protect adjacent areas from contact due to mixing and handling of materials.

C. Mixing: Comply with manufacturer's printed instructions and the following.

1. Each individual 22 lb. unit contains separate, pre-measured quantities of hardener (Part B) and the resin (Part A). After opening each container, stir the individual components thoroughly as described in (2) below before blending. The hardening agent (Part B) is added to the resin (Part A).

2. Pour all of the hardener into the resin portion and stir thoroughly for a minimum of 3 minutes using a low speed drill and an epoxy mixing paddle. Once mixed, pour some of the epoxy back into the hardener container, stir for 10 seconds, and then pour all of the contents back into the resin container. Mix for an additional 30 seconds before applying.

D. Application: Comply with manufacturer's printed instructions and the following.

1. Apply a coat of freshly mixed ARDEX MC™ RAPID to the prepared concrete surface in a uniform direction at an application rate of up to 190 sq. ft. per unit to achieve a coating thickness of 14 mils. Use a short-nap paint roller or notched squeegee for smoother surfaces, and a longer nap roller for more uneven substrates. To minimize the potential for pinhole formation, work the ARDEX MC™ RAPID into the surface with the roller to ensure maximum penetration. ARDEX MC™ RAPID can also be worked into the surface with a paintbrush for hard to reach areas and corners.

a. While this coat is still in a fresh state (maximum 20 minutes), broadcast an excess of fine sand (less than 1/50 of an inch in grain size or 98.5% passing sieve size #35 or #30) consistently over the entire area.

Note: When broadcasting sand, use a NIOSH approved dust mask in conformance with OSHA requirements regarding the handling of sand. Do not stand or walk on the freshly applied epoxy when broadcasting the sand.

b. Once an area has been completely covered with sand, the surface of the sand can be walked on, being careful not to expose the epoxy at any time. Use approximately 1 lb. of sand per square foot of area. Once the sand broadcast is complete, avoid all traffic over the surface for a minimum of 4 hours.

c. After 4 hours, broom sweep and vacuum the surface to remove all loose sand. The clean, prepared surface of the sand is the priming system for the ARDEX Underlayment. No additional priming is required.

d. Following the application of MC Rapid and sand broadcast, install ARDEX HC 100™ or ARDEX V1200™ Underlayment in accordance with printed instructions found in the corresponding technical brochure.

e. It is not necessary to re-test the substrate for moisture emissions prior to installing the coating or floor covering.

3.03 FIELD QUALITY CONTROL

A. Where specified, field sampling of the ARDEX products is to be done by taking an entire unopened bag/unit of the product being installed to an independent testing facility to perform testing. There is no in-situ test method applicable for this system.

3.04 PROTECTION

A. Prior to the installation of the finish flooring, the surface of the underlayment should be protected from abuse by other trades by the use of plywood, Masonite or other suitable protection course.

END OF SECTION

SECTION 07 41 00 – INSULATED METAL ROOF PANELS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

A This Section includes the following:
1. Steel faced factory insulated roof panels
2. Accessories including fasteners, perimeter trim and penetration treatments

1.03 REFERENCES

A ASTM International:

1. ASTM A792; Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process
2. ASTM B117; Standard Practice for Operating Salt Spray (Fog) Apparatus
3. ASTM C518: Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus
4. ASTM D523; Standard Test Method for Specular Gloss
5. ASTM D522; Standard Test Methods for Mandrel Bend Test of Attached Organic Coatings
6. ASTM D714; Standard Test Method for Evaluating Degree of Blistering of Paints
7. ASTM D968; Standard Test Methods for Abrasion Resistance of Organic Coatings by Falling Abrasive
8. ASTM D1308; Standard Test Method for Effect of Household Chemicals on Clear and Pigmented Organic Finishes
9. ASTM D2244; Standard practice for Calculation of Color Tolerances and Color Differences from Instrumentally Measured Color Coordinates
10. ASTM D2247; Standard Practice for Testing Water Resistance of Coatings in 100 percent Relative Humidity
11. ASTM D2794; Standard Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact)
12. ASTM D3359; Standard Test Methods for Measuring Adhesion by Tape Test
13. ASTM D3363; Standard Test Method for Film Hardness by Pencil Test
14. ASTM D4145; Standard Test Method for Coating Flexibility of Prepainted Sheet
15. ASTM D4214; Standard Test Methods for Evaluating the Degree of Chalking of Exterior Paint Films
16. ASTM E72; Standard Test Methods of Conducting Strength Tests of Panels forBuilding Construction
17. ASTM E84; Standard Test Method for Surface Burning Characteristics of Building Materials
18. ASTM E283; Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen
19. ASTM E331; Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference
20. ASTM E1646; Standard Test Method for Water Penetration of Exterior Metal Roof Panel Systems by Uniform Static Air Pressure Difference
21. ASTM E1680; Standard Test Method for Rate of Air Leakage Through Exterior Metal Roof Panel Systems

22. ASTM G153; Standard Practice for Operating Enclosed Carbon Arc Light Apparatus for Exposure of Nonmetallic Materials
23. ASTM G154; Standard Practice for Operating Fluorescent Light Apparatus for UV Exposure of Nonmetallic Materials
24. ASTM A653: Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
25. ASTM A755: Standard Specification for Steel Sheet, Metallic Coated by the Hot-Dip Process and Pre-painted by the Coil-Coating Process for Exterior Exposed Building Products

B Underwriters Laboratories:
1. UL 580; Tests for uplift resistance of roof assemblies

C Factory Mutual
1. FM 4471; Approval standard for Class 1 panel roofs

1.04 SUBMITTALS

A Product Data: Submit manufacturer current technical literature for each type of product.

B Shop Drawings: Submit detailed drawings and panel analysis showing:

1. Profile
2. Gauge of both exterior and interior sheet
3. Location, layout and dimensions of panels of roof structure
4. Location and type of fasteners
5. Shape and method of attachment of all trim
6. Locations and type of sealants
7. Other details as may be required for a weathertight installation

C Panel Analysis: Provide panel calculations to indicate compliance with max deflection of L/240 for the indicated design loads. Include effects of thermal differential between the exterior and interior panel facings.

D Samples: Each color indicated. 6”x6” minimum

E Miscellaneous Certifications:

1. Submit documentation that products have been certified in accordance with ISO 14025.

F Quality Assurance Submittals:

1. Design Data, Test Reports: Provide manufacturer test reports indicating product compliance with requirements.

2. Manufacturer Erection Instructions: Provide manufacturer’s written installationinstructions including proper material storage, material handling, installationsequence, panel location(s), and attachment methods, details and required trimand accessories.

1.05 QUALITY ASSURANCE

A Manufacturer Qualifications:

1. Manufacturer shall have a minimum of five (5) yearsexperience in the production of insulated metal standing seam roof panels. Manufacturer shall demonstrate past experience with examples of projects of similar type and exposure.

2. Manufacturer to be registered with a Program Operator with a Certified, Environmental Product Declaration, in conformance with ISO 14025, for Insulated Metal Panels.

B Installer Qualifications:

1. Installer shall be authorized by the panel manufacturer and the work shall be supervised by a person having a minimum of five (5) years' experience installing insulated metal standing seam roof panels on similar type and size projects.

2. Installation shall be in accordance with manufacturer's installation guidelines and recommendations.

C Wind and Uplift Criteria:

1. Design Design Wind and Uplift Loading: In accordance with ASCE 7-10 Chapter 30 with 110 mph ultimate design wind speed, Exposure C, Risk Category II, and Kzt= 1.00.

2. Units shall be rated and carry the following listings:
   a) Factory Mutual 1-105 uplift rating for 5 foot spans with minimum 14 gauge purlins
   b) Factory Mutual 4771 – Class 1 Approval
   c) UL 580, Class 90 uplift ratings for 5 foot spans with a minimum 14 gauge purlins
   d) UL 580, Class 90 uplift rating for panels attached to 20 gauge decking with fastening, 3 foot on center.

D Snow Load: 26 psf

E Fire Classifications:

1. Factory Mutual Class 1A Approval when installed at a maximum roof slope of 5:12.

1.06 DELIVERY, STORAGE, AND HANDLING

A Deliver panel materials and components in manufacturer's original, unopened, undamaged packaging with identification labels intact.

B Store roofing panel materials on dry, level, firm, and clean surface using the three inch factory provided foam supports under the panels. Use of wood substitute is not acceptable. Stack no more than two bundles high. Elevate and ventilate to allow air to circulate and moisture to escape.

1.07 WARRANTY

A Limited Warranty: Standard form in which manufacturer agrees to repair or replace items that fail in materials or workmanship within specified warranty period. The items covered by the warranty include structural performance and finish performance.

1. Warranty Period: Two (2) years from date of Substantial Completion, or 2 years and 6 months from the date of shipment from manufacturer's plant, whichever occurs first.

B Finish Warranty: Standard form in which manufacturer agrees to repair or replace metal panels that evidence deterioration of fluoropolymer finish, including flaking or peeling from approved primed metal substrate, chalk in excess of 8 when tested in accordance with ASTM D4214,

Method A, and /or color fading in excess of 5 KE Hunter units on panels when tested in accordance with ASTM D2244.

1. Warranty Period: Twenty (20) years from date of Substantial Completion, or 20 years and 3 months from the date of shipment from manufacturer's plant, whichever occurs first.

C Installers "Weather-tight" Warranty: The Manufacturer Certified Installer shall provide a "leak-free" roofing warranty in which the installer agrees to repair leaks discovered in the roofing system under the terms outlined by the roofing manufacturer within the specified warranty period.

1. Warranty Period: Two (2) years from date Substantial Completion.

D Weather-tight Warranty: Provide manufacturer's limited weathertightness warranty in which manufacturer agrees to repair or replace components of roofing system that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Twenty (20) years from date Substantial Completion, or 20 years and 3 months from the date of shipment from manufacturer's plant, whichever occurs first.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A Kingspan Insulated Panels; 726 Summerhill Drive, Deland, FL 32724; 386-626-6789; or 2000 Morgan Road, Modesto, CA 95358; 209-531-9091; (www.kingspanpanels.us)

B Basis of Design: KingZip

C Substitutions Limitations:

1. Submit written request for approval of substitutions to the Architect [a minimum of [14] days prior to the date for receipt of bids. Include the following information:
   a) Name of materials and description of the proposed substitute.
   b) Drawings, cutsheets, performance and test data.
   c) List of projects (and addresses) similar is scope and photographs of existing installations
   d) Other information necessary for evaluation.

2. After evaluation by Architect, approval will be issued via addendum. No verbal approval will be given.

2.02 STANDING SEAM ROOF PANELS

A Panel Description:

1. Panel thickness: 5 inches

2. Panel width: 42 inch wide

3. Panel length: Maximum length for minimal seams.

4. The side joint shall consist of a 2 inch vertical sidelap, mechanically seamed, with fasteners and thermally broken attachment clip completely concealed within the side joint.

5. Exterior Face of Panel:

a) Material: AZ50/Galvalume/Zincalume per ASTM A 792

b) Profile: Shallow “minor rib”

c) Texture: Smooth

d) Gauge: 22 gauge

e) Yield: 33 ksi minimum

f) Exterior Finish: Valspar Fluropon PVDF finish, dry film thickness of 1.0 mil including primer.

g) Color: Pewter – Metallic #439ZZ099

6. Interior Face of Panel:

a) Material: AZ50/Galvalume/Zincalume per ASTM A792

b) Profile: Shallow “minor rib”

c) Texture: Stucco embossed

d) Gauge: [22 gauge

e) Yield: 33 ksi minimum

f) Interior Finish: Valspar Dynapon modified polyester finish with a total minimum dry film thickness of 1.0 mil including primer.

g) Color: Regal White

7. Insulating Core: Minimum 95 percent closed cell structure urethane modified isocyanurate core with the following minimum physical properties:

a) Density Nominal: 2.4 pcf

b) Shear Strength: 25 psi (to rise)

c) Tensile Strength: 23 psi

d) Compressive Strength: 14-22 psi

e) Surface burning characteristics when tested in accordance with ASTM E84:

1. Flame Spread: Less than 25

2. Smoke Developed: Less than 450

B Physical Characteristics:

1. Structural Test: Design shall be verified by representative structural test for wind loads in accordance with ASTM E72. The deflection criteria shall be L/240.

2. Thermal Properties: The panel shall provide a nominal R-value of 7.2 [hr·ft2·°F/Btu] per inch thickness when tested in accordance with ASTM C 518 at 75°F mean temperature and 8.0 [hr·ft2·°F/Btu] per inch thickness when tested in accordance with ASTM C 518 at 35°F mean temperature

3. Fatigue Test: There shall be no evidence of metal/insulation interface delamination when the panel is tested by simulated wind loads of 20 psf (positive and negative loads), when applied for two million alternate cycles.

4. Bond Strength: No metal primer interface corrosion and/or delamination shall occur after 1000 hours at 140 deg. F and 100 percent relative humidity. No delamination shall occur after 2-1/2 hours in a 2 psi 212 deg. F autoclave.

5. Water Penetration: There shall be no uncontrolled water leakage at pressures of up to 20 psf when tested in accordance with ASTM E331 and ASTM E1646. Tested assembly must include endlap and sidelap conditions.

6. Air Infiltration: Air infiltration through the roof shall not exceed 0.003 cfm/sf at 6.24 psf air pressure differential when tested in accordance with ASTM E283 and ASTM E1680. Tested assembly must include endlap and sidelap conditions.

7. Hailstorm Rating: Factory Mutual 1 SH hailstorm rating.

C Finish Characteristics:

1. Gloss: 15 ± 5 tested in accordance with ASTM D523

2. Pencil Hardness: HB – H tested in accordance with ASTM D3363

3. Flexibility, T-Bend: 1-2T bend tested in accordance with ASTM D4145

4. Flexibility, Mandrel: No cracking tested in accordance with ASTM D522

5. Adhesion: No adhesion loss tested in accordance with ASTM D3359

6. Reverse Impact: No cracking or adhesion loss tested in accordance with ASTM D2794

7. Abrasion Resistance: 65 ± 10 liters tested in accordance with ASTM D968

8. Graffiti Resistance: Minimal effect

9. Acid Pollutant Resistance: No effect tested in accordance with ASTM D1308

10. Salt Fog Resistance: Passes 1000 hours tested in accordance with ASTM B117

11. Cyclic Salt Fog and UV Exposure: Passes 2016 hours tested in accordance with ASTM B5894

12. Humidity Resistance: Passes 1500 hours when tested in accordance with ASTM D2247 and D714

13. Color Retention: Passes 5000 hours when tested in accordance with ASTM G153 and G154

14. Chalk Resistance: Maximum chalk is a rating of 8 when tested in accordance with ASTM D4214, Method A

15. Color Tolerances: Greater than 5∆E units on panels when tested in accordance with ASTM D224.

2.03 ACCESSORIES

A Fasteners:

1. Self drilling fasteners shall be corrosion resistant plated steel, designed to resist maximum negative pulloff loads and hold the face sheet mechanically to the structural support.Panel width: 42 inch wide

2. Panel attachment clip shall be two pieces and fully concealed within the panel sidejoint. Base clip shall be a minimum 14 gauge galvanized, and top clip shall be a minimum 20 gauge stainless steel with an integral thermal break.

3. Vibration resistant type (anti-backout threads) fasteners. Self-drilling flathead screws with sealing washers and square drives, designed to resist back out by increasing thread friction as screw loosens.

B Perimeter Trim and Penetration Treatments: All required trim and metal flashing with same coating, color, and gauge as the exterior face of the insulated metal roof panel.

C Butyl Tape: Per panel manufacturer's recommendations for panel to panel and panel to trim seal.

D Butyl Sealants: Non-skinning type per panels manufacturer's recommendations

2.04 SKYLIGHTS

A Manufacturer: R & S Manufacturing and Sales

B Model: Bristolite Daylighting Systems ALB-CM-2-WPC-C16MM10

C Size: Custom 30 inches by 120 inches (28120)

D Domes: Double dome

1. Outer dome: White Polycarbonate

2. Inner dome: Clear Multiwall Polycarbonate

E Specifications:

1. VLT: 58%

2. SHGC: .20

3. U Factor: .44

F Frame and Curb Finish: Kynar. Color to match roof

G Curb model: MB5-SC (Seams to match Kingspan KingZip roof system)

1. Height: 6 inches

2. Curb and dome to be manufactured by single source

3. Material: Aluminum

4. Provide sub framing as required by manufacturer

PART 3 - EXECUTION

3.01 EXAMINATION

A Examine alignment of the structure and supports prior to installing the insulated metal roof panels.Proceed with installation only after unsatisfactory conditions have been corrected.

1. Structure Tolerance: In the plane of the roof 0 inches inward, plus 1/2 inch outward

2. All deviations from structural tolerances shall be corrected by the responsible party prior to installation of the panels.

B Examine individual panels upon removing from the bundle; both edges should be visually examined and any slight overfill of insulation should be carefully removed.

3.02 PANEL INSTALLATION

A Remove protective film before installation, or immediately thereafter to prevent sunlight damage.

B Cut panels, where indicated on shop drawings, using a power circular saw with fine tooth carbide tip blades or a band saw prior to installation. Ventilate area where polyurethane dust is generated. Personnel should wear respiratory and eye protection devices.

C Apply butyl sealant vapor seal around interior perimeter of roof assembly per panel manufacturer’s instructions.

D Apply butyl tape on panel sidelaps and clip assemblies per panel manufacturer’s instructions.

E Secure units to the steel supports with manufacturer’s recommended fastener.

F Place panel fasteners through predrilled top clip and base clip, concealed within the side joint of the panel. Heads of concealed fasteners shall be insulated from the exterior environment to prevent condensation and “ice balling” from occurring on the fastener shaft.

G Apply endlap sealing tape and butyl to panel surface to be lapped per manufacturer’s instructions.

H Endlap panel stitch fasteners to be vibration resistant type.

I As each panel is installed, crimp hidden clip assembly prior to placement of next panel.

J Repair or replace metal panels and trim that have been damaged.

3.03 TRIM INSTALLATION

A Place trim to determine the location of the closure strips, sealant and ridge closure trims.

B Apply butyl tape above and below the foam closure strip and seat the closure strip firmly in the tape to ensure a continuous seal. If any voids exist add butyl caulking and reseat the closure.

C Place a continuous layer of butyl tape on top of the metal ridge closure trims for the length of the building.

D Fasten the exterior ridge trim to the metal ridge closure trims, per manufacturer's recommendations, on center with 1/4 inch by 7/8 inch low profile vibration resistant stitch fasteners.

END OF SECTION

SECTION 07 41 13 – NON-INSULATED METAL ROOF PANELS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

A This Section includes the following:

1. Double lock standing seam, single element, metal roof panels.

2. Accessories including concealed anchor clips, fasteners, perimeter flashing, trim and penetration treatments.

B Related Sections include the following:
1. Division 7 Section "Sheet Metal Flashing and Trim" for fascia, copings, flashings and other sheet metal work not part of metal wall panel assemblies.

1.03 REFERENCES

A ASTM International
1. ASTM A240; Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for GeneralApplications.
2. ASTM A641; Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire.
3. ASTM A666; Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
4. ASTM A792 – Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.
5. ASTM B117; Standard Practice for Operating Salt Spray(Fog) Apparatus.
6. ASTM B209; Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
7. ASTM B370; Standard Specification for Copper Sheet and Strip for Building Construction.
8. ASTM C612; Standard Specification for Mineral Fiber Block and Board Thermal Insulation.
9. ASTM C645 – Standard Test Method for Nonstructural Steel Framing Members.
10. ASTM C920 – Standard Specification for Elastomeric Joint Sealants.
11. ASTM C1311; Standard Specification for Solvent Release Sealants.
12. 12. ASTM D522; Standard Test Methods for Mandrel Bend Test of Attached Organic Coatings.
13. D523; Standard Test Method for Specular Gloss.
14. ASTM D714; Standard Test Method for Evaluationg Degree of Blistering of Paints.
15. ASTM D968; Standard Test Methods for Abrasion Resistance of Organic Coatings by Falling Abrasive.
16. ASTM D1308; Standard Test Method for Effect of Household Chemicals on Clear and Pigmented Organic Finishes.
17. ASTM D2244; Standard practice for Calculation of Color Tolerances and Color Differences from Instrumentally Measured Color Coordinates
18. ASTM D2247; Standard Practice for Testing Water Resistnace of Coatings in 100% Relative Humidity.
19. ASTM D2794; Standard Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact).
20. ASTM D3359; Standard Test Methods for Measuring Adhesion by Tape Test.

21. ASTM D3363; Standard Test Method for Film Hardness by Pencil Test.
22. ASTM D4145; Standard Test Method for Coating Flexibility of Prepainted Sheet.
23. ASTM D4214; Standard Test Methods for Evaluating the Degree of Chalking of Exterior Paint Films
24. ASTM D5894; Standard Practice for Cyclic Salt Fog/UV Exposure of Painted Metal, (Alternating Exposures in a Fog/Dry Cabinet and a UV/Condensation Cabinet)
25. ASTM E283; Standard Test Method for determining Rate of Air Leakage Through Exterior Windows, Curtain Walls and Doors under Specified Pressure Differences across the Specimen.
26. ASTM E330; Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.
27. ASTM E331; Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference.
28. ASTM E1680; Standard Test Method for Rate of Air Leakage through Exterior Metal Roof Panel Systems.
29. ASTM G153; Standard Practice for Operating Enclosed Carbon Arc Light Apparatus for Exposure of Nonmetallic Materials.
30. ASTM G154; Standard Practice for Operating Fluorescent Light Apparatus for UV Exposure of Nonmetallic Materials.

1.04 ADMINISTRATIVE REQUIREMENTS

A Pre-installation meeting: Conduct a pre-installation meeting at the job site attended by Owner, Architect, Manufacturer's Technical Representative, Panel Installer, and Contractors of related trades. Coordinate structural support requirements in relation to insulated wall panel system, installation of any separate air/water barriers, treatment of fenestration, and other requirements specific to the project.

1.05 SUBMITTALS

A Product Data: Submit manufacturer current technical literature for each type of product.

B Delegated Design: Design metal wall panel assembly, submit comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

C Shop Drawings – Submit detailed drawings showing:

1. Profile
2. Gauge of panel
3. Location layout and dimensions of panels
4. Location and type of fasteners
5. Shape and method of attachment of all trim
6. Locations and type of sealants
7. Installation sequence.
8. Other details as may be required for a weathertight installation

D Samples: Provide nominal 3 x 5 inch of each color indicated. Provide panel width by 10 inches long minimum

1.06 QUALITY ASSURANCE

A Manufacturer Qualifications:

1. Manufacturer shall have a minimum of five (5) years experience in the production of insulated wall panels. Manufacturer shall demonstrate past experience with examples of projects of similar type and exposure.

B Installer Qualifications:

1. Installer shall be Authorized by the manufacturer and the work shall be supervised by a person having a minimum of five (5) years' experience installing insulated wall panels on similar type and size projects.

2. Installation shall be in accordance with manufacturer's installation guidelines and recommendations.

C Design Data, Test Reports: Provide manufacturer test reports indicating product compliance with requirements. Manufacturer Erection Instructions: Provide manufacturer's written installation instructions including proper material storage, material handling, installation sequence, panel location(s), and attachment methods, details and required trim and accessories.

D Source Limitations: Obtain each type of metal wall panel through one source from a single manufacturer.

E Product Options: Drawings indicate size, profiles, and dimensional requirements of metal wall panels and are based on the specific system indicated.

1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.

F Wind and Uplift Criteria:

1. Design Design Wind and Uplift Loading: In accordance with ASCE 7-10 Chapter 30 with 110 mph ultimate design wind speed, Exposure C, Risk Category II, and Kzt= 1.00.

2. Units shall be rated and carry the following listings:
   a) Factory Mutual 1-105 uplift rating for 5 foot spans with minimum 14 gauge purlins
   b) Factory Mutual 4771 – Class 1 Approval
   c) UL 580, Class 90 uplift ratings for 5 foot spans with a minimum 14 gauge purlins
   d) UL 580, Class 90 uplift rating for panels attached to 20 gauge decking with fastening, 3 foot on center.

G Snow Load: 32 psf

1.07 DELIVERY, STORAGE, AND HANDLING

A Deliver panel materials and components in manufacturer's original, unopened, undamaged packaging with identification labels intact.

B Store wall panel materials on dry, level, firm, and clean surface. Stack no more than two bundles high. Elevate one end of bundle to allow moisture run-off, cover and ventilate to allow air to circulate and moisture to escape.

C Deliver components, sheets, metal wall panels, and other manufactured items so as not to be damaged or deformed. Package metal wall panels for protection during transportation and handling.

D Unload, store, and erect metal wall panels in a manner to prevent bending, warping, twisting, and surface damage.

E Stack metal wall panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal wall panels to ensure dryness, with positive slope for drainage of water. Do not store metal wall panels in contact with other materials that might cause staining, denting, or other surface damage.

F Protect strippable protective covering on metal wall panels from exposure to sunlight and high humidity, except to extent necessary for period of metal wall panel installation.

1.08 WARRANTY

A. Material Warranty: Standard form in which manufacturer agrees to repair or replace items that fail in materials or workmanship within specified warranty period. The items covered by the warranty include structural performance and finish performance.

1. Warranty Period: Two (2) years from date of Substantial Completion

B. Finish Warranty: Standard form in which manufacturer agrees to repair or replace metal panels that evidence deterioration of fluoropolymer finish, including flaking or peeling from approved primed metal substrate, chalk in excess of 8 when tested in accordance with ASTM D4214, Method A, and /or color fading in excess of 5 KE Hunter units on panels when tested in accordance with ASTM D2244.

1. Warranty Period: Twenty (20) years from date Substantial Completion, or 20 years and 3 months from the date of shipment from manufacturer's plant, whichever occurs first.

C. Installers "Weather-tight" Warranty: The Manufacturer Certified Installer shall provide a "leak-free" roofing warranty in which the installer agrees to repair leaks discovered in the roofing system under the terms outlined by the roofing manufacturer within the specified warranty period.

1. Warranty Period: Two (2) years from date Substantial Completion.

D. Weather-tight Warranty: Provide manufacturer's limited weathertightness warranty in which manufacturer agrees to repair or replace components of roofing system that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Twenty (20) years from date Substantial Completion, or 20 years and 3 months from the date of shipment from manufacturer's plant, whichever occurs first.

PART 2 - PRODUCTS

2.01 MANUFACTURER

A. Morin; a Kingspan Group Company; 685 Middle Street, Bristol, Connecticut 06010-8416; 1-800-640-9501 (Toll Free); (www.morincorp.us)

B. Basis of Design: SLR Double Lock Standing Seam Roof Panels

C. Substitutions Limitations:

1. Submit written request for approval of substitutions to the Architect [a minimum of [14] days prior to the date for receipt of bids. Include the following information:
   a) Name of materials and description of the proposed substitute.
   b) Drawings, cutsheets, performance and test data.
   c) List of projects (and addresses) similar is scope and photographs of existing installations
   d) Other information necessary for evaluation.

2. After evaluation by Architect, approval will be issued via addendum. No verbal approval will be given.

2.02 PERFORMANCE REQUIREMENTS

A. Structural Performance:

1. Wind assembly shall be tested for structural performance under uniform static air pressure differences in accordance with ASTM E1592.

B. Deflection Snow Loads: 32psf

C. Metal roof panels shall be capable of withstanding a 250 pound concentrated load applied to a 4 square inch area in the middle of the panel. No noticeable buckling or permanent distortion of the panel shall occur.

D. Water Penetration under Static Pressure: Provide metal roof panel systems designed to resist penetration of water under static pressure. Testing shall be based on ASTM E331. Roof panels when tested shall have no water leakage at 40.0 pounds per square foot.

E. Air nfiltration: Provide metal roof panel assemblies designed to resist air infiltration. Testing shall be done based on ASTM E283 and E1680. Roof panels when tested shall have a maximum air leakage of 0.153 cfm per square feet of fixed roof area at a minimum static air-pressure differential of 40.0 foot pounds per square foot.

F. Finish Characteristics:

1. Gloss: 15 +/- 5 tested in accordance with ASTM D523

2. Pencil Hardness: HB – H tested in accordance with ASTM D3363

3. Flexibility, T-Bend: 1-2T bend tested in accordance with ASTM D4145

4. Flexibility, Mandrel: No cracking tested in accordance with ASTM D522

5. Adhesion: No adhesion loss tested in accordance with ASTM D3359

6. Reverse Impact: No cracking or adhesion loss tested in accordance withASTM D2794

7. Abrasion Resistance: 65 +/- 10 liters tested in accordance with ASTM D968

8. Graffiti Resistance: Minimal effect

9. Acid Pollutant Resistance: No effect tested in accordance with ASTM D1308

10. Salt Fog Resistance: Passes 1000 hours tested in accordance with ASTM B117

11. Cyclic Salt Fog and UV Exposure: Passes 2016 hours tested in accordance with ASTM D5894

12. Humidity Resistance: Passes 1500 hours when tested in accordance with ASTM D2247 and D714

13. Color Retention: Passes 5000 hours when tested in accordance with ASTM G153 and G154

14. Chalk Resistance: Maximum chalk is a rating of 8 when tested in accordance with ASTM D4214, Method A

15. Color Tolerances: Greater than 5KE units on panels when tested in accordance with ASTM D2244.

2.03 ROOF PANEL MATERIALS

A. Steel:

1. Aluminum Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A792, Class AZ50 coating designation, Grade 40.

2. Gauge: 22 gauge, UON. 20 gauge at Covered Conex storage

2.04 ROOF PANELS

A. Roof Panel Description

1. Panel Width: 18 inches

2. Profile: SLR

3. Height: 2 inches

4. Texture: Smooth

5. Color: Pewter – Metallic #439ZZ099 (as manufactured by Kingspan)

B. Location for Buildings on Site:

1. Main building:

a) outdoor covered storage at west elevation

b) garage door canopies

c) entry canopies

d) patio shed

2. Wash/De-mudding building

3. Sand Barn

4. Water station

5. Generator enclosure

6. Covered Conex storage

2.04 ACCESSORIES

A. Panel accessories: Provide accessories as required for a complete installation. Accessories shall be as indicated on approved shop drawings and per manufacturer's approved standard details. Match material and finish of metal wall panels.

1. Fasteners: Fasteners as recommended by manufacturer.

2. Concealed Anchor Clips: One piece fixed clip

3. Backing plates: Provide metal backing plates at panel end splices fabricated from material recommended by manufacturer.

4. Closure Strips:

a) Closed Cell Closure Strips: Provide minimum 1 inch thick matching metal wall panel profile.

b) Metal Profile Closure Strips: Shall be fabricated from same gauge, material and finish as metal panel.

B. Flashing and Trim:

1. Fabricate trim from same material and material thickness as wall panels. Finish to match metal roof panels.

2. Locations include but are not limited to the following: Drips, eave and rake edges, roof penetrations, hips, and valleys.

C. Panel Sealant:

1. Joint Sealant: ASTM C920 as recommended in writing by metal wall panel manufacturer.

2. Butyl Tape: Per panel manufacturer's recommendations for panel to panel and panel to trim seal.

3. Butyl Sealants: Non-skinning type per panels manufacturer's recommendations

2.05 FABRICATION

A. Metal roof panels shall be formed to lap with edges of adjacent panels which are then mechanically attached to roof deck using fasteners and concealed anchor clips. Anchor clips are then machine seamed into standing seam.

B. Fabricate metal roof panels with joints between panels designed to form weathertight seals.Panels shall be factory formed. Field formed panels are not acceptable.

C. Trim Accessories: Fabricate steel trim accessories to comply with recommendations outlined in SMACNA's "Architectural Sheet Metal Manual".

2.08 FINISHES

A. Steel:

1. Finish and Color:

a) Metal Soffit Color: Kingspan, Pewter – Metallic #439ZZ099 (match roof color)

1. Finish System: 1.0 mil. Fluropolymer (PVDF) Two Coat system: 0.2 mil primer with 0.8 mil Kynar 500 (70 percent) SOLID color coat.

PART 3 – EXECUTION

3.01 EXAMINATION

A Provide field measurements to manufacturer as required to achieve proper fit of the preformed wall panel envelope. Measurements shall be provided in a timely manner so that there is no impact to construction or manufacturing schedule.

B Supporting Steel: All structural supports required for installation of panels shall be by others. Support members shall be installed within the following tolerances:

1. Plus or minus 1/8 inch in 5 feet in any direction along plane of framing.

2. Plus or minus 1/4 inch cumulative in 20 feet in any direction along plane of framing.

3. Plus or minus 1/2 inch from framing plane on any elevation.

C Examine individual panels upon removing from the bundle; notify manufacturer of panel defects. Do not install defective panels.

3.02 PANEL INSTALLATION

A Installation shall be in accordance with manufacturer’s installation guidelines and recommendations.

B Install panels plumb, level, and true-to-line to dimensions and layout indicated on approved shop drawings.

C Installation shall be in accordance with manufacturer’s installation guidelines and recommendations. Roof panels shall be installed weathertight, without distortion, buckles or waves.

D Seaming of panels shall be done using an electric powered seaming machine as recommended by manufacturer.

E Cutting and fitting of panels shall be neat, square and true. Torch cutting is prohibited.

3.03 FLASHING AND TRIM INSTALLATION

A Place trim and trim fasteners only as indicated per details on the approved shop drawings.

B Apply sealant at trim, per manufacturer's details and approved shop drawings,

3.07 CLEANING AND PROTECTION

A Remove protective film immediately after installation.

B Touch-up, repair or replace metal panels and trim that have been damaged.

C After metal roof panel installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.

END OF SECTION

SECTION 07 42 12 – NON-INSULATED METAL WALL & SOFFIT PANELS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

A This Section includes the following:

1. Exposed fastener, field assembled, metal wall panel.

2. Conceal fastener, field assembled, metal soffit panel.

3. Accessories including fasteners, perimeter trim and penetration treatment

B Related Sections include the following:
1. Division 7 Section "Sheet Metal Flashing and Trim" for fascia, copings, flashings and other sheet metal work not part of metal wall panel assemblies.

1.03 REFERENCES

A ASTM International
1. ASTM A240; Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for GeneralApplications.
2. ASTM A641; Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire.
3. ASTM A666; Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
4. ASTM A792 – Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.
5. ASTM B117; Standard Practice for Operating Salt Spray(Fog) Apparatus.
6. ASTM B209; Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
7. ASTM B370; Standard Specification for Copper Sheet and Strip for Building Construction.
8. ASTM C612; Standard Specification for Mineral Fiber Block and Board Thermal Insulation.
9. ASTM C645 – Standard Test Method for Nonstructural Steel Framing Members.
10. ASTM C920 – Standard Specification for Elastomeric Joint Sealants.
11. ASTM C1311; Standard Specification for Solvent Release Sealants.
12. 12. ASTM D522; Standard Test Methods for Mandrel Bend Test of Attached Organic Coatings.
13. D523; Standard Test Method for Specular Gloss.
14. ASTM D714; Standard Test Method for Evaluationg Degree of Blistering of Paints.
15. ASTM D968; Standard Test Methods for Abrasion Resistance of Organic Coatings by Falling Abrasive.
16. ASTM D1308; Standard Test Method for Effect of Household Chemicals on Clear and Pigmented Organic Finishes.
17. ASTM D2244; Standard practice for Calculation of Color Tolerances and Color Differences from Instrumentally Measured Color Coordinates
18. ASTM D2247; Standard Practice for Testing Water Resistnace of Coatings in 100% Relative Humidity.
19. ASTM D2794; Standard Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact).

20. ASTM D3359; Standard Test Methods for Measuring Adhesion by Tape Test.
21. ASTM D3363; Standard Test Method for Film Hardness by Pencil Test.
22. ASTM D4145; Standard Test Method for Coating Flexibility of Prepainted Sheet.
23. ASTM D4214; Standard Test Methods for Evaluating the Degree of Chalking of Exterior Paint Films
24. ASTM D5894; Standard Practice for Cyclic Salt Fog/UV Exposure of Painted Metal, (Alternating Exposures in a Fog/Dry Cabinet and a UV/Condensation Cabinet)
25. ASTM E283; Standard Test Method for determining Rate of Air Leakage Through Exterior Windows, Curtain Walls and Doors under Specified Pressure Differences across the Specimen.
26. ASTM E330; Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.
27. ASTM E331; Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference.
28. ASTM E1680; Standard Test Method for Rate of Air Leakage through Exterior Metal Roof Panel Systems.
29. ASTM G153; Standard Practice for Operating Enclosed Carbon Arc Light Apparatus for Exposure of Nonmetallic Materials.
30. ASTM G154; Standard Practice for Operating Fluorescent Light Apparatus for UV Exposure of Nonmetallic Materials.

1.04 ADMINISTRATIVE REQUIREMENTS

A Pre-installation meeting: Conduct a pre-installation meeting at the job site attended by Owner, Architect, Manufacturer's Technical Representative, Panel Installer, and Contractors of related trades. Coordinate structural support requirements in relation to insulated wall panel system, installation of any separate air/water barriers, treatment of fenestration, and other requirements specific to the project.

1.05 SUBMITTALS

A Product Data: Submit manufacturer current technical literature for each type of product.

B Delegated Design: Design metal wall panel assembly, submit comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

C Shop Drawings – Submit detailed drawings showing:

1. Profile
2. Gauge of panel
3. Location layout and dimensions of panels
4. Location and type of fasteners
5. Shape and method of attachment of all trim
6. Locations and type of sealants
7. Installation sequence.
8. Other details as may be required for a weathertight installation

D Samples: Provide nominal 3 x 5 inch of each color indicated. Provide panel width by 10 inches long minimum

1.06 QUALITY ASSURANCE

A Manufacturer Qualifications:

1. Manufacturer shall have a minimum of five (5) years experience in the production of insulated wall panels. Manufacturer shall demonstrate past experience with examples of projects of similar type and exposure.

B Installer Qualifications:

1. Installer shall be Authorized by the manufacturer and the work shall be supervised by a person having a minimum of five (5) years' experience installing insulated wall panels on similar type and size projects.

2. Installation shall be in accordance with manufacturer's installation guidelines and recommendations.

C Design Data, Test Reports: Provide manufacturer test reports indicating product compliance with requirements. Manufacturer Erection Instructions: Provide manufacturer's written installation instructions including proper material storage, material handling, installation sequence, panel location(s), and attachment methods, details and required trim and accessories.

D Source Limitations: Obtain each type of metal wall panel through one source from a single manufacturer.

E Product Options: Drawings indicate size, profiles, and dimensional requirements of metal wall panels and are based on the specific system indicated.

1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.

1.07 DELIVERY, STORAGE, AND HANDLING

A Deliver panel materials and components in manufacturer's original, unopened, undamaged packaging with identification labels intact.

B Store wall panel materials on dry, level, firm, and clean surface. Stack no more than two bundles high. Elevate one end of bundle to allow moisture run-off, cover and ventilate to allow air to circulate and moisture to escape.

C Deliver components, sheets, metal wall panels, and other manufactured items so as not to be damaged or deformed. Package metal wall panels for protection during transportation and handling.

D Unload, store, and erect metal wall panels in a manner to prevent bending, warping, twisting, and surface damage.

E Stack metal wall panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal wall panels to ensure dryness, with positive slope for drainage of water. Do not store metal wall panels in contact with other materials that might cause staining, denting, or other surface damage.

F Protect strippable protective covering on metal wall panels from exposure to sunlight and high humidity, except to extent necessary for period of metal wall panel installation.

1.08 WARRANTY

A. Material Warranty: Standard form in which manufacturer agrees to repair or replace items that fail in materials or workmanship within specified warranty period. The items covered by the warranty include structural performance and finish performance.

a) Warranty Period: Two (2) years from date of Substantial Completion

B. Finish Warranty: Standard form in which manufacturer agrees to repair or replace metal panels that evidence deterioration of fluoropolymer finish, including flaking or peeling from approved primed metal substrate, chalk in excess of 8 when tested in accordance with ASTM D4214, Method A, and /or color fading in excess of 5 KE Hunter units on panels when tested in accordance with ASTM D2244.

a. Warranty Period: Twenty (20) years from date Substantial Completion, or 20 years and 3 months from the date of shipment from manufacturer's plant, whichever occurs first.

PART 2 - PRODUCTS

2.01 MANUFACTURER

A. Morin; a Kingspan Group Company; 685 Middle Street, Bristol, Connecticut 06010-8416; 1-800-640-9501 (Toll Free); (www.morincorp.us)

B. Basis of Design: Exposed Fastener Wall Panels

C. Substitutions Limitations:

1. Submit written request for approval of substitutions to the Architect [a minimum of [14] days prior to the date for receipt of bids. Include the following information:
   a) Name of materials and description of the proposed substitute.
   b) Drawings, cutsheets, performance and test data.
   c) List of projects (and addresses) similar is scope and photographs of existing installations
   d) Other information necessary for evaluation.

2. After evaluation by Architect, approval will be issued via addendum. No verbal approval will be given.

2.02 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide metal wall panel systems designed to resist the following. Testing shall be done based on ASTM E330:

1. Wind Loads: In accordance with 2016 CBC and ASCE 7-10 Chapter 30 as follows:
   a) Ultimate design wind speed – 110 mph (Risk Category II).
   b) Exposure: C
   c) Kzt = 1.0

2. Deflection Limits: Metal wall panel assemblies shall withstand horizontal deflections no greater than L/180 of the span.

B. Large Missile Impact with Cyclic Pressure: Panels shall successfully pass test standards TAS 201/203 Large Missile Impact with Cyclic inward and outward pressures to demonstrate suitability for High Velocity Hurricane Zone applications with windborne debris.

C. Impact and non-impact testing using uniform static air pressure: Panels shall successfully pass test standard TAS 202 for Testing Impact and Non-Impact Resistant Building Envelope Components using Uniform Static Air Pressure to demonstrate suitability for High Velocity Hurricane Zone applications with windborne debris.

D. Water Penetration under Static Pressure: Provide metal wall panel systems designed to resist penetration of water under static pressure. Testing shall be based on ASTM E331. Wall panels when tested shall have no water leakage at 6 pounds per square foot.

E. Air Infiltration: Provide metal wall panel assemblies designed to resist air infiltration. Testing shall be done based on ASTM E283. Wall panels when tested shall have a maximum air leakage of 0.01 cfm per square feet of fixed wall area at a minimum static air-pressure differential of 1.57 foot pounds per square foot.

F. Finish Characteristics:

1. Gloss: 15 +/- 5 tested in accordance with ASTM D523
2. Pencil Hardness: HB – H tested in accordance with ASTM D3363
3. Flexibility, T-Bend: 1-2T bend tested in accordance with ASTM D4145
4. Flexibility, Mandrel: No cracking tested in accordance with ASTM D522
5. Adhesion: No adhesion loss tested in accordance with ASTM D3359
6. Reverse Impact: No cracking or adhesion loss tested in accordance withASTM D2794
7. Abrasion Resistance: 65 +/- 10 liters tested in accordance with ASTM D968
8. Graffiti Resistance: Minimal effect
9. Acid Pollutant Resistance: No effect tested in accordance with ASTM D1308
10. Salt Fog Resistance: Passes 1000 hours tested in accordance with ASTM B117
11. Cyclic Salt Fog and UV Exposure: Passes 2016 hours tested in accordance with ASTM D5894
12. Humidity Resistance: Passes 1500 hours when tested in accordance with ASTM D2247 and D714
13. Color Retention: Passes 5000 hours when tested in accordance with ASTM G153 and G154
14. Chalk Resistance: Maximum chalk is a rating of 8 when tested in accordance with ASTM D4214, Method A

15. Color Tolerances: Greater than 5KE units on panels when tested in accordance with ASTM D2244.

2.03 WALL PANEL MATERIALS

A. Steel:

1. Aluminum Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A792, Class AZ50 coating designation, Grade 40.

2. Gauge: 22 gauge

2.04 WALL PANELS

A. Wall Panel Description

1. Panel Width: 36 inches

2. Profile: E-36

3. Thickness: 1 inch

4. Orientation: Horizontal

5. Texture: Smooth

6. Sub girt: Panels shall be orientated horizontal over 7/8” (max) sub girt. Sub girt spacing as required by manufacturer.

7. Location: Wash/De-mudding building, Sand Barn, Water station

2.04 SOFFIT PANELS

A. Wall Panel Description

1. Panel Width: 12 inches

2. Profile: F-12-0 (Flat, zero ribs)

3. Thickness: 1 1/2 inch

4. Panel Joint: Tongue and groove interlock joint

5. Texture: Smooth

6. Location: Main building roof overhang, Water station ceiling

2.05 ACCESSORIES

A. Panel accessories: Provide accessories as required for a complete installation. Accessories shall be as indicated on approved shop drawings and per manufacturer’s approved standard details. Match material and finish of metal wall panels.

1. Fasteners: Fasteners with neoprene washers as recommended by manufacturer. Fastener head shall match exposed panel color.

2. Closure Strips:

   a) Closed Cell Closure Strips: Provide minimum 1 inch thick matching metal wall panel profile.

   b) Metal Profile Closure Strips: Shall be fabricated from same gauge, material and finish as metal panel.

B. Trim:

1. Fabricate trim from same material and material thickness as wall panels. Finish to match metal wall panels.

2. Locations include but are not limited to the following: Drips, sills, jambs, corners, framed openings, parapet caps, reveals, fillers, wall mounted equipment (e.g light fixtures, cameras, hose bibs, drain pipes, etc), wall penetrations.

C. Panel Sealant:

1. Joint Sealant: ASTM C920 as recommended in writing by metal wall panel manufacturer.

2. Butyl-Rubber-Based, Solvent-Release Sealant: ASTM C1311.

2.06 FABRICATION

A. Metal soffit panels shall be formed to lap and interconnect with edges of adjacent panels which are then mechanically attached through panel to supports using concealed fasteners.

B. Metal wall panels shall be formed to lap with edges of adjacent panels which are then mechanically attached through panel to supports using fasteners with a neoprene washer. Fastener head shall match wall panel finish.

C. Fabricate metal wall panels to eliminate condensation on interior side of panel and with joints between panels designed to form weathertight seals.

D. Panels shall be factory formed. Field formed panels are not acceptable.

E. Trim Accessories: Fabricate steel trim accessories to comply with recommendations outlined in SMACNA's "Architectural Sheet Metal Manual".

F. Mitered Corners: Structurally bonded horizontal outside or inside trimless corners matching metal wall panel material, profile and factory applied finish shall be fabricated by metal wall panel manufacturer.

1. Welded, riveted or field fabricated corners are not acceptable and will be rejected.

2. Basis of Design: Morin Miterseam Corners (12” x 12”)

2.08 FINISHES

A. Steel:

1. Finish and Color:

    a) Metal Soffit Color: Kingspan, Pewter – Metallic #439ZZ099 (match roof color)

        1. Finish System: 1.0 mil. Fluropolymer (PVDF) Two Coat system: 0.2 mil primer with 0.8 mil Kynar 500 (70 percent) SOLID color coat.

    b) Metal Wall Color: Kingspan, Zinc Grey

        1. Finish System: 1.0 mil. Fluropolymer (PVDF) Two Coat system: 0.2 mil primer with 0.8 mil Kynar 500 (70 percent) SOLID color coat.

PART 3 – EXECUTION

3.01 EXAMINATION

A Provide field measurements to manufacturer as required to achieve proper fit of the preformed wall panel envelope. Measurements shall be provided in a timely manner so that there is no impact to construction or manufacturing schedule.

B Supporting Steel: All structural supports required for installation of panels shall be by others. Support members shall be installed within the following tolerances:

1. Plus or minus 1/8 inch in 5 feet in any direction along plane of framing.

2. Plus or minus 1/4 inch cumulative in 20 feet in any direction along plane of framing.

3. Plus or minus 1/2 inch from framing plane on any elevation.

4. Plumb or level within 1/8 inch at all changes of transverse for pre-formed corner panel applications.

5. Verify that bearing support has been provided behind vertical joints of horizontal panel systems and horizontal joints of vertical panel systems. Width of support shall be as recommended by manufacturer.

C Examine individual panels upon removing from the bundle; notify manufacturer of panel defects. Do not install defective panels.

3.02 PANEL INSTALLATION

A Installation shall be in accordance with manufacturer's installation guidelines and recommendations. Panels shall be orientated horizontal over 7/8" (max) sub girt. Sub girt spacing as required by manufacturer.

B Install panels plumb, level, and true-to-line to dimensions and layout indicated on approved shop drawings.

C Cut panels prior to installing, where indicated on shop drawings, using a power circular saw with fine tooth carbide tip blade per manufacturer's instructions. Personnel should wear respiratory and eye protection devices.

D Butyl Weather Barrier Sealant:

1. Apply non-skinning butyl sealant as shown on shop drawings and manufacturer's installation instructions as necessary to establish the vapor barrier for the panels.

2. Use non-skinning butyl tube sealant only for tight metal-to-metal contact.

3. Do not use non-skinning butyl tube sealant to bridge gaps.

E Place panel fasteners through pre-punched holes in attachment clips, concealed within the joint of the panel. Secure units to the structural supports. Space clips as recommended by manufacturer or otherwise indicated on the approved shop drawings.

3.03 TRIM INSTALLATION

A Place trim and trim fasteners only as indicated per details on the approved shop drawings.

B Field drill weep holes where appropriate in horizontal trim; minimum 1/4 inch diameter at 24 inches on center.

C Place a continuous strip of butyl tube sealant between the inside back face of closure trims and interior panel faces for proper vapor seal.

3.04 SEALANT INSTALLATION FOR EXPOSED JOINTS

A Clean and prime surfaces to receive exterior exposed sealants in accordance with sealant manufacturer's recommendations.

B Follow sealant manufacturer's recommendations for joint width-to-depth ratio, application temperature range, size and type of backer rod, and compatibility of materials for adhesion.

C Direct contact between butyl and silicone sealants shall not be permitted.

3.05 TRIM INSTALLATION

A Place trim and trim fasteners only as indicated per details on the approved shop drawings.

B Field drill weep holes where appropriate in horizontal trim where indicated on shop drawings.

C Place a continuous strip of butyl tape or butyl sealant on closure trims for the length of the panel to be covered as indicated on shop drawings.

3.06 FIELD QUALITY CONTROL

A Testing Agency: General Contractor shall engage an independent testing and inspection agency acceptable to the architect to perform field tests and inspections and to prepare reports of findings.

B Field Water Test: After completing portion of metal wall panel assembly including accessories and trim, test a 2-bay area selected by the architect for water penetration in accordance with AAMA 501.2.

3.07 CLEANING AND PROTECTION

A Remove protective film immediately after installation.

B Touch-up, repair or replace metal panels and trim that have been damaged.

C After metal wall panel installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.

END OF SECTION

SECTION 07 42 12 – INSULATED METAL WALL PANELS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A Steel faced, polyurethane (polyisocyanurate) metal wall panels.

B Accessories including fasteners and perimeter trim.

1.02 SUMMARY

A This Section includes the following:
1. Steel faced factory insulated wall panels for the Main Building
2. Accessories including fasteners, perimeter trim and penetration treatments

1.03 REFERENCES

A American Architectural Manufacturers Association (AAMA)

1. AAMA 501.1: Standard Test Method for Metal Curtain Walls for water penetration using Dynamic Pressure.

2. AAMA 501.2: Quality Assurance and Diagnostic Water Leakage Field Check of Installed Storefronts, Curtain Walls and Sloped Glazing Systems.

B American Society of Civil Engineers (ASCE)

1. ASCE 7: Minimum Design Loads for Buildings and Other Structures.

C ASTM International:

1. ASTM A480: Standard Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet and Strip.

2. ASTM A653: Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process

3. ASTM A755: Standard Specification for Steel Sheet, Metallic Coated by the Hot-Dip Process and Prepainted by the Coil-Coating Process for Exterior Exposed Building Products

4. ASTM A792: Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot–Dip Process

5. ASTM A924: Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process

6. ASTM B117: Standard Practice for Operating Salt Spray (Fog) Apparatus

7. ASTM B209: Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate

8. ASTM C209: Standard Test Methods for Cellulosic Fiber Insulating Board

9. ASTM C273: Standard Test Method for Shear Properties of Sandwich Core Materials.

10. ASTM C518: Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus

11. ASTM C920: Standard Specification for Elastomeric Joint Sealants

12. ASTM D224; Standard Specification for Smooth-Surfaced Asphalt Roll

13. ASTM D522: Standard Test Methods for Mandrel Bend Test of Attached Organic Coatings

14. ASTM D523: Standard Test Method for Specular Gloss

15. ASTM D714: Standard Test Method for Evaluating Degree of Blistering of Paints

16. ASTM D968: Standard Test Methods for Abrasion Resistance of Organic Coatings by Falling Abrasive

17. ASTM D1308: Standard Test Method for Effect of Household Chemicals on Clear and Pigmented Organic Finishes

18. ASTM D1621: Standard Test Method for Compressive Properties of Rigid Cellular Plastics

19. ASTM D1622: Standard Test Method for Apparent Density of Rigid Cellular Plastics

20. ASTM D1623: Standard Test Method for Tensile and Tensile Adhesion Properties of Rigid Cellular Plastics

21. ASTM D1654: Standard Test Method for Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments.

22. ASTM D1929: Standard Test Method for Determining Ignition Temperature of Plastics

23. ASTM D2126: Standard Test Method for Response of Rigid Cellular Plastics to Thermal and Humid Aging.

24. ASTM D2244: Standard practice for Calculation of Color Tolerances and Color Differences from Instrumentally Measured Color Coordinates

25. ASTM D2247: Standard Practice for Testing Water Resistance of Coatings in 100 percent Relative Humidity

26. ASTM D2794: Standard Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact)

27. ASTM D3273: Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber.

28. ASTM D3359: Standard Test Methods for Measuring Adhesion by Tape Test

29. ASTM D3363: Standard Test Method for Film Hardness by Pencil Test

30. ASTM D4145: Standard Test Method for Coating Flexibility of Prepainted Sheet

31. ASTM D4214: Standard Test Methods for Evaluating the Degree of Chalking of Exterior Paint Films

32. ASTM D5894: Standard Practice for Cyclic Salt Fog/UV Exposure of Painted Metal, (Alternating Exposures in a Fog/Dry Cabinet and a UV Condensation Cabinet)

33. ASTM D6226: Standard Test Method for Open Cell Content of Rigid Cellular Plastics.

34. ASTM E72: Standard Test Methods of Conducting Strength Tests of Panels for Building Construction

35. ASTM E84: Standard Test Method for Surface Burning Characteristics of Building Materials

36. ASTM E90: Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements

37. ASTM E283: Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen

38. ASTM E330: Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference

39. ASTM E331: Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference

40. ASTM G153: Standard Practice for Operating Enclosed Carbon Arc Light Apparatus for Exposure of Nonmetallic Materials

41. ASTM G154: Standard Practice for Operating Fluorescent Light Apparatus for UV Exposure of Nonmetallic Materials

D FM Global (FM)

1. Approval Standard 4880; Class 1 Fire Rating of Insulated Wall or Wall and Roof/Ceiling Panels, Interior Finish Materials or Coatings, and Exterior Wall Systems.

2. Approval Standard 4881; Class 1 Exterior Wall Systems.

E California Building Code: Current edition

F National Fire Protection Agency (NFPA)

1. NFPA 259: Standard Test Method for Potential Heat of Building Materials.

2. NFPA 268: Standard Test Method for Determining Ignitibility of Exterior Wall Assemblies Using a Radiant Heat Energy Source.

3. NFPA 285: Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components.

G International Organization for Standardization (ISO)

1. ISO 14025: Environmental Labels and Declarations

1.04 ADMINISTRATIVE REQUIREMENTS

A Pre-installation meeting: Conduct a pre-installation meeting at the job site attended by Owner, Architect, Manufacturer's Technical Representative, Panel Installer, and Contractors of related trades. Coordinate structural support requirements in relation to insulated wall panel system, installation of any separate air/water barriers, treatment of fenestration, and other requirements specific to the project.

1.05 SUBMITTALS

A Product Data: Submit manufacturer current technical literature for each type of product.

B Shop Drawings: Submit detailed drawings and panel analysis showing:

1. Profile
2. Gauge of both exterior and interior sheet
3. Location, layout and dimensions of panels of roof structure
4. Location and type of fasteners
5. Shape and method of attachment of all trim
6. Locations and type of sealants
7. Installation sequence
8. Coordination drawings: Provide elevation drawings and building sections which show panels in relationship to required locations for structural support. Include panel details and details showing attachment to structural support.
9. Other details as may be required for a weathertight installation

C Panel Analysis: Provide panel calculations to verify panels will withstand the design wind loads indicated without detrimental effects or deflection exceeding L/180. Include effects of thermal differential between the exterior and interior panel facings and resistance to fastener pullout.

D Samples: Each color indicated. 6"x6" minimum

E Miscellaneous Certifications:

1. Submit documentation that products have been certified in accordance with ISO 14025.

F Quality Assurance Submittals:

1. Design Data, Test Reports: Provide manufacturer test reports indicating product compliance with requirements.

2. Manufacturer Erection Instructions: Provide manufacturer's written installation instructions including proper material storage, material handling, installation sequence, panel location(s), and attachment methods, details and required trim and accessories.

1.06 QUALITY ASSURANCE

A Manufacturer Qualifications:

1. Manufacturer shall have a minimum of five (5) years experience in the production of insulated wall panels. Manufacturer shall demonstrate past experience with examples of projects of similar type and exposure.
2. Manufacturer to be registered with a Program Operator with a Certified, Environmental Product Declaration, in conformance with ISO 14025, for Insulated Metal Panels.

B Installer Qualifications:

1. Installer shall be Authorized by the manufacturer and the work shall be supervised by a person having a minimum of five (5) years' experience installing insulated wall panels on similar type and size projects.

2. Installation shall be in accordance with manufacturer's installation guidelines and recommendations.

1.07 DELIVERY, STORAGE, AND HANDLING

A Deliver panel materials and components in manufacturer's original, unopened, undamaged packaging with identification labels intact.

B Store wall panel materials on dry, level, firm, and clean surface. Stack no more than two bundles high. Elevate one end of bundle to allow moisture run-off, cover and ventilate to allow air to circulate and moisture to escape.

1.08 WARRANTY

A Limited Warranty: Standard form in which manufacturer agrees to repair or replace items that fail in materials or workmanship within specified warranty period. The items covered by the warranty include structural performance including bond integrity, deflection and buckling.

1. Warranty Period: Two (2) years from date of Substantial Completion, or 2 years and 6 months from the date of shipment from manufacturer's plant, whichever occurs first.

B Finish Warranty: Standard form in which manufacturer agrees to repair or replace metal panels that evidence deterioration of fluoropolymer finish, including flaking or peeling from approved primed metal substrate, chalk in excess of 8 when tested in accordance with ASTM D4214, Method A, and /or color fading in excess of 5 ΔE Hunter units on panels when tested in accordance with ASTM D2244.

1. Warranty Period: Twenty (20) years from date of Substantial Completion, or 20 years and 3 months from the date of shipment from manufacturer's plant, whichever occurs first.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A Kingspan Insulated Panels; 726 Summerhill Drive, Deland, FL 32724; 386-626-6789; or 2000 Morgan Road, Modesto, CA 95358; 209-531-9091; (www.kingspanpanels.us)

B Basis of Design: Kingspan KS Series

C Substitutions Limitations:

1. Submit written request for approval of substitutions to the Architect [a minimum of [14] days prior to the date for receipt of bids. Include the following information:
   a) Name of materials and description of the proposed substitute.
   b) Drawings, cutsheets, performance and test data.
   c) List of projects (and addresses) similar is scope and photographs of existing installations
   d) Other information necessary for evaluation.

2. After evaluation by Architect, approval will be issued via addendum. No verbal approval will be given.

2.02 EXTERIOR WALL PANELS

A. Performance Criteria:

1. Structural Test: Structural performance shall be verifiable by witnessed structural testing for simulated wind loads in accordance with ASTM E72 and E330. Deflection criteria shall be L/180

2. Fatigue Test: There shall be no evidence of metal/insulation interface delamination when the panel is tested by simulated wind loads (positive and negative loads), when applied for two million alternate cycles of L/180 deflection.

3. Freeze/heat Cycling Test: Panels shall exhibit no delamination, surface blisters, permanent bowing or deformation when subjected to cyclic temperature extremes of minus 36 deg. F to plus 180 deg. F temperatures for twenty one, eight-hour cycles.

4. Water Penetration: There shall be no uncontrolled water penetration through the panel joints at a pressure differential of 20 psf, when tested in accordance with ASTM E331.

5. Dynamic Water Penetration: There shall be no uncontrolled water penetration through the panel assembly at a pressure difference of 12 psf, when tested in accordance with AAMA 501.1.

6. Air Infiltration: Air infiltration through the panel shall not exceed 0.001 cfm/sf at 20 psf air pressure differential when tested in accordance with ASTM E283.

7. Humidity Test: Panels shall exhibit no delamination or metal interface corrosion when subjected to plus 140 deg. F temperature and 100 percent relative humidity for a total of 1500 hours (62 days).

8. Autoclave Test: Panels shall exhibit no delamination or shrinkage/melting of the foam core from the metal skins after being subjected in an autoclave to a pressure of 2psig (13.8kPa) at a temperature of plus 218 deg. F (plus 103 deg. C) for a period of 2 1/2 hours.

9. Seismic Performance: Comply with ASCE 7, Section 13, “Seismic Design Requirements for Non-Structural Components”. Panels shall be hard-fastened to structure along one edge only such that lateral slippage between panels can occur in the event of seismic activity.

10. Panel Fire Tests:

a. Fire Endurance Test – 10 minutes: Panels remained in place without joint stitch fastening per CAN/ULC-S101.

b. Fire Endurance Test – 15 minutes: Panels remained in place with joint stitch fastening per CAN/ULC-S101.

11. Flame Spread and Smoke Developed Tests on exposed Insulating Core:

a. Flame Spread: 25 or less

b. Smoke Developed: 250 or less

c. Tests performed in accordance with CAN/ULC-S102 and ASTM E84

12. Fire Test Response Characteristics: Steel-faced panels with polyisocyanurate (ISO) core shall fully comply with Chapter 26 of International Building Code regarding the use of Foam Plastic.

    a. FM 4880: Class I rated per FM Global, panels are approved for use without a thermal barrier and do not create a requirement for automatic sprinkler protection.
    b. NFPA 259 Potential Heat Content; established for foam core.
    c. NFPA 268 Ignitability of Exterior Wall Assemblies Using a Radiant Heat Source; successfully passed acceptance criteria.
    d. NFPA 285 Intermediate Scale Multi-story Fire Evaluation; successfully passed acceptance criteria.
    e. UL 263 Fire Resistive Rating; classified as a component of a fire-rated wall assembly for 1-hour and 2-hour rating Design No. U053 (rated assemblies include appropriate layers of fire-rated Type X Gypsum board).
    f. ASTM D1929 Minimum Flash and Self Ignition; established for foam core.
    g. S101, S102, S127, S134 UL Canada fire test standards; successfully passed.

13. Windborne Debris rating for Wall Panel:

    a. Meet requirements for high velocity hurricane zone with large missile impact when tested in accordance with FM Standard 4881.

14. Insulating Core: Polyisocyanurate (ISO) core, ASTM C591 Type IV, CFC and HCFC free, compliant with Montreal Protocol and Clean Air Act, with the following minimum physical properties:

    a. Core is 95 percent closed cell when tested in accordance with ASTM D6226

    b. Panel shall provide a nominal R-value of 7.2 [hr·ft2·°F/Btu] per inch thickness when tested in accordance with ASTM C 518 at 75°F mean temperature and 8.0 [hr·ft2·°F/Btu] per inch thickness when tested in accordance with ASTM C 518 at 35°F mean temperature.

    c. Foam has a density of 2.2 to 2.8 pounds per cubic foot when tested in accordance with ASTM D1622

    d. Compressive Stress: Panels shall have a compressive stress of 19 psi. when tested according to ASTM D1621

    e. Shear Stress: 25 psi when tested in accordance with ASTM C273

    f. Tensile Stress: 23 psi when tested in accordance with ASTM D1623

    g. Oven Aging at 212 degress F:

        1. 1 day: plus 1 percent volume change

        2. 7 days: plus 3 percent volume change

        3. Tested according to ASTM D2126

h. Low Temperature Aging at minus 40 degress F:

1. 1 day: plus 1 percent volume change

2. 7 days: plus 3 percent volume change

3. Testing according to ASTM D2126

B. Paint Finish Characteristics:

1. Gloss: 15 ± 5 measured at 60 degree angle tested in accordance with ASTM D523.

2. Pencil Hardness: HB-H minimum tested in accordance with ASTM D3363.

3. Flexibility, T-Bend: 1-2T bend with no adhesion loss when tested in accordance with ASTM D4145.

4. Flexibility, Mandrel: No cracking when bent 180° around a 1/8 mandrel as tested in accordance with ASTM D522.

5. Adhesion: No adhesion loss tested in accordance with ASTM D3359.

6. Reverse Impact: No cracking or adhesion loss when impacted 3000 by inches of metal thickness (lb-in), tested in accordance with ASTM D2794.

7. Abrasion Resistance: Nominal 65 liters of falling sand to expose 5/32 inch diameter of metal substrate when tested in accordance with ASTM D968.

8. Graffiti Resistance: Minimal effect.

9. Acid Pollutant Resistance: No effect when subjected to 30 percent sulfuric acid for 18 hours, or 10 percent muriatic acid for 15 minutes when tested in accordance with ASTM D1308.

10. Salt Fog Resistance: Passes 1000 hours, when tested in accordance with ASTM B117 (5 percent salt fog at 95 deg. F).

11. Cyclic Salt Fog and UV Exposure: Passes 2016 hours when tested in accordance with ASTM D5894.

12. Humidity Resistance: Passes 1500 hours at 100 percent relative humidity and 95 deg. F, with a test rating of 10 when tested in accordance with ASTM D2247, and D714.

13. Color Retention: Passes 5000 hours when tested in accordance with ASTM G153 and G154.

14. Chalk Resistance: Maximum chalk is a rating of 8 when tested in accordance with ASTM D4214, Method A.

15. Color Tolerances: Maximum of 5ΔE Hunter units on panels when tested in accordance with ASTM D2244.

C. Exterior Aggregate Finish Characteristics:

1. Moisture Resistance: 14 days exposure with no deleterious effects when tested in accordance with ASTM D2247.

2. Salt Spray: 1000 hours, no deleterious effects when tested in accordance with ASTM B117.

3. Abrasion Resistance: 500 liters of sand, no deleterious effects when tested in accordance with ASTM D968.

4. Freeze/Thaw (60 cycles): No checking, cracking or splitting.

5. Mildew Resistance: No growth of mildew per ASTM D3273.

6. Flame Spread: less than 25, Class 1 rating when tested in accordance with ASTM E84.

D. Panel Assembly:

1. Panel thickness: 3 inches thick.

2. Panel width: 42 inches

3. Panel Lengths: Minimum 8 feet, maximum 52 feet

4. Panel Attachment: Shall consist of fasteners and stainless steel attachment clip completely concealed within the panel side joint.

5. Horizontal Panel Joint Reveals: 1/8 inch

6. Vertical Panel Joint Reveals: 1/8 inch.

7. Exterior Face of Panel:

   a. Material:

      1. Steel coil material shall be in accordance with ASTM A755: [AZ50 Galvalume®/ Zincalume® (55 percent aluminum, 45 percent zinc) in accordance with ASTM A792]

      2. Gauge: 22 gauge

   b. Profile: Micro-Rib

   c. Texture: Smooth

   d. Exterior Paint Finish Color:

      1. Color: Tahoe Blue

      2. Finish System:

         a. 1.0 mil. Fluropolymer (PVDF) Two Coat system: 0.2 mil primer with 0.8 mil Kynar 500 (70 percent) SOLID color coat.]

8. Interior Face of Panel:

a. Material: AZ50/Galvalume/Zincalume per ASTM A792

b. Profile: Shadowline

1. Profile description: Linear striations nominal 0.0625 inch deep by 3/4 inches wide at 3 inches on center.

c. Texture: Non-directional stucco embossed

d. Gauge: 22 gauge

e. Interior Finish: modified polyester, dry film thickness of 1.0 mil including primer

1. Color: Regal White

2.03 ACCESSORIES

A Fasteners:

1. Self drilling fasteners shall be corrosion resistant plated steel with neoprene washer, as recommended by manufacturer.

2. Material: Hex-head type with steel and neoprene washer and 12 gauge stainless steel clip supplied by the manufacturer.

3. Size: As recommended by manufacturer.

B Perimeter Trim:

1. Fabricated perimeter trim and metal flashing: Shall be same gauge, material and coating color as exterior face of insulated metal wall panel.

2. Extruded perimeter trim: Shall be extruded aluminum 6063-T5 alloy with spray applied PVF coating in same color as exterior face of insulated metal wall panel.

PART 3 - EXECUTION

3.01 EXAMINATION

A Provide field measurements to manufacturer as required to achieve proper fit of the preformed wall panel envelope. Measurements shall be provided in a timely manner so that there is no impact to construction or manufacturing schedule.

B Supporting Steel: All structural supports required for installation of panels shall be by others. Support members shall be installed within the following tolerances:

1. Plus or minus 1/8 inch in 5 feet in any direction along plane of framing.

2. Plus or minus 1/4 inch cumulative in 20 feet in any direction along plane of framing.

3. Plus or minus 1/2 inch from framing plane on any elevation.

4. Plumb or level within 1/8 inch at all changes of transverse for pre-formed corner panel applications.

5. Verify that bearing support has been provided behind vertical joints of horizontal panel systems and horizontal joints of vertical panel systems. Width of support shall be as recommended by manufacturer.

C Examine individual panels upon removing from the bundle; notify manufacturer of panel defects. Do not install defective panels.

3.02 PANEL INSTALLATION

A Installation shall be in accordance with manufacturer's installation guidelines and recommendations.

B Install panels plumb, level, and true-to-line to dimensions and layout indicated on approved shop drawings.

C Cut panels prior to installing, where indicated on shop drawings, using a power circular saw with fine tooth carbide tip blade per manufacturer's instructions. Personnel should wear respiratory and eye protection devices.

D Butyl Weather Barrier Sealant:

1. Apply non-skinning butyl sealant as shown on shop drawings and manufacturer's installation instructions as necessary to establish the vapor barrier for the panels.

2. Use non-skinning butyl tube sealant only for tight metal-to-metal contact.

3. Do not use non-skinning butyl tube sealant to bridge gaps.

E Place panel fasteners through pre-punched holes in attachment clips, concealed within the joint of the panel. Secure units to the structural supports. Space clips as recommended by manufacturer or otherwise indicated on the approved shop drawings.

3.03 TRIM INSTALLATION

A Place trim and trim fasteners only as indicated per details on the approved shop drawings.

B Field drill weep holes where appropriate in horizontal trim; minimum 1/4 inch diameter at 24 inches on center.

C Place a continuous strip of butyl tube sealant between the inside back face of closure trims and interior panel faces for proper vapor seal.

3.04 SEALANT INSTALLATION FOR EXPOSED JOINTS

A Clean and prime surfaces to receive exterior exposed sealants in accordance with sealant manufacturer's recommendations.

B Follow sealant manufacturer's recommendations for joint width-to-depth ratio, application temperature range, size and type of backer rod, and compatibility of materials for adhesion.

C Direct contact between butyl and silicone sealants shall not be permitted.

3.05 TRIM INSTALLATION

A Place trim and trim fasteners only as indicated per details on the approved shop drawings.

B Field drill weep holes where appropriate in horizontal trim where indicated on shop drawings.

C Place a continuous strip of butyl tape or butyl sealant on closure trims for the length of the panel to be covered as indicated on shop drawings.

3.06 FIELD QUALITY CONTROL

A Testing Agency: General Contractor shall engage an independent testing and inspection agency acceptable to the architect to perform field tests and inspections and to prepare reports of findings.

B Field Water Test: After completing portion of metal wall panel assembly including accessories and trim, test a 2-bay area selected by the architect for water penetration in accordance with AAMA 501.2.

3.07 CLEANING AND PROTECTION

A Remove protective film immediately after installation.

B Touch-up, repair or replace metal panels and trim that have been damaged.

C After metal wall panel installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.

END OF SECTION

SECTION 07 54 00 – THERMOPLASTIC MEMBRANE ROOFING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

A This Section includes the following:

1. Mechanically fastened membrane roofing system.
2. Vapor retarder.
3. Roof insulation.
4. Dens Deck

B Related Sections include the following:

1. Division 6 Section "Rough Carpentry" for wood nailers, curbs, and blocking and for wood-based, structural-use roof deck panels.
2. Division 7 Section "Building Insulation" for insulation beneath the roof deck.
3. Division 7 Section "Joint Sealants."

1.03 DEFINITIONS

A Roofing Terminology: Refer to ASTM D 1079 and glossary of NRCA's "The NRCA Roofing and Waterproofing Manual" for definition of terms related to roofing work in this Section.

1.04 PERFORMANCE REQUIREMENTS

A General: Provide installed roofing membrane and base flashings that remain watertight; do not permit the passage of water; and resist specified uplift pressures, thermally induced movement, and exposure to weather without failure.

B Material Compatibility: Provide roofing materials that are compatible with one another under conditions of service and application required, as demonstrated by roofing membrane manufacturer based on testing and field experience.

C Roofing System Design: Provide a membrane roofing system that is identical to systems that have been successfully tested by a qualified testing and inspecting agency to resist uplift pressure calculated according to ASCE 7.

1.05 SUBMITTALS

A Product Data: For each type of product indicated.

B Shop Drawings: For roofing system. Include plans, elevations, sections, details, and attachments to other Work.

1. Base flashings and membrane terminations.
2. Tapered insulation, including slopes.

C Maintenance Data: For roofing system to include in maintenance manuals.

D Warranties: Special warranties specified in this Section.

1.06 QUALITY ASSURANCE

A Installer Qualifications: A qualified firm that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product and that is eligible to receive manufacturer's warranty.

B Manufacturer Qualifications: A qualified manufacturer that has UL listing for membrane roofing system identical to that used for this Project.

C Fire-Test-Response Characteristics: Provide membrane roofing materials with the fire-test-response characteristics indicated as determined by testing identical products per test method below by UL, FMG, or another testing and inspecting agency acceptable to authorities having jurisdiction. Materials shall be identified with appropriate markings of applicable testing and inspecting agency.

1. Exterior Fire-Test Exposure: Class B; ASTM E 108, for application and roof slopes indicated.
2. Fire-Resistance Ratings: ASTM E 119, for fire-resistance-rated roof assemblies of which roofing system is a part.

D Preinstallation Conference: Conduct conference at Project site. Comply with requirements in Division 1 Section "Project Management and Coordination." Review methods and procedures related to roofing system including, but not limited to, the following:

1. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
2. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
3. Examine deck substrate conditions and finishes for compliance with requirements, including flatness and fastening.
4. Review structural loading limitations of roof deck during and after roofing.
5. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect roofing system.
6. Review governing regulations and requirements for insurance and certificates if applicable.
7. Review temporary protection requirements for roofing system during and after installation.
8. Review roof observation and repair procedures after roofing installation.

1.07 DELIVERY, STORAGE, AND HANDLING

A Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, and directions for storing and mixing with other components.

B Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer. Protect stored liquid material from direct sunlight.

1. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.

C Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.

D Handle and store roofing materials and place equipment in a manner to avoid permanent deflection of deck.

1.08 PROJECT CONDITIONS

A Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed according to manufacturer's written instructions and warranty requirements.

1.09 WARRANTY

A Special Warranty: Manufacturer's standard form, without monetary limitation, in which manufacturer agrees to repair or replace components of membrane roofing system that fail in materials or workmanship within specified warranty period. Failure includes roof leaks.

1. Special warranty includes roofing membrane, base flashings, roofing membrane accessories, roof insulation, fasteners, vapor retarder, and other components of membrane roofing system.
2. Warranty Period: 20 years from date of Substantial Completion.

B Special Project Warranty: Submit roofing Installer's warranty, signed by Installer, covering Work of this Section, including all components of membrane roofing system such as roofing membrane, base flashing, roof insulation, fasteners, cover boards, substrate boards, and walkway products, for the following warranty period:

1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A In other Part 2 articles where titles below introduce lists, the following requirements apply for product selection:

1. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.02 PVC ROOFING MEMBRANE

A PVC Fleeceback Membrane, Type III, fabric reinforced.

1. Manufacturers:

a) Carlisle Syntec, Inc.
b) Flex Membrane International, Inc.
c) Johns Manville International, Inc.

2. Thickness: 80 mils, nominal.
3. Exposed Face Color: White.

2.03 AUXILIARY MATERIALS

A General: Auxiliary materials recommended by roofing system manufacturer for intended use and compatible with membrane roofing.

1. Liquid-type auxiliary materials shall meet VOC limits of authorities having jurisdiction.

B Sheet Flashing: Manufacturer's standard sheet flashing of same material, type, reinforcement, thickness, and color as TPO sheet membrane.

C Bonding Adhesive: Manufacturer's standard solvent-based bonding adhesive for membrane, and solvent-based bonding adhesive for base flashings.

D Fasteners: Factory-coated steel fasteners and metal or plastic plates meeting corrosion-resistance provisions in FMG 4470, designed for fastening membrane to substrate, and acceptable to membrane roofing system manufacturer.

E Miscellaneous Accessories: Provide pourable sealers, preformed cone and vent sheet flashings, preformed inside and outside corner sheet flashings, T-joint covers, termination reglets, cover strips, and other accessories.

F Flexible Walkways: Provide Factory-formed, nonporous, heavy-duty, slip-resisting, surface-textured walkway pads sourced from membrane roofing system manufacture around all mech. units and leading to the roof access hatch. Basis of Design: JM PVC Walkpad , or architect approved equal.

G

2.04 SUBSTRATE BOARDS

A Substrate Board: ASTM C 1177/C 1177M, glass-mat, water-resistant gypsum substrate, Type X, 1/4” inch thick, or per manuf req.

1. Product: Subject to compliance with requirements, provide "Dens-Deck" by Georgia-Pacific Corporation, or approved equal to match existing.

B Fasteners: Factory-coated steel fasteners and metal or plastic plates meeting corrosion-resistance provisions in FMG 4470, designed for fastening substrate panel to roof deck.

2.05 ROOF INSULATION

A General: Provide 5” THERMAPINK FOAMULAR XPS roof insulation boards that comply with requirements and referenced standards, selected from manufacturer's standard sizes.

2.06 INSULATION ACCESSORIES

A General: Roof insulation accessories recommended by insulation manufacturer for intended use and compatible with membrane roofing.

PART 3 - EXECUTION

3.01 EXAMINATION

A Examine substrates, areas, and conditions, with Installer present, for compliance with the following requirements and other conditions affecting performance of roofing system:

1. Verify that roof openings and penetrations are in place and set and braced and that roof drains are securely clamped in place.
2. Verify that wood blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thicknesses of insulation.
3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A Clean substrate of dust, debris, moisture, and other substances detrimental to roofing installation according to roofing system manufacturer's written instructions. Remove sharp projections.

B Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.

C Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system at the end of the workday or when rain is forecast. Remove and discard temporary seals before beginning work on adjoining roofing.

3.03 SUBSTRATE BOARD INSTALLATION

A Install substrate board with long joints in continuous straight lines, perpendicular to roof slopes with end joints staggered between rows. Tightly butt substrate boards together.

3.04 INSULATION INSTALLATION

A Coordinate installing membrane roofing system components so insulation is not exposed to precipitation or left exposed at the end of the workday.

B Comply with membrane roofing system manufacturer's written instructions for installing roof insulation.

C Install tapered insulation under area of roofing to conform to slopes indicated.

D Install one or more layers of insulation under area of roofing to achieve required thickness. Where overall insulation thickness is 2 inches or greater, install 2 or more layers with joints of each succeeding layer staggered from joints of previous layer a minimum of 6 inches in each direction.

E Trim surface of insulation where necessary at roof drains so completed surface is flush and does not restrict flow of water.

F Install insulation with long joints of insulation in a continuous straight line with end joints staggered between rows, abutting edges and ends between boards. Fill gaps exceeding 1/4 inch with insulation.

1. Cut and fit insulation within 1/4 inch of nailers, projections, and penetrations.

3.05 ROOFING MEMBRANE INSTALLATION

A. Insulation and Dens Deck attachment

1. Carlisle Insulation and Dens Deck shall be mechanically fastened to the roof Deck as follows:

a. For HP Recovery Board or minimum 1-1/2” thick Polyisocyanurate, a Minimum of 5 fasteners and plates per 4’ x 8’ board are required.

2. Carlisle Piranha Plates, Seam Fastening Plates (2” diameter) or Insulation Fastening Plates(3” diameter) must be used with appropriate Carlisle.

3.06 ADHERED ROOFING MEMBRANE INSTALLATION

A Install roofing membrane over area to receive roofing in accordance with membrane roofing system manufacturer's written instructions. Unroll roofing membrane and allow to relax before installing.
1. Install sheet in accordance with ASTM D 5036 and roofing system manufacturer’s written instructions.

B Start installation of roofing membrane in presence of membrane roofing system manufacturer's technical representative.

C Accurately align roofing membrane and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.

D Bonding Adhesive: Apply solvent-based bonding adhesive to substrate and underside of roofing membrane at rate required by manufacturer and allow to partially dry before installing roofing membrane. Do not apply bonding adhesive to splice area of roofing membrane.

E Urethane Membrane Adhesive: Apply 2-Part Urethane Adhesive substrate at rate required by manufacturer and install fleece-backed roofing membrane. Do not apply bonding adhesive to splice area of roofing membrane.

F Apply roofing membrane with side laps shingled with slope of roof deck where possible.

G Adhesive Seam Installation: Clean both faces of splice areas, apply splicing cement, and firmly roll side and end laps of overlapping roofing membranes according to manufacturer's written instructions to ensure a watertight seam installation. Apply lap sealant and seal exposed edges of roofing membrane terminations.
1. Apply a continuous bead of in-seam sealant before closing splice if required by membrane roofing system manufacturer.

H Seams: Clean seam areas, overlap roofing membrane, and hot-air weld side and end laps of roofing membrane according to manufacturer's written instructions to ensure a watertight seam installation.
1. Test lap edges with probe to verify seam weld continuity. Apply lap sealant to seal cut edges of roofing membrane.
2. Verify field strength of seams a minimum of twice daily and repair seam sample areas.
   a) Remove and repair any unsatisfactory sections before proceeding with Work.
3. Repair tears, voids, and lapped seams in roofing membrane that do not meet requirements.

I Spread sealant or mastic bed over deck drain flange at deck drains and securely seal roofing membrane in place with clamping ring.

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

3.07 BASE FLASHING INSTALLATION

A Install sheet flashings and preformed flashing accessories and adhere to substrates according to membrane roofing system manufacturer's written instructions.

B Apply solvent-based bonding adhesive to substrate and underside of sheet flashing at required rate and allow to partially dry. Do not apply bonding adhesive to seam area of flashing.

C Flash penetrations and field-formed inside and outside corners with sheet flashing.

D Clean seam areas and overlap and firmly roll sheet flashings into the adhesive. Weld side and end laps to ensure a watertight seam installation.

E Terminate and seal top of sheet flashings.

3.08 FIELD QUALITY CONTROL

A Repair or remove and replace components of membrane roofing system where test results or inspections indicate that they do not comply with specified requirements.

B Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

C Testing Agency: Contractor shall engage a qualified independent testing and inspecting agency to perform roof tests and inspections and to prepare test reports.

D Final Roof Inspection: Arrange for roofing system manufacturer's Registered Roof Observer (RRO) to inspect roofing installation on completion and submit report to Architect.

E Repair or remove and replace components of roofing system where test results or inspections indicate that they do not comply with specified requirements.

3.09 PROTECTING AND CLEANING

A Protect membrane roofing system from damage and wear during remainder of construction period. When remaining construction will not affect or endanger roofing, inspect roofing for deterioration and damage, describing its nature and extent in a written report, with copies to Architect and Owner.

B Correct deficiencies in or remove membrane roofing system that does not comply with requirements, repair substrates, and repair or reinstall membrane roofing system to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.

END OF SECTION

SECTION 07 62 00 – SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

A This Section includes the following sheet metal flashing and trim:
1. Manufactured reglets.
2. Formed roof drainage system.
3. Formed low-slope roof flashing and trim.
4. Formed wall flashing and trim.
5. Formed equipment support flashing.

B Related Sections include the following:
1. Division 7 Section "Metal Wall Panels" for factory-formed metal wall panels and flashing and trim not part of sheet metal flashing and trim.
2. Division 7 Section " Roofing" " for installing sheet metal flashing and trim integral with roofing membrane.
3. Division 7 Section "Joint Sealants" for field-applied sheet metal flashing and trim sealants.

1.03 PERFORMANCE REQUIREMENTS

A General: Install sheet metal flashing and trim to withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failing, rattling, leaking, and fastener disengagement.

B Thermal Movements: Provide sheet metal flashing and trim that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, hole elongation, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Provide clips that resist rotation and avoid shear stress as a result of sheet metal and trim thermal movements. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
1. Temperature Change (Range): 120 deg F (48.8 deg C), ambient; 180 deg F (82.2 deg C), material surfaces.

C Water Infiltration: Provide sheet metal flashing and trim that do not allow water infiltration to building interior.

1.04 SUBMITTALS

A Shop Drawings: Show layouts of sheet metal flashing and trim, including plans and elevations. Distinguish between shop- and field-assembled work. Include the following:
1. Identify material, thickness, weight, and finish for each item and location in Project.
2. Details for forming sheet metal flashing and trim, including profiles, shapes, seams, and dimensions.
3. Details for fastening, joining, supporting, and anchoring sheet metal flashing and trim, including fasteners, clips, cleats, and attachments to adjoining work.
4. Details of expansion-joint covers, including showing direction of expansion and contraction.

1.05 QUALITY ASSURANCE

A Sheet Metal Flashing and Trim Standard: Comply with SMACNA's "Architectural Sheet Metal Manual." Conform to dimensions and profiles shown unless more stringent requirements are indicated.

1.06 DELIVERY, STORAGE, AND HANDLING

A Deliver sheet metal flashing materials and fabrications undamaged. Protect sheet metal flashing and trim materials and fabrications during transportation and handling.

B Unload, store, and install sheet metal flashing materials and fabrications in a manner to prevent bending, warping, twisting, and surface damage.

C Stack materials on platforms or pallets, covered with suitable weathertight and ventilated covering. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage.

1.07 COORDINATION

A Coordinate installation of sheet metal flashing and trim with interfacing and adjoining construction to provide a leakproof, secure, and noncorrosive installation.

PART 2 - PRODUCTS

2.01 SHEET METALS

A Aluminum Sheet: ASTM B 209 (ASTM B 209M), Alloy 3003, 3004, 3105, or 5005, Temper suitable for forming and structural performance required, but not less than H14, finished as follows:
1. Mill Finish: Standard one-side bright.

B Zinc-Tin Alloy-Coated Stainless-Steel Sheet: ASTM A 240/A 240M, Type 304, dead-soft, fully annealed stainless-steel sheet, coated on both sides with a zinc-tin alloy (50 percent zinc, 50 percent tin).
1. Product: Subject to compliance with requirements, provide "TCS II" by Follansbee Steel.

C Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, G90 (Z275) coating designation; structural quality.

D Lead Sheet: ASTM B 749, Type L51121, copper-bearing lead sheet.

2.02 UNDERLAYMENT MATERIALS

A Polyethylene Sheet: 6-mil- (0.15-mm-) thick polyethylene sheet complying with ASTM D 4397.

B Felts: ASTM D 226, Type II (No. 30), asphalt-saturated organic felt, nonperforated.

C Slip Sheet: Rosin-sized paper, minimum 3 lb/100 sq. ft. (0.16 kg/sq. m).

2.03 MISCELLANEOUS MATERIALS

A General: Provide materials and types of fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation.

B Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads.
1. Exposed Fasteners: Heads matching color of sheet metal by means of plastic caps or factory-applied coating.
2. Fasteners for Flashing and Trim: Blind fasteners or self-drilling screws, gasketed, with hex washer head.
3. Blind Fasteners: High-strength aluminum or stainless-steel rivets.
4. Spikes and Ferrules: Same material as gutter; with spike with ferrule matching internal gutter width.

C Solder for Zinc-Tin Alloy-Coated Stainless Steel: ASTM B 32, 100 percent tin.

D Solder for Lead: ASTM B 32, Grade Sn50, 50 percent tin and 50 percent lead.

E Burning Rod for Lead: Same composition as lead sheet.

F Sealing Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealing tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape.

G Elastomeric Sealant: ASTM C 920, elastomeric polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

H Epoxy Seam Sealer: Two-part, noncorrosive, aluminum seam-cementing compound, recommended by aluminum manufacturer for exterior nonmoving joints, including riveted joints.

I Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil (0.4-mm) dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

J Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required for application.

2.04 MANUFACTURED SHEET METAL FLASHING AND TRIM

A Reglets: Units of type, material, and profile indicated, formed to provide secure interlocking of separate reglet and counterflashing pieces, and compatible with flashing indicated with factory-mitered and -welded corners and junctions.
1. Material: Galvanized steel, 0.0217 inch (0.55 mm) thick.
2. Concrete Type: Provide temporary closure tape to keep reglet free of concrete materials, special fasteners for attaching reglet to concrete forms, and guides to ensure alignment of reglet section ends.
3. Flexible Flashing Retainer: Provide resilient plastic or rubber accessory to secure flexible flashing in reglet where clearance does not permit use of standard metal counterflashing or where Drawings show reglet without metal counterflashing.
4. Counterflashing Wind-Restraint Clips: Provide clips to be installed before counterflashing to prevent wind uplift of counterflashing lower edge.

2.05 FABRICATION, GENERAL

A General: Custom fabricate sheet metal flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated. Shop fabricate items where practicable. Obtain field measurements for accurate fit before shop fabrication.

B Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.

C Fabricate sheet metal flashing and trim without excessive oil canning, buckling, and tool marks and true to line and levels indicated, with exposed edges folded back to form hems.
1. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
2. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.

D Sealed Joints: Form nonexpansion but movable joints in metal to accommodate elastomeric sealant to comply with SMACNA recommendations.

E Expansion Provisions: Where lapped or bayonet-type expansion provisions in the Work cannot be used, form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with elastomeric sealant concealed within joints.

F Conceal fasteners and expansion provisions where possible on exposed-to-view sheet metal flashing and trim, unless otherwise indicated.

G Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.
1. Thickness: As recommended by SMACNA's "Architectural Sheet Metal Manual" for application but not less than thickness of metal being secured.

2.06 ROOF DRAINAGE SHEET METAL FABRICATIONS

A Gutters: Fabricate gutters of dimensions indicated on drawings. If dimensions are not indicated provide 9-inch deep by 5-inch wide with closure flange trim. Confirm profile with Architect prior to fabrication.
1. Fabricate gutters from the following material:
a) Pre-finished metal matching the roof color and finish

B Downspouts: Fabricate downspouts of dimensions indicated on drawings. If dimensions are not indicated provide 5-inch wide by 4-inch deep. Confirm profile with Architect prior to fabrication.
1. Fabricate gutters from the following material:
a) Pre-finished metal matching the roof color and finish

2.07 LOW-SLOPE ROOF SHEET METAL FABRICATIONS

A Copings: Fabricate in minimum 96-inch- (2400-mm-) long, but not exceeding 10-foot- (3-m-) long, sections. Fabricate joint plates of same thickness as copings. Furnish with continuous cleats to support edge of external leg and drill elongated holes for fasteners on interior leg. Miter corners, seal, and solder or weld watertight.
1. Fabricate copings from the following material:
a) Galvanized Steel: 0.0396 inch (1.0 mm.

B Base Flashing: Fabricate from the following material:
1. Galvanized Steel: 0.0276 inch (0.7 mm).

C Counterflashing: Fabricate from the following material:
1. Galvanized Steel: 0.0217 inch (0.55 mm) thick.

D Flashing Receivers: Fabricate from the following material:
1. Galvanized Steel: 0.0217 inch (0.55 mm) thick.

E Roof-Penetration Flashing: Fabricate from the following material:

1. Lead: 4.0 lb/sq. ft. (1.6 mm thick), hard tempered.
2. Galvanized Steel: 0.0276 inch (0.7 mm) thick.

F Roof-Drain Flashing: Fabricate from the following material:
1. Lead: 4.0 lb/sq. ft. (1.6 mm thick), hard tempered.

2.08 WALL SHEET METAL FABRICATIONS

A Through-Wall Flashing: Fabricate continuous flashings in minimum 96-inch- (2400-mm-) long, but not exceeding 12 foot (3.6 m) long, sections, under copings, at shelf angles, and where indicated. Fabricate discontinuous lintel, sill, and similar flashings to extend 6 inches (150 mm) beyond each side of wall openings. Form with 2-inch- (50-mm-) high end dams. Fabricate from the following material:
1. Zinc-Tin Alloy-Coated Stainless Steel: 0.015 inch (0.4 mm) thick.

2.09 MISCELLANEOUS SHEET METAL FABRICATIONS

A Equipment Support Flashing: Fabricate from the following material:
1. Galvanized Steel: 0.0276 inch (0.7 mm) thick.

2.10 FINISHES

A Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.01 EXAMINATION

A Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions and other conditions affecting performance of work.
1. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
2. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION, GENERAL

A General: Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement. Use fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.
1. Torch cutting of sheet metal flashing and trim is not permitted.

B Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating or by other permanent separation as recommended by fabricator or manufacturers of dissimilar metals.

1. Coat side of uncoated aluminum and lead sheet metal flashing and trim with bituminous coating where flashing and trim will contact wood, ferrous metal, or cementitious construction.
2. Underlayment: Where installing metal flashing directly on cementitious or wood substrates, install a course of felt underlayment and cover with a slip sheet or install a course of polyethylene underlayment.
3. Bed flanges in thick coat of asphalt roofing cement where required for waterproof performance.

C Install exposed sheet metal flashing and trim without excessive oil canning, buckling, and tool marks.

D Install sheet metal flashing and trim true to line and levels indicated. Provide uniform, neat seams with minimum exposure of solder, welds, and elastomeric sealant.

E Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.

1. Space cleats not more than 12 inches (300 mm) apart. Anchor each cleat with two fasteners. Bend tabs over fasteners.

F Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet (3 m) with no joints allowed within 24 inches (600 mm) of corner or intersection. Where lapped or bayonet-type expansion provisions cannot be used or would not be sufficiently watertight, form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with elastomeric sealant concealed within joints.

G Fasteners: Use fasteners of sizes that will penetrate substrate not less than 1-1/4 inches (32 mm) for nails and not less than 3/4 inch (19 mm) for wood screws.

1. Galvanized or Prepainted, Metallic-Coated Steel: Use stainless-steel fasteners.
2. Aluminum: Use aluminum or stainless-steel fasteners.

H Seal joints with elastomeric sealant as required for watertight construction.

1. Where sealant-filled joints are used, embed hooked flanges of joint members not less than 1 inch (25 mm) into sealant. Form joints to completely conceal sealant. When ambient temperature at time of installation is moderate, between 40 and 70 deg F (4 and 21 deg C), set joint members for 50 percent movement either way. Adjust setting proportionately for installation at higher ambient temperatures. Do not install sealant-type joints at temperatures below 40 deg F (4 deg C).
2. Prepare joints and apply sealants to comply with requirements in Division 7 Section "Joint Sealants."

I Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Pretin edges of sheets to be soldered to a width of 1-1/2 inches (38 mm) except where pretinned surface would show in finished Work.

1. Do not solder aluminum sheet.
2. Pretinning is not required for zinc-tin alloy-coated stainless steel and lead.
3. Do not use open-flame torches for soldering. Heat surfaces to receive solder and flow solder into joints. Fill joints completely. Completely remove flux and spatter from exposed surfaces.

J Aluminum Flashing: Rivet or weld joints in uncoated aluminum where necessary for strength.

3.03 ROOF DRAINAGE SYSTEM INSTALLATION

A General: Install sheet metal roof drainage items to produce complete roof drainage system according to SMACNA recommendations and as indicated. Coordinate installation of roof perimeter flashing with installation of roof drainage system.

B Parapet Scuppers: Install scuppers where indicated through parapet. Continuously support scupper, set to correct elevation, and seal flanges to interior wall face, over cants or tapered edge strips, and under roofing membrane.
1. Anchor scupper closure trim flange to exterior wall and seal or solder to scupper.

3.04 ROOF FLASHING INSTALLATION

A General: Install sheet metal roof flashing and trim to comply with performance requirements, sheet metal manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, set units true to line, and level as indicated. Install work with laps, joints, and seams that will be permanently watertight.

B Pipe or Post Counterflashing: Install counterflashing umbrella with close-fitting collar with top edge flared for elastomeric sealant, extending a minimum of 4 inches (100 mm) over base flashing. Install stainless-steel draw band and tighten.

C Counterflashing: Coordinate installation of counterflashing with installation of base flashing. Insert counterflashing in reglets or receivers and fit tightly to base flashing. Extend counterflashing 4 inches (100 mm) over base flashing. Lap counterflashing joints a minimum of 4 inches (100 mm) and bed with elastomeric sealant.
1. Secure in a waterproof manner by means of snap-in installation and sealant or lead wedges and sealant.

D Roof-Penetration Flashing: Coordinate installation of roof-penetration flashing with installation of roofing and other items penetrating roof. Install flashing as follows:
1. Turn lead flashing down inside vent piping, being careful not to block vent piping with flashing.
2. Seal with elastomeric sealant and clamp flashing to pipes penetrating roof except for lead flashing on vent piping.

3.05 WALL FLASHING INSTALLATION

A General: Install sheet metal wall flashing to intercept and exclude penetrating moisture according to SMACNA recommendations and as indicated. Coordinate installation of wall flashing with installation of wall-opening components such as windows, doors, and louvers.

3.06 MISCELLANEOUS FLASHING INSTALLATION

A Equipment Support Flashing: Coordinate installation of equipment support flashing with installation of roofing and equipment. Weld or seal flashing with elastomeric sealant to equipment support member.

3.07 CLEANING AND PROTECTION

A Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.

B Clean and neutralize flux materials. Clean off excess solder and sealants.

C Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed. On completion of installation, clean finished surfaces, including removing unused

fasteners, metal filings, pop rivet stems, and pieces of flashing. Maintain in a clean condition during construction.

D Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION

SECTION 07 92 00 – JOINT SEALANTS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

A This Section includes joint sealants for the applications indicated in the Joint-Sealant Schedule at the end of Part 3.

B Related Sections include the following:
1. Division 8 Section "Glazing" for glazing sealants.
2. Division 9 Section "Gypsum Board Assemblies" for sealing perimeter joints of gypsum board partitions to reduce sound transmission.
3. Division 9 Section "Ceramic Tile" for sealing tile joints.

1.03 PERFORMANCE REQUIREMENTS

A Provide elastomeric joint sealants that establish and maintain watertight and airtight continuous joint seals without staining or deteriorating joint substrates.

B Provide joint sealants for interior applications that establish and maintain airtight and water-resistant continuous joint seals without staining or deteriorating joint substrates.

1.04 SUBMITTALS

A Product Data: For each joint-sealant product indicated.

B Qualification Data: For Installer.

1.05 QUALITY ASSURANCE

A Installer Qualifications: Manufacturer's authorized Installer who is approved or licensed for installation of elastomeric sealants required for this Project.

B Source Limitations: Obtain each type of joint sealant through one source from a single manufacturer.

C Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination."

1.06 PROJECT CONDITIONS

A Do not proceed with installation of joint sealants under the following conditions:
1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer.
2. When joint substrates are wet.
3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.

4. Contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

1.07 WARRANTY

A Special Installer's Warranty: Installer's standard form in which Installer agrees to repair or replace elastomeric joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
1. Warranty Period: Five years from date of Substantial Completion.

B Special Manufacturer's Warranty: Manufacturer's standard form in which elastomeric sealant manufacturer agrees to furnish elastomeric joint sealants to repair or replace those that do not comply with performance and other requirements specified in this Section within specified warranty period.
1. Warranty Period: Ten years from date of Substantial Completion.

C Special warranties specified in this Article exclude deterioration or failure of elastomeric joint sealants from the following:
1. Movement of the structure resulting in stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression caused by structural settlement or errors attributable to design or construction.
2. Disintegration of joint substrates from natural causes exceeding design specifications.
3. Mechanical damage caused by individuals, tools, or other outside agents.
4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A Basis of Design Product: The design is based upon Dow Corning products or comparable manufacturer and product.

2.02 MATERIALS, GENERAL

A Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by sealant manufacturer, based on testing and field experience.

2.03 ELASTOMERIC JOINT SEALANTS

A Elastomeric Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied chemically curing sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.

2.04 ACOUSTICAL JOINT SEALANTS

A Acoustical Sealant for Concealed Joints: Manufacturer's standard, nondrying, nonhardening, nonskinning, nonstaining, gunnable, synthetic-rubber sealant recommended for sealing interior concealed joints to reduce airborne sound transmission.
1. Products:
a) Pecora Corporation; BA-98.
b) Tremco; Tremco Acoustical Sealant.

2.05 JOINT-SEALANT BACKING

A General: Provide sealant backings of material and type that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

B Cylindrical Sealant Backings: ASTM C 1330, Type B (bicellular material with a surface skin), and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance:

2.06 MISCELLANEOUS MATERIALS

A Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

B Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.

C Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.01 EXAMINATION

A Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.

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

3.02 PREPARATION

A Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:
1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
2. Clean porous joint substrate surfaces by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following:
   a) Concrete.
   b) Concrete Masonry Unit
   c) Unglazed surfaces of ceramic tile.
3. Remove laitance and form-release agents from concrete.
4. Clean nonporous surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include the following:
   a) Metal.
   b) Glass.
   c) Prefinished architectural panels,

B Joint Priming: Prime joint substrates, where recommended in writing by joint-sealant manufacturer, based on preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

C Masking Tape: Use masking tape where required to prevent contact of sealant with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.03 INSTALLATION OF JOINT SEALANTS

A General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.

B Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C Acoustical Sealant Application Standard: Comply with recommendations in ASTM C 919 for use of joint sealants in acoustical applications as applicable to materials, applications, and conditions indicated.

D Install sealant backings of type indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
1. Do not leave gaps between ends of sealant backings.
2. Do not stretch, twist, puncture, or tear sealant backings.
3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.

E Install sealants using proven techniques that comply with the following and at the same time backings are installed:
1. Place sealants so they directly contact and fully wet joint substrates.
2. Completely fill recesses in each joint configuration.
3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

F Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
1. Remove excess sealant from surfaces adjacent to joints.
2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
3. Provide concave joint configuration per Figure 5A in ASTM C 1193, unless otherwise indicated.

3.04 CLEANING

A Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.05 PROTECTION

A Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

3.06 JOINT-SEALANT SCHEDULE

A Joint-Sealant Application JS-#1: Exterior vertical and horizontal nontraffic construction joints in cast-in-place concrete.
1. Joint Sealant: Dow Corning, #756
2. Joint-Sealant Color: As selected by Architect from manufacturer's full range.

B Joint-Sealant Application JS-2#: Exterior butt joints between metal panels.
1. Joint Sealant: Dow Corning, #791 or 795.
2. Joint-Sealant Color: As selected by Architect from manufacturer's full range.

C Joint-Sealant Application JS-3#: Exterior vertical joints between different materials.
1. Joint Sealant: Dow Corning, #756 or 790.
2. Joint-Sealant Color: As selected by Architect from manufacturer's full range.

D Joint-Sealant Application JS-4#: Exterior perimeter joints between adjacent walls and frames of doors windows and louvers.
1. Joint Sealant: Dow Corning, #756.
2. Joint-Sealant Color: As selected by Architect from manufacturer's full range.

E Joint-Sealant Application JS-#5: Interior perimeter joints of exterior openings.
1. Joint Sealant: Latex sealant.
2. Joint-Sealant Color: As selected by Architect from manufacturer's full range.

F Joint-Sealant Application JS-#6: Interior joints between plumbing fixtures and adjoining walls, floors, and counters.
1. Joint Sealant: Latex sealant.
2. Joint-Sealant Color: White.

G Joint-Sealant Application JS-#7: Perimeter joints between interior wall surfaces and frames of interior doors windows and elevator entrances.
1. Joint Sealant: Dow Corning, #786.
2. Joint-Sealant Color: As selected by Architect from manufacturer's full range .

END OF SECTION

SECTION 08 12 13 – HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

A This Section includes the following:
1. Steel doors.
2. Steel door frames.

B Related Sections include the following:
1. Division 8 Section "Door Hardware ".
2. Division 9 Section "Gypsum Board Assemblies".
3. Division 9 Section "Painting".

1.03 DEFINITIONS

A Steel Sheet Thick nesses: Thickness dimensions, including those referenced in ANSI A250.8, are minimums as defined in referenced ASTM standards for both uncoated steel sheet and the uncoated base metal of metallic-coated steel sheets.

1.04 SUBMITTALS

A Product Data: For each type of door and frame indicated, include door designation, type, level and model, material description, core description, construction details, label compliance, sound and fire-resistance ratings, and finishes.

B Shop Drawings: Show the following:
1. Elevations of each door design.
2. Details of doors including vertical and horizontal edge details.
3. Frame details for each frame type including dimensioned profiles.
4. Details and locations of reinforcement and preparations for hardware.
5. Details of each different wall opening condition.
6. Details of anchorages, accessories, joints, and connections.
7. Details of conduit and preparations for power, signal and control systems.

C Door Schedule: Use same reference designations indicated on Drawings in preparing schedule for doors and frames.

1.05 QUALITY ASSURANCE

A Steel Door and Frame Standard: Comply with ANSI A 250.8, unless more stringent requirements are indicated.

1.06 DELIVERY, STORAGE, AND HANDLING

A Deliver doors and frames cardboard-wrapped or crated to provide protection during transit and job storage. Provide additional protection to prevent damage to finish of factory-finished doors and frames.

B Inspect doors and frames on delivery for damage, and notify shipper and supplier if damage is found. Minor damages may be repaired provided refinished items match new work and are acceptable to Architect. Remove and replace damaged items that cannot be repaired as directed.

C Store doors and frames at building site under cover. Place units on minimum 4-inch- (100-mm-) high wood blocking. Avoid using nonvented plastic or canvas shelters that could create a humidity chamber. If door packaging becomes wet, remove cartons immediately. Provide minimum 1/4-inch (6-mm) spaces between stacked doors to permit air circulation.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Steel Doors and Frames: Ceco Door Products; a United Dominion Company.

2.02 MATERIALS

A Hot-Rolled Steel Sheets: ASTM A 569/A 569M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.

B Cold-Rolled Steel Sheets: ASTM A 366/A 366M, Commercial Steel (CS), or ASTM A 620/A 620M, Drawing Steel (DS), Type B; stretcher-leveled standard of flatness.

C Metallic-Coated Steel Sheets: ASTM A 653/A 653M, Commercial Steel (CS), Type B, with an A40 (ZF120) zinc-iron-alloy (galvannealed) coating; stretcher-leveled standard of flatness.

D Electrolytic Zinc-Coated Steel Sheet: ASTM A 591/A 591M, Commercial Steel (CS), Class B coating; mill phosphatized; suitable for unexposed applications; stretcher-leveled standard of flatness where used for face sheets.

2.03 DOORS

A General: Provide doors of sizes, thicknesses, and designs indicated.

B Exterior Doors: Provide doors complying with requirements indicated below by referencing ANSI A250.8 for level and model and ANSI A250.4 for physical-endurance level:
1. Level 2 and Physical Performance Level B (Heavy Duty), Model 1 (Full Flush).

2.04 FRAMES

A General: Provide steel frames for doors, transoms, sidelights, borrowed lights, and other openings that comply with ANSI A250.8 and with details indicated for type and profile. Conceal fastenings, unless otherwise indicated.

B Frames of 0.053-inch- (1.3-mm-) thick steel sheet for:
1. Door openings wider than 48 inches (1220 mm).
2. Wood doors, unless otherwise indicated.

C Door Silencers: Except on weather-stripped frames, fabricate stops to receive three silencers on strike jambs of single-door frames and two silencers on heads of double-door frames.

D Supports and Anchors: Fabricated from not less than 0.042-inch- (1.0-mm-) thick, electrolytic zinc-coated or metallic-coated steel sheet.

E Inserts, Bolts, and Fasteners: Manufacturer's standard units. Where zinc-coated items are to be built into exterior walls, comply with ASTM A 153/A 153M, Class C or D as applicable.

2.05 FABRICATION

A General: Fabricate steel door and frame units to comply with ANSI A250.8 and to be rigid, neat in appearance, and free from defects including warp and buckle. Where practical, fit and assemble units in manufacturer's plant. Clearly identify work that cannot be permanently factory assembled before shipment, to assure proper assembly at Project site.

B Exterior Door Construction: For exterior locations and elsewhere as indicated, fabricate doors, panels, and frames from metallic-coated steel sheet. Close top and bottom edges of doors flush as an integral part of door construction or by addition of 0.053-inch- (1.3-mm-) thick, metallic-coated steel channels with channel webs placed even with top and bottom edges.

C Core Construction: Manufacturer's standard core construction that produces a door complying with SDI standards.

D Clearances for Non-Fire-Rated Doors: Not more than 1/8 inch (3.2 mm) at jambs and heads, except not more than 1/4 inch (6.4 mm) between pairs of doors. Not more than 3/4 inch (19 mm) at bottom.

E Single-Acting, Door-Edge Profile: Square edge.

F Tolerances: Comply with SDI 117, "Manufacturing Tolerances for Standard Steel Doors and Frames."

G Fabricate concealed stiffeners, reinforcement, edge channels, louvers, and moldings from either cold- or hot-rolled steel sheet.

H Exposed Fasteners: Unless otherwise indicated, provide countersunk flat or oval heads for exposed screws and bolts.

I Hardware Preparation: Prepare doors and frames to receive mortised and concealed hardware according to final door hardware schedule and templates provided by hardware supplier. Comply with applicable requirements in ANSI A250.6 and ANSI A115 Series specifications for door and frame preparation for hardware.
1. For concealed overhead door closers, provide space, cutouts, reinforcement, and provisions for fastening in top rail of doors or head of frames, as applicable.

J Frame Construction: Fabricate frames to shape shown.
1. For exterior applications, fabricate frames with mitered or coped and continuously welded corners.
2. Provide welded frames with temporary spreader bars.

K Reinforce doors and frames to receive surface-applied hardware. Drilling and tapping for surface-applied hardware may be done at Project site.

L Locate hardware as indicated on Shop Drawings or, if not indicated, according to ANSI A250.8.

2.06 FINISHES

A Prime Finish: Manufacturer's standard, factory-applied coat of rust-inhibiting primer complying with ANSI A250.10 for acceptance criteria.

PART 3 - EXECUTION

3.01 INSTALLATION

A General: Install steel doors, frames, and accessories according to Shop Drawings, manufacturer's data, and as specified.

B Placing Frames: Comply with provisions in SDI 105, unless otherwise indicated. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is completed, remove temporary braces and spreaders, leaving surfaces smooth and undamaged.
1. Place frames before construction of enclosing walls and ceilings.
2. In concrete or masonry construction, provide at least three completed opening anchors per jamb; install adjacent to hinge location on hinge jamb and at corresponding heights on strike jamb. Set frames and secure to adjacent construction with bolts and masonry anchorage devices.
3. In metal-stud partitions, provide at least three wall anchors per jamb; install adjacent to hinge location on hinge jamb and at corresponding heights on strike jamb. Attach wall anchors to studs with screws.
4. For openings 90 inches (2286 mm) or more in height, install an additional anchor at hinge and strike jambs.

C Door Installation: Comply with ANSI A250.8. Fit hollow-metal doors accurately in frames, within clearances specified in ANSI A250.8. Shim as necessary to comply with SDI 122 and ANSI/DHI A115.1G.
1. Smoke-Control Doors: Install to comply with NFPA 105.

3.02 ADJUSTING AND CLEANING

A Prime-Coat Touchup: Immediately after installation, sand smooth any rusted or damaged areas of prime coat and apply touch up of compatible air-drying primer.

B Protection Removal: Immediately before final inspection, remove protective wrappings from doors and frames.

END OF SECTION

SECTION 08 12 50 - INTERIOR ALUMINUM FRAMES

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A Section includes interior aluminum frames for doors installed in gypsum board partitions.

B Related Sections:

1 Section 08211 "Flush Wood Doors" for wood doors installed in interior aluminum frames.
2 Section 08411 "Aluminum-Framed Entrances and Storefronts" for aluminum-framed glass doors installed in interior aluminum frames.

1.03 ACTION SUBMITTALS

A Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, fire-resistance rating, and finishes.

B Shop Drawings: Include the following:

1 Frame details for each frame type, including dimensioned profiles and metal thicknesses.
2 Locations of reinforcements and preparations for hardware.
3 Details of each different wall-opening condition.
4 Details of anchorages, joints, field splices, and connections.
5 Details of accessories.
6 Details of moldings, removable stops, and glazing.
7 Details of conduits and preparations for power, signal, and control systems.

C Samples for Initial Selection: For units with factory-applied finishes.

1 Include similar Samples of seals, gaskets, and accessories involving color selection.

D Samples for Verification: For interior aluminum frames, prepared on Samples of size indicated below:

1 Framing Member: 12 inches (300 mm) long.
2 Corner Fabrication: 12-by-12-inch- (300-by-300-mm-) long, full-size window corner, including full-size sections of extrusions with factory-applied color finish.

D Schedule: For interior aluminum frames. Use same designations indicated on Drawings. Coordinate with door hardware schedule and glazing.

1.04 INFORMATIONAL SUBMITTALS

A Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each type of interior aluminum frame.

1.05 CLOSEOUT SUBMITTALS

A Maintenance Data: For interior aluminum frames to include in maintenance manuals.

F. QUALITY ASSURANCE

A Source Limitations: Obtain interior aluminum frames from single source from single manufacturer.

B Fire-Rated Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.

C Smoke- and Draft-Control Assemblies: Where indicated At corridors, smoke barriers, and smoke partitions, provide assemblies tested according to UL 1784 and installed in compliance with NFPA 105.

1 Air Leakage Rate: Maximum air leakage of 0.3 cfm/sq. ft. (3 cu. m per minute/sq. m) at the tested pressure differential of 0.3-inch wg (75 Pa) of water.

D Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.

1 Build mockup of typical wall area as shown on Drawings.
2 Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

E Preinstallation Conference: Conduct conference at Project site.

1.06 DELIVERY, STORAGE, AND HANDLING

A Deliver interior aluminum frames palletized, wrapped, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic. Store interior aluminum frames under cover at Project site.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B Basis-of-Design Product: Timely Frames.

2.02 COMPONENTS

A Aluminum Framing: ASTM B 221 (ASTM B 221M), Alloy 6063-T5 or alloy and temper required to suit structural and finish requirements, not less than 0.062 inch (1.6 mm) thick.

B Door Frames: Extruded aluminum, reinforced for hinges, strikes, and closers.

1 90-Minute Fire-Protection Rating: Fabricate aluminum frame assemblies with a cold-formed, primed, interior steel liner.

C Glazing Frames: Extruded aluminum, for glazing thickness indicated.

D Ceiling Tracks: Extruded aluminum.

E Trim: Extruded aluminum, not less than 0.062 inch (1.6 mm) thick, with removable snap-in casing trim glazing stops and door stops without exposed fasteners.

2.03 ACCESSORIES

A Fasteners: Aluminum, nonmagnetic, stainless-steel or other noncorrosive metal fasteners compatible with frames, stops, panels, reinforcement plates, hardware, anchors, and other items being fastened.

B Door Silencers: Manufacturer's standard continuous mohair, wool pile, or vinyl seals, Gray.

C Smoke Seals: Intumescent strip or fire-rated gaskets, Gray.

D Glazing Gaskets: Manufacturer's standard extruded or molded plastic, to accommodate glazing thickness indicated, Gray.

E Glazing: Comply with requirements in Section 08800 "Glazing."

F Hardware: Comply with requirements in Section 08710 "Door Hardware".

2.04 FABRICATION

A Provide concealed corner reinforcements and alignment clips for accurately fitted hairline joints at butted or mitered connections.

B Factory prepare interior aluminum frames to receive templated mortised hardware; include cutouts, reinforcements, mortising, drilling, and tapping, according to the Door Hardware Schedule and templates furnished as specified in Section 08710 "Door Hardware."

1 Locate hardware as required by fire-rated label for assembly.

C Fabricate frames for glazing with removable stops to allow glazing replacement without dismantling frame.

1 Locate removable stops on the inside of spaces accessed by keyed doors.

D Fabricate components to allow secure installation without exposed fasteners.

2.05 GENERAL FINISH REQUIREMENTS

A Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.06 ALUMINUM FINISHES

A Clear Anodic Finish: AAMA 611, AA-M12C22A31, Class II, 0.010 mm or thicker.

PART 3 - EXECUTION

3.01 EXAMINATION

A Examine walls, floors, and ceilings, with Installer present, for conditions affecting performance of the Work.

B Verify that wall thickness does not exceed standard tolerances allowed by throat size indicated.

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

3.02 INSTALLATION

A General: Install interior aluminum frames plumb, rigid, properly aligned, and securely fastened in place; comply with manufacturer's written instructions.

B Set frames accurately in position and plumbed, aligned, and securely anchored to substrates.

1 At fire-protection-rated openings, install interior aluminum frames according to NFPA 80.

C Install frame components in the longest possible lengths; components up to 96 inches (2450 mm) long must be one piece.

1 Fasten to suspended ceiling grid on maximum 48-inch (1220-mm) centers, using sheet metal screws or other fasteners approved by frame manufacturer.
2 Use concealed installation clips to produce tightly fitted and aligned splices and connections.
3 Secure clips to extruded main-frame components and not to snap-in or trim members.
4 Do not leave screws or other fasteners exposed to view when installation is complete.

3.03 CLEANING

A Clean exposed frame surfaces promptly after installation, using cleaning methods recommended by frame manufacturer and according to AAMA 609 & 610.

B Touch up marred frame surfaces so touchup is not visible from a distance of 48 inches (1220 mm). Remove and replace frames with damaged finish that cannot be satisfactorily repaired.

END OF SECTION

SECTION 08 14 16 – FLUSH WOOD DOORS

PART I – GENERAL

1.01 SUMMARY

A. SECTION INCLUDES

1. Work under this section comprises of furnishing solid core doors with wood veneer faces, light frames, factory fitting and machining and factory finishing for fire labeled and non-labeled flush wood doors.

B. RELATED DOCUMENTS

1. Related documents, drawings and general provisions of contract, including General and Supplementary Conditions and Division 1 specification sections apply to this section.

C. RELATED SECTIONS

1. 08110 – Metal Doors and Frames

1.02 REFERENCES

A. STANDARDS

1. NFPA-80 – Fire Doors and Windows
2. NFPA-105 – Recommend Practice for Installation of Smoke Controlled Door Assemblies
3. WDMA I.S. 1A – Wood Door Manufacturer's Association, Flush Wood Door Performance Standards
4. UL10C - Standard for Positive Pressure Fire Tests of Door Assemblies

B. CODES

1. NFPA-101 – Life Safety Code
2. IBC 2003 – International Building Code
3. ANSI-A117.1 – Accessible and Usable Buildings and Facilities.

4. ADA – Americans with Disabilities Act

1.03 SUBMITTALS

A. PRODUCT DATA

1. Product Data: For each type of door. Include details of core and edge construction and trim for openings. Include factory-finishing specifications.

B. SHOP DRAWINGS

1. Submit Drawings: Indicate location, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data; and the following:
    a. Indicate location, size, and hand of each door.
    b. Indicate dimensions and locations of mortises and holes for hardware.
    c. Indicate dimensions and locations of cutouts.
    d. Indicate requirements for veneer matching.
    e. Indicate location and extent of hardware blocking.
    f. Indicate construction details not covered in Product Data.
    g. Indicate doors to be factory finished and finish requirements.
    h. Indicate fire protection ratings for fire rated doors.

C. SAMPLES

1. Samples for Initial Selection: For factory-finished doors.
2. Factory finishes applied to actual door face materials, approximately 8 by 10 inches (200 by 250 mm), for each material and finish. For each wood species and transparent finish, provide set of three Samples showing typical range of color and grain to be expected in finished Work.
3. Corner sections of doors, approximately 8 by 10 inches (200 by 250 mm), with door faces and edges representing actual materials to be used.
    a. Provide Samples for each species of veneer and solid lumber required.
    b. Provide Samples for each color, texture, and pattern of plastic laminate required.
    c. Finish veneer-faced door Samples with same materials proposed for factory-finished doors.

4. Frames for light openings, 6 inches long, for each material, and finish required

5. Louver blade and frame sections, 6 inches (150 mm) long, for each material and finish specified.

6. Frames for light openings, 6 inches (150 mm) long, for each material, type, and finish required.

1.04 QUALITY ASSURANCE

A. Quality Assurance: Woodwork Institute (WI) Architectural Woodwork Standards & Quality Assurance Program.

1. All millwork and the installation thereof for this project shall be certified for compliance to the contract documents by a Woodwork Institute Director of Architectural Services.

2. Review and certification of Shop drawings prior to issuance to Architect

3. Issuance of WI Certified Compliance Certificate by WI

4. Certified Compliance stamp on cover of shop drawings by WI

5. Inspection of fabrication of millwork by WI personnel at casework/millwork shop

6. Inspection of installation of casework/millwork by WI personnel at project site.

7. Comply with inspection reports as supplied by WI personnel.

8. Millwork and/or installation found to be non-compliant (and not corrected) will be rejected.

9. All fees charged by the Woodwork Institute for their quality assurance compliance program are the responsibility of the millwork manufacturer and/or installer and shall be included in their Contract proposal.

B. Manufacturer Qualifications:

1. Submit WI compliance certificate. Provide original and one (1) copy to be submitted to the Architect.

2. Firm (woodwork manufacturer) with not less than 5 years of production experience similar to this Project, whose qualifications indicate the ability to comply with the requirements of this section.

3. The woodwork manufacturer must have at least one project in the past five (5) years where the value of the woodwork is within twenty percent (20%) of the cost of woodwork for this Project.

4. A manufacturer that is certified for chain of custody by an FSC-accredited certification body.

C. Installer Qualifications:

1. Submit WI compliance certificate. Provide original and one (1) copy to be submitted to the Architect.

2. Arrange for installation of finish carpentry by a firm that can demonstrate successful experience in installing finish cabinetry item similar in type and quality to those required for this Project.

3. An authorized representative who is trained and approved by manufacturer for installation of units required for this Project and who is a certified participant in WI's Quality Certification Program.

D. Source Limitations: Obtain flush wood doors through one source from a single manufacturer wherever possible.

E. Quality Standard: Standard: In addition to requirements specified, comply with WDMA I.S.1-A, latest edition, "Industry Standard for Architectural Wood Flush Doors'.

1. Fire Rated Wood Doors: Doors 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 at positive pressure according to NFPA 252 (neutral pressure at 40" above sill) or UL10C.

a. Oversize Fire Rated Door Assemblies: For units exceeding sizes of tested assemblies provide manufacturer's construction label, indicating compliance to independent 3rd party certification agency's procedure, except for size.

b. Temperature Rise Limit: Where required and at vertical exit enclosures (stairwell openings) and exit passageways, provide doors that have a maximum transmitted temperature end point of not more than 450 deg F above ambient after 30 minutes of standard fire test exposure.

c. Smoke Control Door Assemblies: Comply with NFPA 105.

1) Smoke "S" Label: Doors to bear "S" label, and include smoke and draft control gasketing applied to frame and on meeting stiles of pair doors.

2. Pre-Submittal Conference: Conduct conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier, Installer, and Contractor to review proper methods and procedures for receiving, handling, and installing flush wood doors.

F. SUBSTITUTIONS

1. All substitution requests must be submitted within the procedures and time frame as outlined in Division 1, General Requirements. Approval of products is at the discretion of the architect and his consultant.

G. MANUFACTURER QUALIFICATIONS

1. Manufacturer shall be a member in good standing of the Wood Door Manufacturer's Association (WDMA).

2. Obtain wood doors from a single manufacturer to ensure uniformity in quality of appearance and construction. All material supplied for this project to conform to WDMA I.S. 1A-97 for premium grade wood doors.

H. FIRE RATED DOORS

1. Project requires door assemblies and components that are compliant with positive pressure and S-label requirements. Specifications must be cross-referenced and coordinated with hardware and other door manufacturers to ensure that total opening engineering is compatible with UL10C Standard for Positive Pressure Fire Tests of Door Assemblies, and UBC 7-2, Fire Tests of Door Assemblies.

    a. Certification(s) of compliance shall be made available upon request by the Authority Having Jurisdiction.

2. A physical label to be permanently affixed to the fire door at an authorized facility. Furthermore, all 45, 60, and 90 minute label fire doors are to have manufacturer's standard laminated stiles for improved screw holding and split resistance capability.

    a. At stairwell enclosures, provide doors that have a temperature-rise rating of 450-degree F maximum in 30 minutes of fire exposure.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Protect doors during transit, storage, and handling to prevent damage, soiling, and deterioration. Doors are to be shipped from manufacturer in individual polybags, and shall be inspected immediately upon arrival at jobsite for any damage of defects.

B. Identify each door with individual opening numbers that correlate with designation system used on shop drawings and contract drawings for door, frames and hardware. Use only temporary, removable, or concealed markings.

C. Do not deliver or install doors until building is enclosed, wet-work is complete, and HVAC system is operating and will maintain temperature and relative humidity at occupancy level in storage and installation areas.

1.06 WARRANTY

A. Warranties shall be in addition to, and not a limitation of other rights the owner may have under the contract documents.

B. Submit written warranty on manufacturer's standard form signed by the manufacturer agreeing to replace or repair defective doors which have:

1. Delamination in any degree.

2. Warp or twist of 1/4" or more in any 3' x 6" x 7' plane of door face.

3. Telegraphing of stile, rail or core through face to cause surface variation in excess of 1/100" in any 3" spans.

C. Contractor shall replace or refinish doors where contractor's work contributed to rejection or voiding of manufacturer's warranty.

D. Solid core interior doors shall be warranted for the life of their installation.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Subject to compliance with requirements, provide flush wood doors by one of the manufacturers as listed.

2.02 DOORS

A. GENERAL REQUIREMENTS

1. Doors shall have premium grade A faces with manufacturer's standard five (5) ply construction; minimum 1/8" thick.

2. Faces shall be minimum 1/50" at 12% moisture content thick after finish sanding.

   a. Veneer Cut: Plain Sliced

   b. Face Assembly: Book Match, Running Match

   c. Stain Color: As selected by Manufacturer's Full Range.

   d. Veneer Species: Select White Birch

3. Doors shall have minimum 1" stiles on the hinge stile and 13/16" minimum on the lock stile; both stiles faces shall match the door veneer. Top and bottom rails shall be a minimum 13/16"; rails shall be mill option hardwood or structural composite lumber (SCL).

4. All fire rated doors shall be supplied to meet UL10C positive pressure standards for category "A" doors. All required intumescent seals shall be concealed into the edge of the door; frame applied intumescent seals are not acceptable.

5. All fire rated doors shall be supplied to meet UL10C positive pressure standards for category "B" doors. All required intumescent seals shall be supplied as specified in section 08 71 00 – Door Hardware.

B. NON RATED AND 20 MINUTE DOORS

1. Supply particleboard core complying with WDMA I.S. 1A and ANSI-A208.1, Grade 1-LD, bonded to the door faces, stiles and rails using a Type I adhesive. Components are to be assembled to meet or exceed 20 minute fire door specifications for UL10C fire test requirements.

a. Algoma: Super Novodor / FD 1/3

b. Eggers: PC5 / PC5-20

c. Graham: GPD PC5 / GPD PC5-20

d. Marshfield: DPC-1 / DFP-20

e. VT Industries: 5502

2. Supply engineered core complying with WDMA I.S. 1A, bonded to door faces, stiles and rails using a Type I adhesive. Components are to be assembled to meet or exceed 20 minute fire door specifications for UL10c fire test requirements. Door shall meet or exceed WDMA I.S. 1A Extra Heavy Duty performance standards.

   a. Algoma: FGFW

   b. Eggers: SCL5 / SCL5-20

   c. Graham: GPD EC5 / GPD EC5-20

   d. Marshfield: DCL-1 / DCL-20

   e. VT Industries: 5508

3. Provide LSL Timberstrand blocking at particleboard-core doors as follows to preclude the use of thru-bolts:

   a. Provide 5” top-rail blocking, at doors indicated to have closers.

   b. Provide 5” mid-rail blocking, at doors indicated to have exit devices.

C. FIRE RATED DOORS OVER 20 MINUTES

1. Supply fire resistive composite mineral core construction to provide the fire rating indicated, boned to door faces, stiles and rails using a Type I adhesive. Components are to be assembled to meet or exceed fire door specifications for UL10C fire test requirements.

   a. Algoma: FD

   b. Eggers: FGP

   c. Graham: GPD FD5

   d. Marshfield: DFM

   e. VT Industries: 5545/5511

2. For mineral-core doors, provide composite blocking with improved screw holding capability approved for use in doors of fire ratings indicated as necessary to eliminate need for through-bolting hardware and as follows:

    a. Provide 5” top-rail blocking.

    b. Provide 4 1/2” x 10” lock blocks.

    c. Provide 5” mid-rail blocking, at doors indicated to have exit devices.

3. At hinge stiles, provide manufacturer's standard laminated-edge construction with improved screw-holding capability and split resistance and with outer stile matching face veneer.

2.03 FACTORY FINISHING

A. Prefinish all wood doors at the factory. Finish as selected by architect from manufacturers full range of stain selection.

B. Prefinish all wood doors per WDMA I.S. 1A, Section G-15, Factory Finishing for Premium Grade factory finish systems.

C. Finish doors using three (3) coats of water-clear 100% solids, modified acrylic urethane, cured immediately with ultra-violet light.

D. Factory seal doors on all six (6) sides using manufacturer’s standard meeting these applications.

2.04 LIGHT FRAMES

A. Provide wood frames for light openings as follows:

1. Wood Species: Same species as door faces.

2. Profile: Manufacturer's standard shape.

3. Frames for Openings in Fire Doors: Wood frames and metal glazing clips approved for use in 20-minute fire-rated wood-core doors.

B. Provide manufacturer's standard wood veneered beads for fire doors that are approved for use in doors of fire rating indicated. Include concealed metal glazing clips where required for opening size and fire rating indicated.

C. Provide manufacturer's standard metal light frame formed of 18-gauge, cold-rolled steel sheet, factory primed and approved for use in doors of fire rating indicated.

2.05 FABRICATION

A. Factory fit doors to suit frame-opening sizes indicated, with the following uniform clearances and bevels, unless otherwise indicated:

1. Comply with clearance requirements of referenced quality standard for fitting. Comply with requirements of NFPA 80 for fire-rated doors.

B. Factory machine doors for hardware that is not surface applied. Locate hardware to comply with DHI-WDHS-3. Comply with final hardware schedules, door frame Shop Drawings, DHI A115-W series standards, and hardware templates.

1. Coordinate measurements of hardware mortises in metal frames to verify dimensions and alignment before factory machining.

2. Premachine metal astragals and formed-steel edges for hardware for pairs of fire-rated doors.

C. Cut and trim openings through doors to comply with applicable requirements of referenced standards for kind(s) of door(s) required.

1. Trim openings with moldings of material and profile indicated.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine installed door frames before hanging doors.

1. Verify that frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with plumb jambs and level heads.

2. Reject doors with defects.

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

3.02 INSTALLATION

A. For hardware installation, see Division 8 Section "Door Hardware."

B. Install wood doors to comply with manufacturer's written instructions, referenced quality standard and as indicated.

1. Install fire-rated doors in corresponding fire-rated frames according to NFPA 80.

C. Align factory fitted doors in frames for uniform clearance at each edge.

3.03 ADJUSTING AND PROTECTING

A. Rehang or replace doors that do not swing or operate freely.

B. Refinish or replace doors damaged during installation.

C. Protect doors as recommended by door manufacturer to ensure that wood doors are without damage or deterioration at the time of Substantial Completion.

END OF SECTION

SECTION 08 33 23 – OVERHEAD COILING DOORS

PART 1- GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Exterior Insulated Service Doors

2. Interior Counter doors

B. Related Sections:

1. Division 5 Section "Metal Fabrications" for miscellaneous steel supports.

1.03 PERFORMANCE REQUIREMENTS

A. Operation Cycles: Provide overhead coiling door components and operators capable of operating for not less than number of cycles indicated for each door. One operation cycle is complete when a door is opened from the closed position to the fully open position and returned to the closed position.

B. Structural Performance, Exterior Doors: Exterior overhead coiling doors shall withstand the wind loads, the effects of gravity loads, and loads and stresses within limits and under conditions indicated according to SEI/ASCE 7 and as indicated on structural drawings, sheet S001.

C. Wind Loads: As indicated on Structural Drawings, Basis of Design, Sheet S001.

D. Seismic Performance: As indicated on Structural Drawings, Basis of Design, Sheet S001.

1.04 SUBMITTALS

A. Product Data: For each type and size of overhead coiling door and accessory. Include the following:

1. Construction details, material descriptions, dimensions of individual components, profiles for slats, and finishes.
2. Rated capacities, operating characteristics, electrical characteristics, and furnished accessories.
3. Samples: For each exposed product and for each color and texture specified.
4. Maintenance Data: For overhead coiling doors to include in maintenance manuals.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for both installation and maintenance of units required for this Project.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Source Limitations: Obtain overhead coiling doors from single source from single manufacturer.

1. Obtain operators and controls from overhead coiling door manufacturer.

1.06 WARRANTY

A. Provide Rolling Steel Service doors and Rolling Steel Fire doors with limited 2 Year Warranty on defects in materials and workmanship on the door; excludes the counterbalance spring and finish.

B. Provide rolling steel Advanced Performance service doors with limited 5 Year Warranty on all doors system materials and workmanship.

C. Provide Aluminum Security Shutters, Model 523 with limited 2 Year Warranty on defects in materials and workmanship on the door and components. Provide Powder Coat Finish with a 2 years warranty against excessive fading, cracking, blistering, flaking or peeling.

PART 2 – PRODUCTS

2.01 EXTERIOR INSULATED SERVICE DOOR CURTAIN MATERIALS AND CONSTRUCTION

A. Door Curtains: Fabricate overhead coiling-door curtain of interlocking metal slats, designed to withstand wind loading indicated, in a continuous length for width of door without splices. Unless otherwise indicated, provide slats of thickness and mechanical properties recommended by door manufacturer for performance, size, and type of door indicated, and as follows:
   1 Insulation: Fill slats for insulated doors with manufacturer's standard thermal insulation complying with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, according to ASTM E 84-07. Enclose insulation completely within slat faces.
   2 Metal Interior Curtain-Slat Facing: Match metal of exterior curtain-slat face.

B. Steel Door Curtain Slats: Zinc-coated (galvanized), cold-rolled structural steel sheet; complying with ASTM A 653/A 653M, with G90 (Z275) zinc coating; nominal sheet thickness (coated) of 0.028 inch (0.71 mm) and as required to meet requirements.

C. Stainless-Steel Door Curtain Slats: ASTM A 666, Type 304; sheet thickness of 0.025 inch (0.64 mm) and as required to meet requirements.

D. Gasket Seal: Provide insulated slats with manufacturer's standard interior-to-exterior thermal break or with continuous gaskets between slats.

E. Bottom Bar for Service Doors: Manufacturer's standard continuous channel or tubular shape, fabricated from manufacturer's standard hot-dip galvanized steel, stainless steel, or aluminum extrusions to match curtain slats and finish.

F. Astragal for Interior Doors: Equip each door bottom bar with a replaceable, adjustable, continuous, compressible gasket of flexible vinyl, rubber, or neoprene as a cushion bumper.

G. Curtain Jamb Guides: Manufacturer's standard angles or channels and angles of same material and finish as curtain slats unless otherwise indicated, with sufficient depth and strength to retain curtain, to allow curtain to operate smoothly, and to withstand loading. Slot bolt holes for guide adjustment. Provide removable stops on guides to prevent overtravel of curtain.

2.02 INTERIOR COUNTER DOORS WITH SILL AND TRIM DOOR CURTAIN MATERIALS AND CONSTRUCTION

A. Face-of-wall mounted Frame, Hood, and Fascia for Counter Door: Welded sheet metal assembly of the following sheet metal:

1 Galvanized Steel: Nominal 0.064-inch thick, hot-dip galvanized steel sheet with G90 (Z275) zinc coating, complying with ASTM A 653/A 653M.
2 Stainless Steel: 0.062-inch thick stainless-steel sheet, Type 304, complying with ASTM A 666.

B. Bottom Bar for Counter Doors: Manufacturer's standard continuous channel or tubular shape, fabricated from manufacturer's standard hot-dip galvanized steel, stainless steel, or aluminum extrusions to match curtain slats and finish.

C. Endlocks for Counter Doors: Manufacturer's standard locks on not less than alternate curtain slats for curtain alignment and resistance against lateral movement.

D. Removable Posts and Jamb Guides for Counter Doors: Manufacturer's standard.

E. Curtain Jamb Guides: Manufacturer's standard angles or channels and angles of same material and finish as curtain slats unless otherwise indicated, with sufficient depth and strength to retain curtain, to allow curtain to operate smoothly, and to withstand loading. Slot bolt holes for guide adjustment. Provide removable stops on guides to prevent overtravel of curtain.

2.03 LOCKING DEVICES ON COUNTER DOORS

A. Locking Device Assembly: Fabricate with cylinder lock, spring-loaded dead bolt, operating handle, cam plate, and adjustable locking bars to engage through slots in tracks.
1 Lock Cylinders: Provide cylinders specified in Division 08 Section "Door Hardware." and keyed to building keying system.
2 Keys: Provide Two for each cylinder.

B. Emergency Chain Hoist Lock Keeper: Suitable for padlock.

C. Safety Interlock Switch: Equip power-operated doors with safety interlock switch to disengage power supply when door is locked.

2.04 CURTAIN ACCESSORIES

A. Push/Pull Handles: Equip each push-up-operated or emergency-operated door with lifting handles on each side of door, finished to match door.

1 Provide pull-down straps or pole hooks for doors more than 84 inches (2130 mm) high.

2 Weatherseals: Equip each exterior door with weather-stripping gaskets fitted to entire perimeter of door for a weathertight installation, unless otherwise indicated.

2.05 COUNTERBALANCING MECHANISM

A. General: Counterbalance doors by means of manufacturer's standard mechanism with an adjustable-tension, steel helical torsion spring mounted around a steel shaft and contained in a spring barrel connected to top of curtain with barrel rings. Use grease-sealed bearings or self-lubricating graphite bearings for rotating members.

B. Counterbalance Barrel: Fabricate spring barrel of manufacturer's standard hot-formed, structural-quality, welded or seamless carbon-steel pipe, of sufficient diameter and wall thickness to support rolled-up curtain without distortion of slats and to limit barrel deflection to not more than 0.03 in./ft. (2.5 mm/m) of span under full load.

C. Spring Balance: One or more oil-tempered, heat-treated steel helical torsion springs. Size springs to counterbalance weight of curtain, with uniform adjustment accessible from outside barrel. Secure ends of springs to barrel and shaft with cast-steel barrel plugs.

D. Torsion Rod for Counterbalance Shaft: Fabricate of manufacturer's standard cold-rolled steel, sized to hold fixed spring ends and carry torsional load.

E. Brackets: Manufacturer's standard mounting brackets of either cast iron or cold-rolled steel plate.

2.06 ELECTRIC DOOR OPERATORS

A. General: Electric door operator assembly of size and capacity recommended and provided by door manufacturer for door specified, with electric motor and factory-prewired motor controls, starter, gear-reduction unit, solenoid-operated brake, clutch, remote-control stations, control devices, integral gearing for locking door, and accessories required for proper operation.

1 Comply with NFPA 70.
2 Provide control equipment complying with NEMA ICS 1, NEMA ICS 2, and NEMA ICS 6, with NFPA 70 Class 2 control circuit, maximum 24 V, ac or dc.

B. Usage Classification: Electric operator and components capable of operating for not less than number of cycles per hour indicated for each door.

C. Electric Motors: Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements specified in Division 11 Section "Common Motor Requirements for Equipment" unless otherwise indicated.

1 Electrical Characteristics:
a Phase: Single phase.
b Volts: 115 V.
c Hertz: 60.

2. Motor Type and Controller: Reversible motor and controller (disconnect switch) for motor exposure indicated.
3. Motor Size: Large enough to start, accelerate, and operate door in either direction from any position, at a speed not less than 8 in./sec. (203 mm/s) and not more than 12 in./sec. (305 mm/s), without exceeding nameplate ratings or service factor.
4. Operating Controls, Controllers (Disconnect Switches), Wiring Devices, and Wiring: Manufacturer's standard unless otherwise indicated.

D. Obstruction Detection Device: Equip motorized door with indicated external automatic safety sensor capable of protecting full width of door opening. For non-fire-rated doors, activation of device immediately stops and reverses downward door travel.

1 Photoelectric Sensor: Manufacturer's standard system designed to detect an obstruction in door opening without contact between door and obstruction. Provide self-monitoring capability designed to interface with door operator control circuit to detect damage to or disconnection of sensing device.

E. Remote-Control Station: Momentary-contact, three-button control station with push-button controls labeled "Open," "Close," and "Stop."

1 Interior units, full-guarded, surface-mounted, heavy-duty type, with general-purpose NEMA ICS 6, Type 1 enclosure.
2 Exterior units, full-guarded, standard-duty, surface-mounted, weatherproof type, NEMA ICS 6, Type 4 enclosure, key operated.

F. Emergency Manual Operation: Equip each electrically powered door with capability for emergency manual operation. Design manual mechanism so required force for door operation does not exceed 25 lbf (111 N).

G. Emergency Operation Disconnect Device: Equip operator with hand-operated disconnect mechanism for automatically engaging manual operator and releasing brake for emergency manual operation while disconnecting motor without affecting timing of limit switch. Mount mechanism so it is accessible from floor level. Include interlock device to automatically prevent motor from operating when emergency operator is engaged.

H. Motor Removal: Design operator so motor may be removed without disturbing limit-switch adjustment and without affecting emergency manual operation.

2.07 EXTERIOR INSULATED SERVICE DOOR ASSEMBLY

A. Insulated Service Door: Overhead coiling door formed with curtain of interlocking metal slats.

1 Manufacturers: Basis of Design: Wayne Dalton Model 800C. Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following

a Cookson Company.
b Overhead Door Corporation.

2. Operation Cycles: Not less than 20,000.

3. Curtain R-value: 7.7-8 (U-factor of 0.125) as calculated by ASHRAE Handbook. Value shall not be below 7.

4. Door Curtain Material: Galvanized steel.

5. Door Curtain Slats: Flat profile slats of 3-inch center-to-center height.

   a Insulated-Slat Interior Facing: Metal

6. Curtain Jamb Guides: Galvanized steel with exposed finish matching curtain slats. Provide continuous integral wear strips (UHMW) to prevent metal-to-metal contact and to minimize operational noise.

7. Integral Frame, Hood, and Fascia: Galvanized steel.

   a Mounting: Face of wall, between jambs.

8. Locking Devices: Single-jamb side locking bars, operable from inside.

9. Electric Door Operator:
   a Usage Classification: Medium duty, up to 15 cycles per hour.
   b Motor Exposure: Interior. Check door schedule for mounting location to avoid conflict with structural column.
   c Emergency Manual Operation: Chain type.
   d Obstruction-Detection Device: Automatic photoelectric sensor.
   e Remote-Control Station: Interior.

10. Door Finish:

    a Powder-Coated Finish: Basis of design RAL 7042. Color as selected by Architect from full spectrum of RAL selections. Interior Curtain-Slat Facing to match finish of exterior curtain-slat face.

11. Air infiltration perimeter seal package: Door to be a compliant and listed ICC-EC rated air infiltration coiling door. Package shall include at a minimum: guide cover, guide cap, dual brush exterior guide seal, 3 inch lintel rubber seal, internal hood baffle and bottom astragal.

2.08 INTERIOR COUNTER DOOR ASSEMBLY

A. Insulated Service Door: Overhead coiling door formed with curtain of interlocking metal slats.

   1 Manufacturers: Basis of Design: Wayne Dalton Model 800C. Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following

      a Cookson Company.
      b Overhead Door Corporation.

B. Operation Cycles: Not less than 20,000.

C. Door Curtain Material: Galvanized steel.

D. Door Curtain Slats: Flat profile slats of 3-inch center-to-center height.

E. Curtain Jamb Guides: Galvanized steel with exposed finish matching curtain slats. Provide continuous integral wear strips to prevent metal-to-metal contact and to minimize operational noise.

F. Integral Frame, Hood, and Fascia: Galvanized steel.

1. Mounting: Face of wall, between jambs.

G. Locking Devices: Single-jamb side locking bars, operable from inside

H. Electric Door Operator:
   1 Usage Classification: Medium duty, up to 15 cycles per hour.
   2 Motor Exposure: Interior.
   3 Emergency Manual Operation: Chain type.
   4 Obstruction-Detection Device: Automatic photoelectric sensor.
   5 Remote-Control Station: Interior.

I. Door Finish:

   1 Powder-Coated Finish: Color as selected by Architect from full spectrum of RAL selections.

   2 Interior Curtain-Slat Facing: Match finish of exterior curtain-slat face.

2.09 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.10 STEEL AND GALVANIZED-STEEL FINISHES

A. Powder-Coat Finish: Basis of design RAL 7042. Color as selected by Architect from full spectrum of RAL selections. Interior Curtain-Slat to match finish of exterior curtain-slat face.

2.11 EXTERIOR COILING DOOR VISION SLATS

A. Vision Slats: 5”x3/4” spaced 1” apart. Provide the maximum number possible along the width of the door.

B. Location: Center vision slat vertically within curtain slat. Vision slats shall be placed in each curtain slat from 3’-0” to 6’-0” above finish floor.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates areas and conditions, with Installer present, for compliance with requirements for substrate construction and other conditions affecting performance of the Work.

B. Examine locations of electrical connections.

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

3.02 INSTALLATION

A. Install overhead coiling doors and operating equipment complete with necessary hardware, anchors, inserts, hangers, and equipment supports; according to manufacturer's written instructions and as specified.

B. Install overhead coiling doors, hoods, and operators at the mounting locations indicated for each door.

C. Accessibility: Install overhead coiling doors, switches, and controls along accessible routes in compliance with regulatory requirements for accessibility.

D. Smoke-Control Doors: Install according to NFPA 80 and NFPA 105.

3.03 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

B. Perform installation and startup checks according to manufacturer's written instructions.
C. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

3.04 ADJUSTING

A. Adjust hardware and moving parts to function smoothly so that doors operate easily, free of warp, twist, or distortion.

B. Lubricate bearings and sliding parts as recommended by manufacturer.

3.05 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain overhead coiling doors.

3.06 CLEANING

A. Clean curtain and components using non-abrasive materials and methods recommended by manufacturer.

B. Remove labels and visible markings.

C. Touch-up, repair or replace damaged products before Substantial Completion.

3.8 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

SECTION 08 36 10 - ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

A This Section includes the following:
1. Exterior aluminum-framed storefronts.
a) Glazing is retained mechanically with gaskets on four sides.
2. Exterior manual-swing aluminum doors.

B Related Sections include the following:
1. Division 7 Section "Joint Sealants" for installation of joint sealants installed with aluminum-framed systems and for sealants to the extent not specified in this Section.
2. Division 8 Section "Door Hardware" for hardware to the extent not specified in this Section.
3. Division 8 Section "Glazing" for glazing requirements to the extent not specified in this Section.

1.03 PERFORMANCE REQUIREMENTS

A General: Provide aluminum-framed systems, including anchorage, capable of withstanding, without failure, the effects of the following:
1. Structural loads.
2. Thermal movements.
3. Movements of supporting structure indicated on Drawings including, but not limited to, story drift and deflection from uniformly distributed and concentrated live loads.
4. Dimensional tolerances of building frame and other adjacent construction.
5. Failure includes the following:
a) Deflection exceeding specified limits.
b) Thermal stresses transferred to building structure.
c) Framing members transferring stresses, including those caused by thermal and structural movements, to glazing.
d) Noise or vibration created by wind and thermal and structural movements.
e) Loosening or weakening of fasteners, attachments, and other components.
f) Sealant failure.
g) Failure of operating units to function properly.

1.04 SUBMITTALS

A Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of product indicated.

B Shop Drawings: For aluminum-framed systems. Include plans, elevations, sections, details, and attachments to other work.
1. Include details of provisions for system expansion and contraction and for draining moisture occurring within the system to the exterior.
2. For entrances, include hardware schedule and indicate operating hardware types, functions, quantities, and locations.

C Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for aluminum-framed systems.

D Maintenance Data: For aluminum-framed systems to include in maintenance manuals.

1.05 QUALITY ASSURANCE

A Installer Qualifications: Capable of assuming engineering responsibility and performing work of this Section and who is acceptable to manufacturer.
1. Engineering Responsibility: Preparation of data for aluminum-framed systems including Shop Drawings based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project and submission of reports of tests performed on manufacturer's standard assemblies.

B Product Options: Information on Drawings and in Specifications establishes requirements for systems' aesthetic effects and performance characteristics. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction. Performance characteristics are indicated by criteria subject to verification by one or more methods including preconstruction testing, field testing, and in-service performance.
1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.

C Accessible Entrances: Comply with the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG)."

1.06 PROJECT CONDITIONS

A Field Measurements: Verify actual locations of structural supports for aluminum-framed systems by field measurements before fabrication and indicate measurements on Shop Drawings.

PART 2 - PRODUCTS

2.01 MANUFACTURERS: Basis of Design: Kawneer Trifab 451UT. Subject to compliance with requirements, provide products by the following or approved equivalent:
1. Kawneer.
2. Oldcastle Building Envelop
3. Vistawall Architectural Products.

2.02 MATERIALS

A Kawner, “Trifab 451UT, 2”x4.5”, center glass plane.

B Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.

2.03 FRAMING SYSTEMS

A Framing Members: Manufacturer's standard extruded-aluminum framing members of thickness required and reinforced as required to support imposed loads.

B Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.

C Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.
1. Where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration, use self-locking devices.
2. Reinforce members as required to receive fastener threads.

D Flashing: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials. Form exposed flashing from sheet aluminum finished to match framing and of sufficient thickness to maintain a flat appearance without visible deflection.

E Framing System Gaskets and Sealants: Manufacturer's standard recommended by manufacturer for joint type.

2.04 GLAZING SYSTEMS

A Glazing: As specified in Division 8 Section "Glazing."

B Glazing Gaskets: Manufacturer's standard compression types, replaceable, molded or extruded, that maintain uniform pressure and watertight seal.

C Spacers and Setting Blocks: Manufacturer's standard elastomeric types.

2.05 DOORS

A Doors: Manufacturer's standard glazed doors, for manual swing operation.
1. Door Construction: 1-3/4-inch (44.5-mm) overall thickness, with minimum 0.125-inch-(3.2-mm-) thick, extruded-aluminum tubular rail and stile members. Mechanically fasten corners with reinforcing brackets that are deep penetration and fillet welded or that incorporate concealed tie rods.
2. Door Design: Wide stile; 5-inch (127-mm) nominal width.
a) Accessible Doors: Smooth surfaced for width of door in area within 10 inches (255 mm) above floor or ground plane.
3. Glazing Stops and Gaskets: Beveled or Square, snap-on, extruded-aluminum stops and preformed gaskets.

B Door Hardware: As specified in Division 8 Section "Door Hardware."

2.06 ACCESSORY MATERIALS

A Joint Sealants: For installation at perimeter of aluminum-framed systems, as specified in Division 7 Section "Joint Sealants."

B Bituminous Paint: Cold-applied asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos, formulated for 30-mil (0.762-mm) thickness per coat.

2.07 FABRICATION

A Form aluminum shapes before finishing.

B Framing Members, General: Fabricate components that, when assembled, have the following characteristics:
1. Profiles that are sharp, straight, and free of defects or deformations.
2. Accurately fitted joints with ends coped or mitered.
3. Means to drain water passing joints, condensation occurring within framing members, and moisture migrating within the system to exterior.

4. Physical and thermal isolation of glazing from framing members.
5. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
6. Provisions for field replacement of glazing from exterior.
7. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.

C Mechanically Glazed Framing Members: Fabricate for flush glazing (without projecting stops).

D Door Frames: Reinforce as required to support loads imposed by door operation and for installing hardware.
1. At exterior doors, provide compression weather stripping at fixed stops.

E Doors: Reinforce doors as required for installing hardware.
1. At pairs of exterior doors, provide sliding weather stripping retained in adjustable strip mortised into door edge.
2. At exterior doors, provide weather sweeps applied to door bottoms.

F Hardware Installation: Factory install hardware to the greatest extent possible. Cut, drill, and tap for factory-installed hardware before applying finishes.

G After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

2.08 ALUMINUM FINISHES

A General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

C Finnish: Class II, Color Anodic Finish: AA-M12C22A41, color – Clear Anodized

PART 3 - EXECUTION

3.01 EXAMINATION

A Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.
1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A General:
1. Comply with manufacturer's written instructions.
2. Do not install damaged components.
3. Fit joints to produce hairline joints free of burrs and distortion.
4. Rigidly secure nonmovement joints.
5. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration.
6. Seal joints watertight, unless otherwise indicated.

B Metal Protection:

1. Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape or installing nonconductive spacers as recommended by manufacturer for this purpose.
2. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

C Install components to drain water passing joints, condensation occurring within framing members, and moisture migrating within the system to exterior.

D Set continuous sill members and flashing in full sealant bed as specified in Division 7 Section "Joint Sealants" and to produce weathertight installation.

E Install components plumb and true in alignment with established lines and grades, without warp or rack.

F Install glazing as specified in Division 8 Section "Glazing."

G Entrances: Install to produce smooth operation and tight fit at contact points.
1. Exterior Entrances: Install to produce tight fit at weather stripping and weathertight closure.
2. Field-Installed Hardware: Install surface-mounted hardware according to hardware manufacturers' written instructions using concealed fasteners to greatest extent possible.

H Install perimeter joint sealants as specified in Division 7 Section "Joint Sealants" and to produce weathertight installation.

I Erection Tolerances: Install aluminum-framed systems to comply with the following maximum tolerances:
1. Location and Plane: Limit variation from true location and plane to 1/8 inch in 12 feet (3 mm in 3.7 m); 1/4 inch (6 mm) over total length.
2. Alignment:
   a) Where surfaces abut in line, limit offset from true alignment to 1/16 inch (1.5 mm).
   b) Where surfaces meet at corners, limit offset from true alignment to 1/32 inch (0.8 mm).
3. Diagonal Measurements: Limit difference between diagonal measurement to 1/8 inch (3 mm).

3.03 FIELD QUALITY CONTROL

A Testing Agency: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.

B Testing Services: Testing and inspecting of representative areas to determine compliance of installed systems with specified requirements shall take place as follows and in successive stages as indicated on Drawings. Do not proceed with installation of the next area until test results for previously completed areas show compliance with requirements.
1. Water Spray Test: Before installation of interior finishes has begun, a minimum area of 75 feet (23 m) by 1 story of aluminum-framed systems designated by Architect shall be tested according to AAMA 501.2 and shall not evidence water penetration.

C Repair or remove work where test results and inspections indicate that it does not comply with specified requirements.

D Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.04 ADJUSTING

A Entrances: Adjust operating hardware for smooth operation according to hardware manufacturers' written instructions.

1. For doors accessible to people with disabilities, adjust closers to provide a 3-second closer sweep period for doors to move from a 70-degree open position to 3 inches (75 mm) from the latch measured to the leading door edge.

END OF SECTION

SECTION 08 71 00 – FINISH HARDWARE

PART 1 - GENERAL

1.01 SUMMARY:

A. Section Includes: Finish hardware except as otherwise specified or specifically omitted herein.

B. Specific Omissions: Hardware for the following is specified or indicated elsewhere.
1. Windows
2. Cabinets of all kinds, including open wall shelving and locks.
3. Toilet accessories of all kinds including grab bars.

1.02 SUBSTITUTIONS & SUBMITTALS:

A. Requests for substitutions must be made in writing 10 days prior to bid date to allow architect to issue an addendum. If proposing a substitute, submit that product data attached to one showing specified item and indicate savings to be made. No other substitutions will be allowed.

1. Items listed with no substitute manufactures have been requested by Owner to match existing.

B. SUBMITTALS: Submit six copies of schedule at earliest possible date prior to delivery of hardware. Organize schedule into "Hardware Sets" with an index of doors and heading, indicating complete designations of every item required for each door or opening. Include the following information:
1. Type, style, function, size, quantity and finish of each hardware item.
2. Name, part number and manufacturer of each item.
3. Fastenings and other pertinent information.
4. Location of hardware set cross referenced to indications on drawings both on floor plans and in door schedule.
5. Explanation of all abbreviations, symbols, and codes contained in schedule.
6. Mounting locations for hardware.
7. Door and frame sizes and materials.
8. Submit manufacture's technical data and installation instructions for the electronic hardware.
9. Catalog cuts.

C. Templates: Where required, furnish hardware templates to each fabricator of doors, frames and other work to be factory-prepared for the installation of hardware.

1.03 QUALITY ASSURANCE:

A. Qualifications:
1. Obtain each kind of hardware (latch and locksets, exit devices, hinges, and closers) from only one manufacturer, although several may be indicated as offering products complying with requirements.

2. Hardware supplier shall be a direct factory contract supplier who has in his employment a certified architectural hardware consultant (AHC) who is available

at all reasonable times during the course of the Work, and for project hardware consultation to the Owner, Architect, and Contractor.

B. Schedule Designations: Except as otherwise indicated, the use of one manufacturer's numeric designation system in schedules does not imply that another manufacturer's products will not be acceptable, unless they are not equal in design, size, weight, finish function, or other quality of significance. See 1.02 A for substitutions.

C. Exit Doors: Openable at all times from the inside without the use of a key or any special knowledge or effort.

D. Fire-rated openings: Provide hardware for fire-rated openings in compliance with NFPA Standard No. 80. This requirement takes precedence over other requirements for such hardware. Provide only such hardware which has been tested and listed by UL for the type and size of door required, and complies with the requirements of the door and the door frame labels. Latching hardware, door closers, ball bearing hinges, and seals are required whether or not listed in the Hardware schedule.
   1. Where panic exit devices are required on fire-rated doors, provide supplementary marking on door UL label on exit device indicating "Fire Exit Hardware."

1.04 DELIVERY, STORAGE, AND HANDLING:

A. Acceptance at the Site: Individually package each unit of finish hardware complete with proper fastening and appurtenances, clearly marked on the outside to indicate contents and specific locations in the Work.

B. Deliver packaged hardware items at the times and to the locations (shop or field) for installation, as directed by the Contractor.

1.05 PROJECT CONDITIONS:

A. Coordination: Coordinate hardware with other work. Furnish hardware items of proper design for use on doors and frames of the thickness, profile, swing security and similar requirements indicated, as necessary for the proper installation and function, regardless of omissions or conflicts in the information on the Contract Documents.

B. Upon request, check the Shop Drawings for doors and entrances to confirm that adequate provisions will be made for the proper installation of hardware.

1.06 WARRANTY:

A. Provide guarantee from hardware supplier as follows:
   1. Closers: Ten years: except electronic closers: Two years.
   2. Exit Devices & Locksets: Three years
   3. All other Hardware: Two years.

PART 2 - PRODUCTS

2.01 MANUFACTURERS:

A. See Drawings for Approved manufacturers.

B. Furnish all items of hardware required to complete the work in accordance with specifications and plans.

C. Carefully inspect Project for the extent of the finish hardware required to complete the Work. Where there is a conflict between these Specification and the existing hardware furnish finish hardware to specification.

2.02 MATERIALS:

A. Exterior: Mortise type Locks and Latches shall be heavy-duty with hinged, anti-friction, 3/4 inch throw latchbolt with anti-friction piece made of self lubricating stainless steel. Functions and design as indicated on the hardware groups. Deadbolt functions shall be 1 inch projection made of hardened stainless steel. both deadbolt and latchbolt are to extend into the case a minimum of 3/8 inch when fully extended. Furnish locksets and latchsets with sufficient curved strike lip to protect door trim. Provide locksets with 7-pin interchangeable core cylinders. All mortise cylinders shall have a concealed internal set screw for securing the cylinder to the lockset. The internal set screw will be accessible only by removing the core from the cylinder body. Locksets and latchsets to have self-aligning, thru-bolted trim. Auxiliary deadlatch to be made of one piece stainless steel, permanently lubricated. Lever handles must be of forged or cast brass, bronze or stainless steel construction. Levers which contain a hollow cavity are not acceptable. Spindle to be such that if forced it will twist first, then break, thus preventing forced entry. Levers to be operated with a roller bearing spindle hub mechanism.

Interior: All locksets and latchsets shall be extra-heavy-duty lever cylindrical with Best 7-pin interchangeable core. Lockset and Cores to be of the same manufacturer to maintain complete lockset warranty. Locks to have solid shank with no opening for access to keyed lever keeper. Keyed Lever to be protected by means of a break-away mechanism to prevent forced entry, when excessive torque is applied, a replaceable part will shear. Lock chassis must be through-bolted (outside of the lock chassis prep) to prevent rotation of chassis after installation. Lock manufacturer shall provide a three-year warranty, in writing, to the Owner, along with three copies of the lock service manual. Strikes shall be 16 gauge curved brass, bronze or stainless steel with a 1” deep box construction, and have sufficient length to clear trim and protect clothing.

1. Grade 1 Cylindrical Locks shall have minimum 9/16 throw. All deadbolts shall have 1-inch minimum throw.
2. Comply with requirements of local security ordinances.
3. Lock Series and Design: Best 35H7 15H Trim and 93K7 15D Trim.
   Cylinders: Best 7-Pin

B. Hinges: Outswinging exterior doors shall have non removable pin hinges. All hinge open widths shall be minimum, but of sufficient size to permit door to swing 180. Furnish hinges with five knuckles and flush bearing.

1. Furnish 3 hinges per leaf to 7 foot 6 inch height. Add one for each additional 30 inches in height or fraction thereof.
2. Provide hinges as listed in schedule.

C. Exit Devices: Furnish all sets at wood doors with sex bolts unless otherwise specified. Lever handle trim shall match locksets. All touch bar type devices shall have deadlocking latchbolt, stainless steel touchpads or vinyl covered pads and be non-handed. The unlatching force shall not exceed 15 pounds when applied in the direction of exit travel.

D. Surface Door Closers: Full rack and pinion type with removable non-ferrous cover. Provide sex bolts at all wood doors. Place closers inside building, stairs, and rooms. Closers shall be non-handed, non-sized and adjustable.

1. Provide multi-size 1 through 6 at all doors rated or not.
2. Flush transom offset brackets shall be used where parallel arm closers are listed for doors with fixed panels over.
3. Drop brackets are required at narrow head rails.

4. Set exterior doors closers to have 8.5 lbs maximum pressure to open, interior non-rated at 5 lbs, rated openings at 12 lbs.

E. Kickplates: Provide with four beveled edges, 10 inches high by width less 2 inches on single doors and 1 inch on pairs of doors. Furnish screws to match finish.

F. Seals: All seals shall be finished to match adjacent frame color. Seals shall be furnished as listed in schedule. Material shall be UL listed for labeled openings.

G. Screws: All exposed screws shall be Phillips head.

H. Silencers: Furnish silencers on all interior frames, 3 for single doors, 2 for pairs. Omit where any type of seals occur.

2.03 FINISH:

A. Generally to be BHMA 626 Satin Chrome.
1. Protection Plates, Push, Pulls shall be BHMA 630.

B. Spray door closers to match other hardware, unless otherwise noted.

C. Aluminum items shall be finished to match predominant adjacent material. Seals to coordinate with frame color.

2.04 KEYING REQUIREMENTS:

A. Provide construction cores and keys during the construction period. Construction control and operating keys and core shall not be part of the Owner's permanent keying system or furnished on the same keyway (or key section) as the Owner's permanent keying system. Permanent cores and keys (prepared according to the accepted keying schedule) will be furnished to the Owner (by the local Best factory representative) prior to occupancy.

B. All cylinders shall be Best 7-pin, interchangeable core.

C. Permanent keys and cores shall be stamped with the applicable key mark for identification. These visual key control marks or codes will not include the actual key cuts. Permanent keys will also be stamped "Do Not Duplicate."

D. Locksets and cylinders will be keyed, master keyed, and grand master keyed into the Owner’s system. Keying will be performed by Owner.

F. The Owner, or the Owner's agent, will install permanent cores and return the construction cores to the Best Access Systems Factory Representative. All Construction cores and keys remain the property of Best Access Systems.

G. Keying schedule: Submit three copies of separate detailed schedule indicating clearly how the Owner's final instructions on keying of locks has been fulfilled.

H. Keys: Brass
1. Stamping: Permanently inscribe each key with a visual key control number and include the following notation:
   a. Notation: Information to be furnished by Owner
2. Quantity: In addition to one extra key blank for each lock, provide the following:
   a. Cylinder Change Keys: Three
   b. Master Keys: Five

c. Grand Master Keys: Five
d. Great-Grand Master Keys: Five

PART 3 - EXECUTION

3.01 HARDWARE LOCATIONS:

A. Hinges:
1. Bottom Hinge: 10 inches from door bottom to bottom of hinge.
2. Top Hinge: 5 inches from door top to top of hinge.
3. Center Hinge: Center between top and bottom hinge.
4. Extra Hinge: 6 inches from bottom of top hinge to top of extra hinge.

B. Lock: 38 inches from finished floor to center of lever or knob.

C. Push Bar: 44 inches from bottom of door to center of bar.

D. Push Plate: 44 inches from bottom of door to center of plate.

E. Pull Plate: 42 inches from bottom of door to center of pull.

F. Exit Device: 39-13/16 inches from finished floor to center of pad.

G. Deadlock Strike: 44 inches from floor, centered.

3.02 INSTALLATION:

A. Install each hardware item per manufacturer's instructions and recommendations. Do not install surface mounted items until finishes have been completed on the substrate. Set units level, plumb and true to line and location. Adjust and reinforce the attachment substrate as necessary for proper installation and operation.
B. Installation shall conform to local governing agency security ordinance.

3.03 ADJUSTING:

A. Adjust and check each operating item of hardware and each door to ensure proper operation or function of every unit. Replace units which cannot be adjusted to operate freely and smoothly.

B. Inspection: Hardware supplier shall inspect all hardware furnished within 10 days of contractor's request and include with his guarantee a statement that this has been accomplished. Inspector or Contractor shall sign off the hardware as being complete and correctly installed and adjusted. Further corrections of defective material shall be the responsibility of his representative.

3.04 SCHEDULE OF FINISH HARDWARE:

A. Schedule of Finish Hardware on the Drawings indicates which Hardware Set is used with door.

END OF SECTION

SECTION 08 80 00 – GLAZING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section includes glazing for the following products and applications, including those specified in other Sections where glazing requirements are specified by reference to this Section:
   1. Windows and sidelites.
   2. Doors.
   3. Glazed entrances.
   4. Storefront framing.

B. Related Sections include the following:
   1. Division 8 Section "Aluminum-Framed Entrances and Storefronts."

1.03 DEFINITIONS

1.04 PERFORMANCE REQUIREMENTS

A. General: Provide glazing systems capable of withstanding normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, and installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.

B. Thermal Movements: Provide glazing that allows for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures acting on glass framing members and glazing components. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
   1. Temperature Change (Range): 120 deg F (48.8 deg C), ambient; 180 deg F (82.2 deg C), material surfaces.

1.05 SUBMITTALS

A. Product Data: For each glass product and glazing material indicated.

B. Samples: For the following products, in the form of 12-inch- (300-mm-) square Samples for glass.
   1. Each color of tinted float glass.

1.06 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has completed glazing similar in material, design, and extent to that indicated for this Project; whose work has resulted in glass installations with a record of successful in-service performance; and who employs glass installers for this Project who are certified under the National Glass Association Glazier Certification Program as Level 2 (Senior Glaziers) or Level 3 (Master Glaziers).

B. Installer Qualifications: An experienced installer who has completed glazing similar in material, design, and extent to that indicated for Project and whose work has resulted in construction with a record of successful in-service performance.

C. Fire-Rated Window Assemblies: 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 NFPA 257.

D. Safety Glass: Category II materials complying with testing requirements in 16 CFR 1201 and ANSI Z97.1.
   1. Subject to compliance with requirements, permanently mark safety glass with certification label of Safety Glazing Certification Council or another certification agency acceptable to authorities having jurisdiction.

E. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below, unless more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.
   1. GANA Publications: GANA'S "Glazing Manual" and "Laminated Glass Design Guide."
   2. SIGMA Publications: SIGMA TM-3000, "Vertical Glazing Guidelines," and SIGMA TB-3001, "Sloped Glazing Guidelines."

F. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of the following inspecting and testing agency:
   1. Insulating Glass Certification Council.
   2. Associated Laboratories, Inc.
   3. National Accreditation and Management Institute.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Protect glazing materials according to manufacturer's written instructions and as needed to prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

B. For insulating-glass units that will be exposed to substantial altitude changes, comply with insulating-glass manufacturer's written recommendations for venting and sealing to avoid hermetic seal ruptures.

1.08 PROJECT CONDITIONS

A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.

1.09 WARRANTY

A. General Warranty: 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. Manufacturer's Special Warranty on Coated-Glass Products: Written warranty, made out to Owner and signed by coated-glass manufacturer agreeing to furnish replacements for those coated-glass units that deteriorate within specified warranty period indicated below.
   1. Warranty Period: 10 years from date of Substantial Completion.

C. Manufacturer's Special Warranty on Insulating Glass: Written warranty, made out to Owner and signed by insulating-glass manufacturer agreeing to furnish replacements for insulating-glass units that deteriorate within specified warranty period indicated below.
   1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 PRODUCTS AND MANUFACTURERS

A. Products: Subject to compliance with requirements, provide one of the products indicated in schedules at the end of Part 3.

2.02 INSULATING GLASS

A. Insulating-Glass Units: Preassembled units consisting of sealed lites of glass separated by a dehydrated interspace and complying with ASTM E 774 for Class CBA units and with requirements specified in this Article and in the Insulating-Glass Schedule at the end of Part 3.
   1. Provide Kind HS (heat-strengthened) float glass in place of annealed glass where needed to resist thermal stresses induced by differential shading of individual glass lites and to comply with glass design requirements specified in "Performance Requirements" Article. Provide Kind FT (fully tempered) where safety glass is indicated.

B. Overall Unit Thickness and Thickness of Each Lite: Dimensions indicated in the Insulating-Glass Schedule at the end of Part 3 are nominal and the overall thicknesses of units are measured perpendicularly from outer surfaces of glass lites at unit's edge.

C. Sealing System: Dual seal, with primary and secondary sealants as follows:
   1. Manufacturer's standard sealants.

D. Spacer Specifications: Manufacturer's standard spacer material and construction.

E. Spacer Specifications: Manufacturer's standard spacer material and construction complying with the following requirements:
   1. Aluminum with mill or clear-anodized finish.
   2. Corner Construction: Manufacturer's standard corner construction.

2.03 GLAZING GASKETS

A. Dense Compression Gaskets: Molded or extruded gaskets of material indicated below, complying with standards referenced with name of elastomer indicated below, and of profile and hardness required to maintain watertight seal:
   1. Neoprene, ASTM C 864.
   2. EPDM, ASTM C 864.
   3. Silicone, ASTM C 1115.
   4. Thermoplastic polyolefin rubber, ASTM C 1115.
   5. Any material indicated above.

B. Soft Compression Gaskets: Extruded or molded, closed-cell, integral-skinned gaskets of material indicated below; complying with ASTM C 509, Type II, black; and of profile and hardness required to maintain watertight seal:
   1. Neoprene.
   2. EPDM.
   3. Silicone.
   4. Thermoplastic polyolefin rubber.
   5. Any material indicated above.

2.04 MISCELLANEOUS GLAZING MATERIALS

A. General: Provide products of material, size, and shape complying with referenced glazing standard, requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.

B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.

C. Setting Blocks: Elastomeric material with a Shore A durometer hardness of 85, plus or minus 5.

D. Spacers: Elastomeric blocks or continuous extrusions with a Shore A durometer hardness required by glass manufacturer to maintain glass lites in place for installation indicated.

E. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).

2.05 FABRICATION OF GLASS AND OTHER GLAZING PRODUCTS

A. Fabricate glass and other glazing products in sizes required to glaze openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing standard, to comply with system performance requirements.

B. Grind smooth and polish exposed glass edges.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine framing glazing, with Installer present, for compliance with the following:
1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
2. Presence and functioning of weep system.
3. Minimum required face or edge clearances.
4. Effective sealing between joints of glass-framing members.

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

3.02 PREPARATION

A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.

3.03 GLAZING, GENERAL

A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.

B. Glazing channel dimensions, as indicated on Drawings, provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances. Adjust as required by Project conditions during installation.

C. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass is glass with edge damage or

other imperfections that, when installed, could weaken glass and impair performance and appearance.

D. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction sealant-substrate testing.

E. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.

F. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

G. Provide spacers for glass lites where the length plus width is larger than 50 inches (1270 mm) as follows:
   1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
   2. Provide 1/8-inch (3-mm) minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.

H. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.

I. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.

J. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.

K. Square cut wedge-shaped gaskets at corners and install gaskets in a manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended by gasket manufacturer.

3.04 GASKET GLAZING (DRY)

A. Fabricate compression gaskets in lengths recommended by gasket manufacturer to fit openings exactly, with stretch allowance during installation.

B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.

C. Center glass lites in openings on setting blocks and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.

D. Install gaskets so they protrude past face of glazing stops.

3.05 PROTECTION AND CLEANING

A. Protect exterior glass from damage immediately after installation by attaching crossed streamers to framing held away from glass. Do not apply markers to glass surface. Remove nonpermanent labels, and clean surfaces.

B. Protect glass from contact with contaminating substances resulting from construction operations, including weld splatter. If, despite such protection, contaminating substances do come into contact with glass, remove them immediately as recommended by glass manufacturer.

C. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for build-up of dirt, scum, alkaline deposits, or stains; remove as recommended by glass manufacturer.

D. Remove and replace glass that is broken, chipped, cracked, abraded, or damaged in any way, including natural causes, accidents, and vandalism, during construction period.

E. Wash glass on both exposed surfaces in each area of Project not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended by glass manufacturer.

3.06 MONOLITHIC FLOAT-GLASS SCHEDULE

A. All glazing, except for door sidelites and pass-thru windows, shall be 1” insulated glass.

B. Uncoated Clear Float Glass: Where glass as designated below is indicated, provide Type I (transparent glass, flat), Class 1 (clear) glass lites complying with the following:
   1. Uncoated Clear Fully Tempered Float Glass: Kind FT (fully tempered).

C. Coated Tinted Float Glass: Where glass as designated below is indicated, provide Class 2 (tinted, heat-absorbing, and light-reducing) glass lites complying with the following:
   1. Tint Color: “Solar Grey" by PPG.
   2. Coated Tinted Fully Tempered Float Glass: Kind FT (fully tempered).

D. Low-E Coated Float Glass: Where glass as designated below is indicated, provide Class 2 (heat-absorbing, and light-reducing) glass lites complying with the following:

   1. Low-E coated Fully Tempered Float Glass: Kind FT (fully tempered).

END OF SECTION

SECTION 09 29 00 – GYPSUM BOARD ASSEMBLIES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section includes the following:
   1. Interior gypsum wallboard.
   2. Tile backing panels.

1.03 DEFINITIONS

A. Gypsum Board Terminology: Refer to ASTM C 11 for definitions of terms for gypsum board assemblies not defined in this Section or in other referenced standards.

1.04 SUBMITTALS

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

1.05 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: For gypsum board assemblies with fire-resistance ratings, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing and inspecting agency acceptable to authorities having jurisdiction.
   1. Fire-Resistance-Rated Assemblies: Indicated by design designations from GA-600, "Fire Resistance Design Manual."

B. Gypsum Board Finish Mockups: Before finishing gypsum board assemblies, install mockups of at least 100 sq. ft. (9 sq. m) in surface area to demonstrate aesthetic effects and qualities of materials and execution.
   1. Install mockups for the following applications:
      a) Surfaces indicated to receive textured paint finishes.
   2. Simulate finished lighting conditions for review of mockups.
   3. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in original packages, containers, or bundles bearing brand name and identification of manufacturer or supplier.

B. Store materials inside under cover and keep them dry and protected against damage from weather, direct sunlight, surface contamination, corrosion, construction traffic, and other causes. Stack gypsum panels flat to prevent sagging.

1.07 PROJECT CONDITIONS

A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written recommendations, whichever are more stringent.

PART 2 - PRODUCTS

2.01 INTERIOR GYPSUM WALLBOARD

A. Panel Size: Provide in maximum lengths and widths available that will minimize joints in each area and correspond with support system indicated.

B. Gypsum Wallboard: ASTM C 36.
   1. Type X (where indicated):
      a) Thickness: 5/8 inch (15.9 mm).
      b) Long Edges: Tapered.
      c) Location: As indicated .

2.02 RESTROOMS, JANITORIAL, STORAGE AREAS

A. Panel Size: Provide in maximum lengths and widths available that will minimize joints in each area and correspond with support system indicated.

B. Water-Resistant Gypsum Backing Board: ASTM C 630/C 630M.
   1. Core: 5/8 inch (15.9 mm), regular type.

C. Cementitious backer board for tile locations, Denshield or approved equal. “Greenboard” is not acceptable at tile installations.

2.03 TRIM ACCESSORIES

A. Interior Trim: ASTM C 1047.
   1. Material: Galvanized or aluminum-coated steel sheet, rolled zinc, plastic, or paper-faced galvanized steel sheet].
   2. Shapes:
      a) Cornerbead: Use at outside corners.
      b) L-Bead: L-shaped; exposed long leg receives joint compound; use where indicated.

2.04 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C 475.

B. Joint Tape:
   1. Interior Gypsum Wallboard: Paper.
   2. Tile Backing Panels: As recommended by panel manufacturer.

C. Joint Compound for Interior Gypsum Wallboard: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.
   1. Prefilling: At open joints and damaged surface areas, use setting-type taping compound.
   2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type taping compound.
      a) Use setting-type compound for installing paper-faced metal trim accessories.
   3. Fill Coat: For second coat, use setting-type, sandable topping compound.
   4. Finish Coat: For third coat, use setting-type, sandable topping compound.

D. Joint Compound for Tile Backing Panels:

1. Water-Resistant Gypsum Backing Board: Use setting-type taping and setting-type, sandable topping compounds.

2.05 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.

B. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.
1. Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch (0.84 to 2.84 mm) thick.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Contractor shall float, patch, repair, or skim existing wall surfaces as required, in order to achieve an acceptable wall substrate for the application of a new wall finish.

3.02 APPLYING AND FINISHING PANELS, GENERAL

A. Gypsum Board Application and Finishing Standards: ASTM C 840 and GA-216.

B. Install ceiling board panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in the central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.

C. Install gypsum panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch (1.5 mm) of open space between panels. Do not force into place.

D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.

E. Attach gypsum panels to steel studs so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.

F. Attach gypsum panels to framing provided at openings and cutouts.

G. Form control and expansion joints with space between edges of adjoining gypsum panels.

H. Cover both faces of steel stud partition framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.
1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. (0.7 sq. m) in area.
2. Fit gypsum panels around ducts, pipes, and conduits.
3. Where partitions intersect open concrete coffers, concrete joists, and other structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to

fit profile formed by coffers, joists, and other structural members; allow 1/4- to 3/8-inch- (6.4- to 9.5-mm-) wide joints to install sealant.

I. Isolate perimeter of non-load-bearing gypsum board partitions at structural abutments, except floors. Provide 1/4- to 1/2-inch- (6.4- to 12.7-mm-) wide spaces at these locations, and trim edges with U-bead edge trim where edges of gypsum panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.

J. Space fasteners in gypsum panels according to referenced gypsum board application and finishing standard and manufacturer's written recommendations.
   1. Space screws a maximum of 12 inches (304.8 mm) o.c. for vertical applications.

K. Space fasteners in panels that are tile substrates a maximum of 8 inches (203.2 mm) o.c.

3.03 PANEL APPLICATION METHODS

A. Single-Layer Application:
   1. On ceilings, apply gypsum panels before wall/partition board application to the greatest extent possible and at right angles to framing, unless otherwise indicated.
   2. On partitions/walls, apply gypsum panels vertically (parallel to framing) or horizontally (perpendicular to framing), unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.
      a) Stagger abutting end joints not less than one framing member in alternate courses of board.
      b) At stairwells and other high walls, install panels horizontally, unless otherwise indicated or required by fire-resistance-rated assembly.

B. Single-Layer Fastening Methods: Apply gypsum panels to supports with steel drill screws.

C. Tile Backing Panels:
   1. Water-Resistant Gypsum Backing Board: Install at showers, toilet, and locker rooms, and where indicated. Install with 1/4-inch (6.4-mm) gap where panels abut other construction or penetrations.
   2. Areas Not Subject to Wetting: Install standard gypsum wallboard panels to produce a flat surface except at showers, tubs, and other locations indicated to receive water-resistant panels.
   3. Where tile backing panels abut other types of panels in the same plane, shim surfaces to produce a uniform plane across panel surfaces.

3.04 INSTALLING TRIM ACCESSORIES

A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.

B. Control Joints: Install control joints according to ASTM C 840 and in specific locations approved by Architect for visual effect.

3.05 FINISHING GYPSUM BOARD ASSEMBLIES

A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.

B. Prefill open joints and damaged surface areas.

C. Apply joint tape over gypsum board joints, except those with trim having flanges not intended for tape.

D. Contractor shall install a new “orange peel” wall finish texture over the existing wall texture at all existing wall locations.

E. Contractor shall float, patch, repair, or skim existing wall surfaces as required, in order to achieve an acceptable wall substrate for the application of a new wall finish.

F. Gypsum Board Finish Levels: Finish panels to levels indicated below, according to ASTM C 840, for locations indicated:
   1. Level 1: Embed tape at joints in ceiling plenum areas, concealed areas, and where indicated, unless a higher level of finish is required for fire-resistance-rated assemblies and sound-rated assemblies.
   2. Level 4: Embed tape and apply separate first, fill, and finish coats of joint compound to tape, fasteners, and trim flanges at panel surfaces that will be exposed to view, unless otherwise indicated.

END OF SECTION

SECTION 09 30 00 – CERAMIC TILE

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section includes the following:
   1. Glazed porcelain floor tile.
   2. Glazed wall tile.
   3. Metal edge strips installed as part of tile installations.

1.03 PERFORMANCE REQUIREMENTS

A. Static Coefficient of Friction: For tile installed on walkway surfaces, provide products with the following values as determined by testing identical products per ASTM C 1028:
   1. Level Surfaces: Minimum 0.6 wet.

1.04 SUBMITTALS

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

B. Samples for Verification:
   1. Full-size units of each type and composition of tile and for each color and finish required.
   2. Full-size units of each type of trim and accessory.
   3. Metal edge strips in 6-inch (150-mm) lengths.

1.05 QUALITY ASSURANCE

A. Source Limitations for Tile: Obtain all from one source or producer.
   1. Obtain tile from same production run and of consistent quality in appearance and physical properties for each contiguous area.

B. Source Limitations for Setting and Grouting Materials: Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from a single manufacturer and each aggregate from one source or producer.

C. Source Limitations for Other Products: Obtain each of the following products specified in this Section through one source from a single manufacturer for each product:
   1. Joint sealants.
   2. Metal edge strips.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirement in ANSI A137.1 for labeling sealed tile packages.

B. Store tile and cementitious materials on elevated platforms, under cover, and in a dry location.

C. Store liquid latexes and emulsion adhesives in unopened containers and protected from freezing.

1.07 PROJECT CONDITIONS

A. Environmental Limitations: Do not install tile until construction in spaces is complete and ambient temperature and humidity conditions are maintained at the levels indicated in referenced standards and manufacturer's written instructions.

1.08 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Tile and Trim Units: Furnish quantity of full-size units equal to 3 percent of amount installed, for each type, composition, color, pattern, and size indicated.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply for product selection:
   1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the products specified.
   2. Basis-of-Design Product: The design for each tile type is based on the product named. Subject to compliance with requirements, provide either the named product or a comparable product by one of the other manufacturers specified.

2.02 PRODUCTS, GENERAL

A. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1, "Specifications for Ceramic Tile," for types, compositions, and other characteristics indicated.
   1. Provide tile complying with Standard grade requirements, unless otherwise indicated.
   2. For facial dimensions of tile, comply with requirements relating to tile sizes specified in Part 1 "Definitions" Article.

B. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI standards referenced in "Setting and Grouting Materials" Article.

C. Factory Blending: For tile exhibiting color variations within ranges selected during Sample submittals, blend tile in factory and package so tile units taken from one package show same range in colors as those taken from other packages and match approved Samples.

2.03 TILE PRODUCTS

A. Manufacturers: As indicated on Drawings, color to be selected by Architect from manufacturer’s full range of selections.

B. Unglazed Ceramic Floor Tile (restrooms): As indicated on Drawings, color to be selected by Architect from manufacturer’s full range of selections.

C. Glazed Wall Tile: As indicated on Drawings, color to be selected by Architect from manufacturer’s full range of selections.

D. Glazed Ceramic Floor Tile: As indicated on Drawings, color to be selected by Architect from manufacturer’s full range of selections.

E. Glazed Wall Tile Trim Units: Matching characteristics of adjoining flat tile and coordinated with sizes and coursing of adjoining flat tile where applicable. Provide shapes as follows, selected from manufacturer's standard shapes:
   1. Base for Thin-Set Mortar Installations: Restroom locations shall have a coved base. Schluter Dilex – AHK.
   2. Wainscot Cap for Thin-Set Mortar Installations: Schluter Reno – U, EBU100.
   3. Wainscot Cap for Flush Conditions: Schluter Reno – U, EBU100.
   4. External Corners for Thin-Set Mortar Installations: Field-butted square corners.
   5. Internal Corners: Field-butted square corners except with coved base and cap angle pieces designed to fit with stretcher shapes.

2.04 SETTING AND GROUTING MATERIALS

A. Available Manufacturers:
   1. Custom Building Products.
   2. DAP, Inc.
   3. LATICRETE International Inc.
   4. MAPEI Corporation.

B. Organic Adhesive: ANSI A136.1, Type I.

C. Standard Sanded Cement Grout: ANSI A118.6, color as indicated.

2.05 ELASTOMERIC SEALANTS

A. Colors: Provide colors of exposed sealants to match colors of grout in tile adjoining sealed joints, unless otherwise indicated.

B. One-Part, Mildew-Resistant Silicone Sealant: ASTM C 920; Type S; Grade NS; Class 25; Uses NT, G, A, and, as applicable to nonporous joint substrates indicated, O; formulated with fungicide, intended for sealing interior ceramic tile joints and other nonporous substrates that are subject to in-service exposures of high humidity and extreme temperatures.
   1. Available Products:
      1. Dow Corning Corporation; Dow Corning 786.
      2. GE Silicones; Sanitary 1700.
      3. Pecora Corporation; Pecora 898 Sanitary Silicone Sealant.
      4. Tremco, Inc.; Tremsil 600 White.

2.06 MISCELLANEOUS MATERIALS

A. Trowelable Underlayments and Patching Compounds: Latex-modified, portland cement-based formulation provided or approved by manufacturer of tile-setting materials for installations indicated.

B. Metal Edge Strips: Angle or L-shape, height to match tile and setting-bed thickness, metallic or combination of metal and PVC or neoprene base, designed specifically for flooring applications, stainless steel; ASTM A 666, 300 Series exposed-edge material.

C. Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.

D. Grout Sealer: Manufacturer's standard silicone product for sealing grout joints that does not change color or appearance of grout.
   1. Available Products:

1. Bonsal, W. R., Company; Grout Sealer.
2. Bostik; CeramaSeal Grout Sealer.
3. Custom Building Products; Surfaceguard Grout Sealer.
4. MAPEI Corporation; KER 003, Silicone Spray Sealer for Cementitious Tile Grout.
5. Summitville Tiles, Inc.; SL-15, Invisible Seal Penetrating Grout and Tile Sealer.

2.07 MIXING MORTARS AND GROUT

A. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions.

B. Add materials, water, and additives in accurate proportions.

C. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

2.08 UNCOUPLING MEMBRANE

A. Basis of Design: Schluter-DITRA

1. Description: 1/8" (3 mm) thick, orange, high-density polyethylene membrane with a grid structure of 1/2" x 1/2" (12 mm x 12 mm) square cavities, each cut back in a dovetail configuration, and a polypropylene anchoring fleece laminated to its underside. Conforms to definition for uncoupling membranes in the Tile Council of North America Handbook for Ceramic Tile Installation; and meets or exceeds the requirements of the “American national standard specifications for load bearing, bonded, waterproof membranes for thin-set ceramic tile and dimension stone installation A118.10,” and is listed by cUPC®, and is evaluated by ICC-ES (see Report No. ESR-2467 and PMG 1204).

2. Waterproofing seaming membrane: a. Provide with Schluter®-KERDI-BAND Seams and Corners material 0.004" (4 mil) thick, orange polyethylene membrane, with polypropylene fleece laminated on both sides.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of installed tile.
1. Verify that substrates for setting tile are firm; dry; clean; free of oil, waxy films, and curing compounds; and within flatness tolerances required by referenced ANSI A108 Series of tile installation standards for installations indicated.
2. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed before installing tile.
3. Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust joint locations in consultation with Architect.

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

3.02 PREPARATION

A. Remove coatings, including curing compounds and other substances that contain soap, wax, oil, or silicone, that are incompatible with tile-setting materials.

B. Blending: For tile exhibiting color variations within ranges selected during Sample submittals, verify that tile has been factory blended and packaged so tile units taken from one package show same range of colors as those taken from other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.

C. Contractor shall grind, patch, float the floor substrate as required to create a level flooring surface.

3.03 INSTALLATION, GENERAL

A. ANSI Tile Installation Standards: Comply with parts of ANSI A108 Series "Specifications for Installation of Ceramic Tile" that apply to types of setting and grouting materials and to methods indicated in ceramic tile installation schedules.

B. TCA Installation Guidelines: TCA's "Handbook for Ceramic Tile Installation." Comply with TCA installation methods indicated in ceramic tile installation schedules.

C. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions, unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.

D. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.

E. Jointing Pattern: Lay tile in grid pattern, unless otherwise indicated. Align joints when adjoining tiles on floor, base, walls, and trim are same size. Lay out tile work and center tile fields in both directions in each space or on each wall area. Adjust to minimize tile cutting. Provide uniform joint widths, unless otherwise indicated.
   1. For tile mounted in sheets, make joints between tile sheets same width as joints within tile sheets so joints between sheets are not apparent in finished work.

F. Lay out tile wainscots to next full tile beyond dimensions indicated.

G. Expansion Joints: Locate expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles.
   1. Locate joints in tile surfaces directly above joints in concrete substrates.
   2. Prepare joints and apply sealants to comply with requirements in Division 7 Section "Joint Sealants."

H. Grout tile to comply with requirements of the following tile installation standards:
   1. For ceramic tile grouts (sand-portland cement; dry-set, commercial portland cement; and latex-portland cement grouts), comply with ANSI A108.10.

I. Moisture Testing:
   1. Perform anhydrous calcium chloride test, ASTM F 1869 and ASTM 2170. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. (1.36 kg of water/92.9 sq. m) in 24 hours.
   2. Perform concrete pH Test: Perform pH tests on concrete floors regardless of the age or grade level. If the pH is greater than 10, it must be neutralized prior to beginning the installation.

3. Perform tests recommended by manufacturer and submit test results to Architect. Proceed with installation only after substrates pass testing.
4. In the event that moisture vapor emissions rate and pH levels are exceeded., the Contractor, at his expense, shall install a barrier coat and moisture sealer, “ARDEX MC RAPID”. Contractor shall apply per manufacturer’s instructions, prior to installation of the flooring material.

3.04 FLOOR TILE INSTALLATION

A. General: Install tile to comply with requirements in the Floor Tile Installation Schedule, including those referencing TCA installation methods and ANSI A108 Series of tile installation standards.

B. Joint Widths: Per manuf. Recommendation.

C. Metal Edge Strips: Install at locations indicated or where exposed edge of tile flooring meets carpet or other flooring that finishes flush with top of tile.

D. Grout Sealer: Apply grout sealer to grout joints according to grout-sealer manufacturer's written instructions. As soon as grout sealer has penetrated grout joints, remove excess sealer and sealer that has gotten on tile faces by wiping with soft cloth.

3.05 WALL TILE INSTALLATION

A. Install types of tile designated for wall installations to comply with requirements in the Wall Tile Installation Schedule, including those referencing TCA installation methods and ANSI setting-bed standards.

B. Joint Widths: Install tile on walls with 1/16 inch joint widths:

3.06 CLEANING AND PROTECTING

A. Cleaning: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.
   1. Clean grout smears and haze from tile according to tile and grout manufacturer's written instructions, but no sooner than 10 days after installation. Use only cleaners recommended by tile and grout manufacturers and only after determining that cleaners are safe to use by testing on samples of tile and other surfaces to be cleaned. Protect metal surfaces and plumbing fixtures from effects of cleaning. Flush surfaces with clean water before and after cleaning.
   2. Remove temporary protective coating by method recommended by coating manufacturer that is acceptable to tile and grout manufacturer. Trap and remove coating to prevent it from clogging drains.

B. When recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile walls and floors. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear.

C. Prohibit foot and wheel traffic from tiled floors for at least seven days after grouting is completed.

D. Before final inspection, remove protective coverings and rinse neutral cleaner from tile surfaces.

3.07 FLOOR TILE INSTALLATION SCHEDULE

A. Tile Installation: Interior floor installation on over concrete slab, MegaFlex Crack Prevention Mortar set; TCA F115 and ANSI A108.5.

1. Tile Type: Glazed porcelain floor tile.
2. Grout: Standard sanded cement grout.

3.08 WALL TILE INSTALLATION SCHEDULE

A. Tile Installation: Interior wall installation over cementitious backer board, DensShield, or approved equal, on metal studs; organic adhesive; TCA W242 and ANSI A108.4.
   1. Tile Type: Glazed wall tile.
   2. Grout: Standard non-sanded cement grout.

END OF SECTION

SECTION 09 51 10 – ACOUSTICAL PANEL CEILINGS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:
   1. Acoustical ceiling panels
   2. Exposed grid suspension system
   3. Wire hangers, fasteners, main runners, cross tees, and wall angle moldings
   4. Perimeter Trim

1.03 DEFINITIONS

A. AC: Articulation Class.

B. CAC: Ceiling Attenuation Class.

C. LR: Light Reflectance coefficient.

D. NRC: Noise Reduction Coefficient.

1.04 SUBMITTALS

A. Samples for Initial Selection: For components with factory-applied color finishes.

B. Samples for Verification: For each component indicated and for each exposed finish required, prepared on Samples of size indicated below.
   1. Acoustical Panel: Set of 6-inch- (150-mm-) square Samples of each type, color, pattern, and texture.
   2. Exposed Suspension System Members, Moldings, and Trim: Set of 12-inch- (300-mm-) long Samples of each type, finish, and color.

1.05 QUALITY ASSURANCE

A. Acoustical Testing Agency Qualifications: An independent testing laboratory, or an NVLAP-accredited laboratory, with the experience and capability to conduct the testing indicated, as documented according to ASTM E 548. NVLAP-accredited laboratories must document accreditation, based on a "Certificate of Accreditation" and a "Scope of Accreditation" listing the test methods specified.

B. Source Limitations:
   1. Surface-Burning Characteristics: Provide acoustical panels with the following surface-burning characteristics complying with ASTM E 1264 for Class A materials as determined by testing identical products per ASTM E 84:
      a) Smoke-Developed Index: 450 or less.

C. Seismic Standard: Provide acoustical panel ceilings designed and installed to withstand the effects of earthquake motions according to the following:
   1. Standard for Ceiling Suspension Systems Requiring Seismic Restraint: Comply with ASTM E 580.
   2. UBC Standard 25-2, "Metal Suspension Systems for Acoustical Tile and for Lay-in Panel Ceilings."

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver acoustical panels, suspension system components, and accessories to Project site in original, unopened packages and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.

B. Before installing acoustical panels, permit them to reach room temperature and a stabilized moisture content.

C. Handle acoustical panels carefully to avoid chipping edges or damaging units in any way.

1.07 PROJECT CONDITIONS

A. Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.
   1. Pressurized Plenums: Operate ventilation system for not less than 48 hours before beginning acoustical panel ceiling installation.

1.08 COORDINATION

A. Coordinate layout and installation of acoustical panels and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

1.09 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Acoustical Ceiling Panels: Full-size panels equal to 2.0 percent of quantity installed.
   2. Suspension System Components: Quantity of each exposed component equal to 2.0 percent of quantity installed.

PART 2 - PRODUCTS

2.01 ACOUSTICAL PANELS, GENERAL

A. Acoustical Panel Standard: Provide manufacturer's standard panels of configuration indicated that comply with ASTM E 1264 classifications as designated by types, patterns, acoustical ratings, and light reflectances, unless otherwise indicated.
   1. Mounting Method for Measuring NRC: Type E-400; plenum mounting in which face of test specimen is 15-3/4 inches (400 mm) away from test surface per ASTM E 795.

B. Acoustical Panel Colors and Patterns: Match appearance characteristics indicated for each product type.

1. Where appearance characteristics of acoustical panels are indicated by referencing pattern designations in ASTM E 1264 and not manufacturers' proprietary product designations, provide products selected by Architect from each manufacturer's full range that comply with requirements indicated for type, pattern, color, light reflectance, acoustical performance, edge detail, and size.

2.02 ACOUSTICAL CEILING UNITS.

A. Products:
   1. Basis of design shall match existing ceiling tile and is based upon the following: Armstrong Ceilings; **Ultima 2x2x1**.
      1. Surface Texture: Fine
      2. Composition: Mineral Fiber
      3. Color: White
      4. Size: 24 inches x 24 inches
      5. Edge Profile: Beveled Tegular 15/16IN for interface with Prelude XL 15/16" Exposed Tee grid.
      6. Noise Reduction Coefficient(NRC): 0.75 ASTM C 423; Classified with UL label on product carton.
      7. Ceiling Attenuation Class (CAC) : 35 ASTM C 1414; Classified with UL label on product carton.
      8. Flame Spread: ASTM E 1264; Class A (UL)
      9. Light Reflectance White Panel: 0.90, ASTM E 1477.
      10. Dimensional Stability: HumiGuard Plus
      11. Recycle Content: Post-Consumer - 0% - 1% Pre-Consumer Waste - 75% - 76%
      12. Acceptable Product: Ultima Tegular, 1914, as manufactured by Armstrong World Industries

2.03 METAL SUSPENSION SYSTEMS, GENERAL

A. Metal Suspension System Standard: Basis of design shall match exiting and is based upon Armstrong Prelude XL 15/16”. Provide manufacturer's standard direct-hung metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable requirements in ASTM C 635.

B. Finishes and Colors, General: Match existing color. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes. Provide manufacturer's standard factory-applied finish for type of system indicated.

C. Attachment Devices: Size for five times the design load indicated in ASTM C 635, Table 1, "Direct Hung," unless otherwise indicated.
   1. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hangers of type indicated, and with capability to sustain, without failure, a load equal to 10 times that imposed by ceiling construction, as determined by testing per ASTM E 1190, conducted by a qualified testing and inspecting agency.

D. Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:
   1. Zinc-Coated Carbon-Steel Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper.
   2. Nickel-Copper-Alloy Wire: ASTM B 164, nickel-copper-alloy UNS No. N04400.
   3. Size: Select wire diameter so its stress at three times hanger design load (ASTM C 635, Table 1, "Direct Hung") will be less than yield stress of wire, but provide not less than 0.106-inch- (2.69-mm-) diameter wire.

E. Seismic Struts: Manufacturer's standard compression struts designed to accommodate seismic forces.

F. Seismic Clips: Manufacturer's standard seismic clips designed and spaced to secure acoustical panels in-place.

2.04 METAL SUSPENSION SYSTEM FOR ACOUSTICAL PANEL CEILING.

A General: ASTM C635, commercial quality pretreated and painted hot-dipped galvanized cold-rolled steel, exposed surfaces prefinished in manufacturer's standard corrosion resistant enamel paint finish; color: Flat White #050 or as selected from manufacturer's standard colors.

B Available Systems

1. Armstrong Ceilings: "Prelude XL 15/16” Exposed Tee "

C Suspension System Components:

1. Main Tees: UL Classified **Heavy Duty** Classification; Double-web G30 hot-dipped galvanized painted steel; 1-25/32" high; Box Profile; 9/16" wide slotted grid system with ¼” reveal; notched 24” o.c. / c.t. hole at 12” o.c.; mitered intersections.
2. Cross Tees :
   a. 1-25/32" high; Double-web G30 hot-dipped galvanized painted steel; Box Profile; 9/16” wide slotted grid system with ¼” reveal; no notch.
   b Main tees and cross tees shall be positively locked, yet shall be removable without the use of tools.

D Accessories:

1. Wall Molding Available Products:

a Angle Wall Molding: Angle shape; 7/8" mounting flange by minimum 7/8" face flange; hemmed edges; exposed surface pre-finished to match suspension system components
   1) Inside Corner: Field-mitered joints at wall molding.
   2 Inside Corner: Prefabricated corner cap; formed to 90° angle; hemmed edge; size and finish to match wall molding.
   3 Outside Corner: Prefabricated corner cap; formed to 90° angle; hemmed edge; size and finish to match wall molding.
      a Available Products: Armstrong 7800

2. Attachment clip for tee to wall molding
   a Available Products: BERC2
      1) Alternate to 2" wall molding, stabilizer bars, and perimeter wires
      2 Contractor to verify acceptance by local code officials prior to installation

E Suspension System Attachment devices:

A. Hanger Wire: Galvanized carbon steel; soft temper; pre-stretched; yield stress load at least three times the design load but not less than 12-gauge.

F Suspension System Warranty: When used with a USG acoustical ceiling panel, this suspension system has a Lifetime 30 year warranty that it shall be free from the occurrence of 50% red rust. When used without a USG acoustical ceiling panel, the period of warranty is 10 years.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, including structural framing to which acoustical panel ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of acoustical panel ceilings.

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

3.02 PREPARATION

A. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders, and comply with layout shown on reflected ceiling plans.

3.03 INSTALLATION, GENERAL

A. General: Install acoustical panel ceilings to comply with UBC Standard 25-2 and seismic requirements indicated, per manufacturer's written instructions.

B. Suspend ceiling hangers from building's structural members and as follows:
   1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
   2. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
   3. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.
   4. Secure wire hangers to ceiling suspension members and to supports above with a minimum of three tight turns. Connect hangers directly either to structures or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
   5. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, post-installed mechanical or adhesive anchors, or power-actuated fasteners that extend through forms into concrete.
   6. Do not attach hangers to steel deck tabs.
   7. Space hangers not more than 48 inches (1200 mm) o.c. along each member supported directly from hangers, unless otherwise indicated; provide hangers not more than 8 inches (200 mm) from ends of each member.

C. Secure bracing wires to ceiling suspension members and to supports with a minimum of four tight turns. Suspend bracing from building's structural members as required for hangers, without attaching to permanent metal forms, steel deck, or steel deck tabs. Fasten bracing wires into concrete with cast-in-place or post-installed anchors.

D. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.
   1. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.

2. Screw attach moldings to substrate at intervals not more than 16 inches (400 mm) o.c. and not more than 3 inches (75 mm) from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet (3.2 mm in 3.66 m). Miter corners accurately and connect securely.
3. Do not use exposed fasteners, including pop rivets, on moldings and trim.

E. Install suspension system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.

F. Install acoustical panels with undamaged edges and fit accurately into suspension system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide a neat, precise fit.
1. Arrange directionally patterned acoustical panels as follows:
a) As indicated on reflected ceiling plans.
b) Install panels with pattern running in one direction parallel to long axis of space.
2. For square-edged panels, install panels with edges fully hidden from view by flanges of suspension system runners and moldings.
3. For reveal-edged panels on suspension system runners, install panels with bottom of reveal in firm contact with top surface of runner flanges.
4. Paint cut edges of panel remaining exposed after installation; match color of exposed panel surfaces using coating recommended in writing for this purpose by acoustical panel manufacturer.

3.04 CLEANING

A. Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension system members. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION

SECTION 09 65 19 – RESILIENT WALL BASE

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section includes the following:
   1. Static dissipative tile (SDT).
   2. Resilient wall base and accessories.

1.03 SUBMITTALS

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

B. Samples for Verification: Full-size units of each color and pattern of resilient floor tile required.
   1. Resilient Wall Base and Accessories: Manufacturer's standard-size Samples, but not less than 12 inches (300 mm) long, of each resilient product color and pattern required.

C. Maintenance Data: For resilient products to include in maintenance manuals.

1.04 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: Provide products identical to those tested for fire-exposure behavior per test method indicated by a testing and inspecting agency acceptable to authorities having jurisdiction.

B. Perform moisture test of concrete floor slab in accordance with this section.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F (10 deg C) or more than 90 deg F (32 deg C). Store tiles on flat surfaces.

1.06 PROJECT CONDITIONS

A. Maintain temperatures within range recommended by manufacturer, but not less than 70 deg F (21 deg C) Insert temperature or more than 95 deg F (35 deg C) Insert temperature, in spaces to receive floor tile during the following time periods:
   1. 48 hours before installation.
   2. During installation.
   3. 48 hours after installation.

B. After postinstallation period, maintain temperatures within range recommended by manufacturer, but not less than 55 deg F (13 deg C) Insert temperature or more than 95 deg F (35 deg C) Insert temperature.

C. Close spaces to traffic during floor covering installation.

D. Close spaces to traffic for 48 hours after floor covering installation.

E. Install resilient products after other finishing operations, including painting, have been completed.

1.07 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Floor Tile: Furnish 1 box for every 50 boxes or fraction thereof, of each type, color, and pattern of floor tile installed.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Products: Subject to compliance with requirements, provide one of the products listed in other Part 2 articles.

2.02 COLORS AND PATTERNS

A. Colors and Patterns: As selected by Architect from manufacturer's full range. Bidders shall assume for bidding purposes a random floor pattern of 4 colors throughout the facility. Pattern shall be as selected by Architect.

2.03 RESILIENT WALL BASE

A. Wall Base: ASTM F 1861.
   1. Armstrong World Industries, Inc.
   2. Azrock Commercial Flooring, DOMCO.
   3. Burke Mercer Flooring Products.
   4. Marley Flexco (USA), Inc.
   5. Roppe Corporation.

B. Style: Cove (with top-set toe).

C. Minimum Thickness: 0.125 inch (3.2 mm).

D. Height: 6 inches (102 mm).

E. Lengths: Coils in manufacturer's standard length.

F. Outside Corners: Premolded.

G. Inside Corners: Premolded.

H. Surface: Smooth.

2.04 RESILIENT MOLDING ACCESSORY

A. Description: Carpet edge for glue-down applications.
   1. Burke Mercer Flooring Products.
   2. Marley Flexco (USA), Inc.
   3. Roppe Corporation.

B. Material: Vinyl.

C. Profile and Dimensions: As indicated.

2.05 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic cement based formulation provided or approved by resilient product manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by manufacturer to suit resilient products and substrate conditions indicated.

C. Metal Edge Strips: Extruded aluminum with mill finish of width shown, of height required to protect exposed edges of tiles, and in maximum available lengths to minimize running joints.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for installation tolerances, moisture content, and other conditions affecting performance.
   1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.
   2. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Prepare substrates according to manufacturer's written recommendations to ensure adhesion of resilient products.

B. Concrete Substrates: Prepare according to ASTM F 710.
   1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
   2. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer. Proceed with installation only after substrates pass testing.
   3. Moisture Testing:
      a) Perform anhydrous calcium chloride test, ASTM F 1869 and ASTM 2170. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. (1.36 kg of water/92.9 sq. m) in 24 hours.
      b) Perform tests recommended by manufacturer and submit test results to Architect. Proceed with installation only after substrates pass testing.

      c) In the event that moisture vapor emissions exceed 3lbs./1000 sq. ft./24 hrs., the Contractor, at his expense, shall install a barrier coat and moisture sealer, “ARDEX MC RAPID”. Contractor shall apply per manufacturer’s instructions, prior to installation of the flooring material

C. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.

D. Access Flooring Panels: Remove protective film of oil or other coating using method recommended by access flooring manufacturer.

E. Contractor shall grind, patch, float the floor substrate as required to create an even and level flooring surface.

F. Use trowelable leveling and patching compound to fill cracks, holes, and depressions in substrates.

G. Move resilient products and installation materials into spaces where they will be installed at least 48 hours in advance of installation.
   1. Do not install resilient products until they are same temperature as space where they are to be installed.

H. Sweep and vacuum clean substrates to be covered by resilient products immediately before installation. After cleaning, examine substrates for moisture, alkaline salts, carbonation, and dust. Proceed with installation only after unsatisfactory conditions have been corrected.

3.03 RESILIENT WALL BASE INSTALLATION

A. Apply wall base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.

B. Install wall base in lengths as long as practicable without gaps at seams and with tops of adjacent pieces aligned.

C. Tightly adhere wall base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.

D. Do not stretch wall base during installation.

E. On masonry surfaces or other similar irregular substrates, fill voids along top edge of wall base with manufacturer's recommended adhesive filler material.

F. Premolded Corners: Install premolded corners before installing straight pieces.

3.04 RESILIENT ACCESSORY INSTALLATION

A. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of floor coverings that would otherwise be exposed.

3.05 CLEANING AND PROTECTION

A. Perform the following operations immediately after completing resilient product installation:
   1. Remove adhesive and other blemishes from exposed surfaces.
   2. Sweep and vacuum surfaces thoroughly.
   3. Damp-mop surfaces to remove marks and soil.
      a) Do not wash surfaces until after time period recommended by manufacturer.

B. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period. Use protection methods recommended in writing by manufacturer.
   1. Apply protective floor polish to horizontal surfaces that are free from soil, visible adhesive, and surface blemishes if recommended in writing by manufacturer.
      a) Use commercially available product acceptable to manufacturer.
      b) Coordinate selection of floor polish with Owner's maintenance service.
   2. Cover products installed on horizontal surfaces with undyed, untreated building paper until Substantial Completion.

3. Do not move heavy and sharp objects directly over surfaces. Place hardboard or plywood panels over flooring and under objects while they are being moved. Slide or roll objects over panels without moving panels.

END OF SECTION

SECTION 096536 - STATIC-CONTROL RESILIENT FLOORING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Static-dissipative vinyl composition floor tile

B. Related Requirements:

1. Section 096513 "Resilient Base and Accessories" for resilient base, reducer strips, and other accessories installed with static-control resilient flooring.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site

1. Review methods and procedures related to static-control resilient flooring including, but not limited to, the following:

a. Examination and preparation of substrates to receive static-control resilient flooring.
b. Installation: including seamless installation techniques.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For each type of static-control resilient flooring. Include floor-covering layouts, edges, columns, doorways, enclosing partitions, built-in furniture, cabinets, and cutouts.

1. Show details of special patterns.
2. Show locations of inscribed maintenance tiles.
3. Submit grounding diagram showing location of grounding strips and connections.

C. Samples for Initial Selection: For each type of static-control resilient flooring.

D. Samples for Verification: For each type of static-control resilient flooring, of size indicated below:

1. Floor Tile: 6-by-9-inch
2. Heat-Welding Bead: Include manufacturer's standard-size Samples, but not less than 9 inches long, of each color required.

E. Seam Samples: For seamless-installation technique indicated and for each static-control resilient flooring product, color, and pattern required; with seam running lengthwise and in center of 6-by-9-inch. Sample applied to a rigid backing and prepared by Installer for this Project.

F. Product Schedule: For static-control resilient flooring. Use same designations indicated on Drawings.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for static-control resilient flooring.

C. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of static-control resilient flooring to include in maintenance manuals.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Floor Tile: Furnish one box for every 5 boxes or fraction thereof, of each type, color, and pattern of floor tile installed.

1.8 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs workers for this Project who are competent in techniques required by manufacturer for static-control resilient flooring and seaming method.

1. Engage an installer who employs workers for this Project who are trained or certified by manufacturer for installation techniques required.

B. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Build mockups for static-control resilient flooring including integral-flash-cove base and resilient base and accessories.

a. Size: Minimum 10 sq. ft. for each type, color, and pattern.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Store static-control resilient flooring and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer but not less than 50 deg F or more than 90 deg F.

1. Floor Tile: Store on flat surfaces.

1.10 PROJECT CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than **70 deg F** or more than **85 deg F** in spaces to receive static-control resilient flooring during the following time periods:

1. 48 hours before installation.
2. During installation.
3. 48 hours after installation.

B. Until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.

C. Close spaces to traffic during static-control resilient flooring installation.

D. Close spaces to traffic for 48 hours after static-control resilient flooring installation.

E. Install static-control resilient flooring after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Static-Dissipative Properties: Provide static-control resilient flooring with static-control properties indicated as determined by testing identical products per test method indicated by an independent testing and inspecting agency.

1. Electrical Resistance: Test per [ASTM F 150 with 100-V applied voltage] [ESD-STM-7.1].

a. Average greater than 1 megohm and less than or equal to 1000 megohms when test specimens are tested surface to ground.
b. Average greater than 1 megohm and less than or equal to 1000 megohms when installed floor coverings are tested surface to ground.

2. Static Generation: Less than [**300**] <**Insert number**> V when tested per AATCC-134 at 20 percent relative humidity with conductive footwear.
3. Static Decay: 5000 to zero V in less than [**0.25**] <**Insert number**> seconds when tested per FED-STD-101C/4046.1.

B. Conductive Properties: Provide static-control resilient flooring with static-control properties indicated as determined by testing identical products per test method indicated by an independent testing and inspecting agency.

1. Electrical Resistance: Test per [ASTM F 150 with 500-V applied voltage] [ESD-STM-7.1] [NFPA 99, Annex E] [UL 779].

    a. Average greater than 25,000 ohms and less than 1 megohm when test specimens and installed floor coverings are tested surface to surface (point to point).
    b. Average greater than 25,000 ohms with no single measurement less than 10,000 ohms when installed floor coverings are tested surface to ground.

2. Static Generation: Less than [**100**] <**Insert number**> V when tested per AATCC-134 at 20 percent relative humidity with conductive footwear.
3. Static Decay: 5000 to zero V in less than [**0.03**] [**0.01**] <**Insert number**> seconds when tested per FED-STD-101C/4046.1.

C. Fire-Test-Response Characteristics: As determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.

1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

2.2 STATIC-DISSIPATIVE RESILIENT FLOOR COVERINGS

A. Static-Dissipative, Vinyl Composition Floor Tile: ASTM F 1066 (vinyl composition floor tile, nonasbestos formulated), Class 2 (through-pattern tile).

1. As indicated on drawings
2. Thickness: In manufacturer's standard thickness, but not less than 0.08 inch.
3. Size: 24 by 24 inches
4. Seaming Method: Heat welded
5. Colors and Patterns: As indicated on drawings

2.3 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified portland cement or blended hydraulic-cement-based formulation provided or approved by manufacturer for applications indicated.

B. Static-Control Adhesive: Provided or approved by manufacturer; type that maintains electrical continuity of floor-covering system to ground connection.

C. Grounding Strips: Provided or approved by manufacturer; type and size that maintains electrical continuity of floor-covering system to ground connection.

D. Seamless-Installation Accessories:

1. Heat-Welding Bead: Solid-strand product of manufacturer for heat welding seams.

    a. Color: As selected by Architect from manufacturer's full range to contrast with floor covering.

E. Integral-Flash-Cove Base Accessories:

1. Cove Strip: 1-inch radius support strip provided or approved by manufacturer.
2. Cap Strip: Tapered vinyl cap provided or approved by manufacturer.

3. Corners: Metal inside and outside corners and end stops provided or approved by floor-covering manufacturer.

F. Maintenance Floor Tiles: Special floor tiles inscribed "Conductive floor. Do not wax."

G. Floor Polish: Provide protective, static-control liquid floor polish products as recommended by floor-covering manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer and manufacturer's representative present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion or static-control characteristics of floor coverings.

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

3.2 PREPARATION

A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of static-control resilient flooring and electrical continuity of floor-covering systems.

B. Concrete Substrates: Prepare according to ASTM F 710.

1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
2. Remove substrate coatings and other substances that are incompatible with floor-covering adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
3. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer. Proceed with installation only after substrates pass testing.
4. Moisture Testing:
    a. Perform anhydrous calcium chloride test, ASTM F 1869 and ASTM 2170. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. (1.36 kg of water/92.9 sq. m) in 24 hours.
    b. Perform concrete pH Test: Perform pH tests on concrete floors regardless of the age or grade level. If the pH is greater than 10, it must be neutralized prior to beginning the installation.
    c. Perform tests recommended by manufacturer and submit test results to Architect. Proceed with installation only after substrates pass testing.
    d. In the event that moisture vapor emissions rate and pH levels are exceeded., the Contractor, at his expense, shall install a barrier coat and moisture sealer, “ARDEX MC RAPID”. Contractor shall apply per manufacturer’s instructions, prior to installation of the flooring material.

C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound and remove bumps and ridges to produce a uniform and smooth substrate.

D. Do not install static-control resilient flooring until it is same temperature as space where it is to be installed.

1. Move static-control resilient flooring and installation materials into spaces where they will be installed at least 48 hours in advance of installation.

E. Sweep and vacuum substrates to be covered by static-control resilient flooring immediately before installation.

3.3 INSTALLATION, GENERAL

A. Install static-control resilient flooring according to manufacturer's written instructions.

B. Embed grounding strips in static-control adhesive. Extend grounding strips beyond perimeter of static-control resilient floor-covering surfaces to ground connections.

C. Scribe, cut, and fit static-control resilient flooring to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, and door frames.

D. Extend static-control resilient flooring into toe spaces, door reveals, closets, and similar openings. Extend static-control resilient flooring to center of door openings.

E. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on static-control resilient flooring as marked on substrates. Use chalk or other nonpermanent, nonstaining marking device.

F. Install static-control resilient flooring on covers for telephone and electrical ducts, and similar items in installation areas. Maintain overall continuity of color and pattern with pieces of static-control resilient flooring installed on covers. Tightly adhere static-control resilient flooring edges to substrates that abut covers and to cover perimeters.

G. Adhere static-control resilient flooring to substrates using a full spread of static-control adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

H. Seamless Installation:

1. Heat-Welded Seams: Comply with ASTM F 1516. Rout joints and heat weld with welding bead to permanently fuse sections into a seamless floor covering. Prepare, weld, and finish seams to produce surfaces flush with adjoining floor-covering surfaces.
2. Chemically Bonded Seams: Bond seams with chemical-bonding compound to permanently fuse sections into a seamless floor covering. Prepare seams and apply compound to produce tightly fitted seams without gaps, overlays, or excess bonding compound on floor-covering surfaces.

I. Integral-Flash-Cove Base: Cove static-control flooring 6 inches up vertical surfaces. Support static-control resilient flooring at horizontal and vertical junction with cove strip. Butt at top against cap strip.

1. Install metal corners at inside and outside corners.

3.4 FLOOR-TILE INSTALLATION

A. Comply with manufacturer's written instructions for installing floor tile.

B. Lay out floor tiles from center marks established with principal walls, discounting minor offsets, so floor tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half floor tile at perimeter.

1. Lay floor tiles square with room axis

C. Match floor tiles for color and pattern by selecting floor tiles from cartons in same sequence as manufactured and packaged if so numbered. Discard broken, cracked, chipped, or deformed floor tiles.

1. Lay static-dissipative, vinyl composition floor tiles with grain running in one direction

D. In each space where conductive, solid vinyl floor tile is installed, install maintenance floor tile identifying conductive floor tile in locations approved by Architect.

3.5 SHEET FLOOR-COVERING INSTALLATION

A. Comply with manufacturer's written instructions for installing sheet floor coverings.

B. Unroll sheet floor coverings and allow them to stabilize before cutting and fitting.

C. Lay out sheet floor coverings as follows:

1. Maintain uniformity of sheet floor-covering direction.
2. Minimize number of seams and place them in inconspicuous and low-traffic areas, at least 6 inches away from parallel joints in floor-covering substrates.
3. Match edges of floor coverings for color shading at seams.
4. Avoid cross seams.

3.6 FIELD QUALITY CONTROL

A. Testing: Engage a qualified testing agency to test electrical resistance of static-control resilient flooring for compliance with requirements.

1. Arrange for testing after static-control adhesives have fully cured and static-control resilient flooring has stabilized to ambient conditions and after ground connections are completed.
2. Arrange for testing of static-control resilient flooring before and after performing floor polish procedures.

B. Static-control resilient flooring will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.7 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protection of static-control resilient flooring.

B. Perform the following operations immediately after completing static-control resilient flooring:

1. Remove static-control adhesive and other blemishes from exposed surfaces.
2. Sweep and vacuum surfaces thoroughly.
3. Damp-mop surfaces to remove marks and soil.

C. Protect static-control resilient flooring from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

1. Do not wax static-control resilient flooring.
2. If recommended in writing by manufacturer, apply protective static-control floor polish formulated to maintain or enhance floor covering's electrical properties; ensure static-control resilient flooring surfaces are free from soil, static-control adhesive, and surface blemishes.

a. Verify that both floor polish and its application method are approved by manufacturer and that floor polish will not leave an insulating film that reduces static-control resilient flooring's effectiveness for static control.

D. Cover static-control resilient flooring until Substantial Completion.

END OF SECTION

SECTION 09 68 00 – CARPET

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section includes the following:
   1. Woven carpet.

B. Related Sections include the following:
   1. Division 9 Section "Resilient Floor Tile" for resilient wall base and accessories installed with carpet.

1.03 SUBMITTALS

A. Product Data: For each type of product indicated. Include manufacturer's written data on physical characteristics, durability, and fade resistance. Include installation recommendations for each type of substrate required.

B. Samples: For each of the following products and for each color and texture required. Label each Sample with manufacturer's name, material description, color, pattern, and designation indicated on Drawings and in schedules.
   1. Carpet: 12-inch- (300-mm-) square Sample.

C. Maintenance Data: For carpet to include in maintenance manuals specified in Division 1. Include the following:
   1. Methods for maintaining carpet, including cleaning and stain-removal products and procedures and manufacturer's recommended maintenance schedule.
   2. Precautions for cleaning materials and methods that could be detrimental to carpet.

1.04 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who is certified by the Floor Covering Installation Board or who can demonstrate compliance with its certification program requirements.

B. Fire-Test-Response Characteristics: Provide products with the critical radiant flux classification indicated in Part 2, as determined by testing identical products per ASTM E 648 by an independent testing and inspecting agency acceptable to authorities having jurisdiction.

C. Product Options: Products and manufacturers named in Part 2 establish requirements for product quality in terms of appearance, construction, and performance. Other manufacturers' products comparable in quality to named products and complying with requirements may be considered. Refer to Division 1 Section "Substitutions."

D. Carpet shall meet testing and product requirements for Carpet and Rug Institute’s Green Label Plus Program. Carpet Cushion shall meet the requirements of the Carpet and Rug Institute’s Green Label Program.

1.05 DELIVERY, STORAGE, AND HANDLING

A. General: Comply with CRI 104, Section 5, "Storage and Handling."

1.06 PROJECT CONDITIONS

A. General: Comply with CRI 104, Section 6.1, "Site Conditions; Temperature and Humidity."

B. Environmental Limitations: Do not install carpet until wet work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

C. Do not install carpet over concrete slabs until slabs have cured and are sufficiently dry to bond with adhesive and concrete slabs have pH range recommended by carpet manufacturer.

D. Where demountable partitions or other items are indicated for installation on top of carpet, install carpet before installing these items.

1.07 WARRANTY

A. General Warranty: Special warranty 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. Special Carpet Warranty: Written warranty, signed by carpet manufacturer agreeing to replace carpet that does not comply with requirements or that fails within specified warranty period. Warranty does not include deterioration or failure of carpet due to unusual traffic, failure of substrate, vandalism, or abuse. Failures include, but are not limited to, more than 10 percent loss of face fiber, edge raveling, snags, runs, and delamination.
   1. Warranty Period: 10 years from date of Substantial Completion.

1.08 EXTRA MATERIALS

A. Furnish extra materials described below, before installation begins, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Carpet: Full-width rolls equal to 5 percent of amount installed for each type indicated, but not less than 10 sq. yd. (8.3 sq. m).

PART 2 - PRODUCTS

2.01 WOVEN CARPET TILES

A. Available Product: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
   1. As indicated on drawings – quarter-turn layout, or approved equal.

2.02 INSTALLATION ACCESSORIES

A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided by or recommended by the following:
   1. Carpet manufacturer.

B. Adhesives: Water-resistant, mildew-resistant, nonstaining type to suit products and subfloor conditions indicated, that complies with flammability requirements for installed carpet and that is recommended by the following:
   1. Carpet manufacturer.

C. Seaming Cement: Hot-melt adhesive tape or similar product recommended by carpet manufacturer for taping seams and butting cut edges at backing to form secure seams and to prevent pile loss at seams.

D. Metal Edge Strips: Extruded aluminum with mill finish of width shown, of height required to protect exposed edge of carpet, and of maximum lengths to minimize running joints.

E. Barrier Coat: “ARDEX MC RAPID., or approved equal per manufacturer’s instructions.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other conditions affecting carpet performance. Verify that substrates and conditions are satisfactory for carpet installation and comply with requirements specified.

B. Concrete Subfloors: Verify that concrete slabs comply with ASTM F 710 and the following:
   1. Slab substrates are dry and free of curing compounds, sealers, hardeners, and other materials that may interfere with adhesive bond. Determine adhesion and dryness characteristics by performing bond and moisture tests recommended by the following:
      1. Carpet manufacturer.
   2. Subfloor finishes comply with requirements specified in Division 3 Section "Cast-in-Place Concrete" for slabs receiving carpet.
   3. Subfloors are free of cracks, ridges, depressions, scale, and foreign deposits.

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

3.02 PREPARATION

A. General: Comply with CRI 104, Section 6.2, "Site Conditions; Floor Preparation," and carpet manufacturer's written installation instructions for preparing substrates indicated to receive carpet installation.

B. Use trowelable leveling and patching compounds, as required, according to manufacturer's written instructions, to fill cracks, holes, and depressions in substrates for proper installation of flooring material.

C. Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by the following:
   1. Carpet manufacturer.

D. Broom and vacuum clean substrates to be covered immediately before installing carpet. After cleaning, examine substrates for moisture, alkaline salts, carbonation, or dust. Proceed with installation only after unsatisfactory conditions have been corrected.

3.03 INSTALLATION

A. Direct-Glue-Down Installation: Comply with CRI 104, Section 8, "Direct Glue-Down Installation."

B. Moisture Testing:
   1. Perform anhydrous calcium chloride test, ASTM F 1869 and ASTM 2170. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. (1.36 kg of water/92.9 sq. m) in 24 hours.
   2. Perform concrete pH Test: Perform pH tests on concrete floors regardless of the age or grade level. If the pH is greater than 10, it must be neutralized prior to beginning the installation.
   3. Perform tests recommended by manufacturer and submit test results to Architect. Proceed with installation only after substrates pass testing.
   4. In the event that moisture vapor emissions rate and pH levels are exceeded., the Contractor, at his expense, shall install a barrier coat and moisture sealer, “ARDEX MC RAPID”. Contractor shall apply per manufacturer’s instructions, prior to installation of the flooring material.

C. Comply with carpet manufacturer's written recommendations for seam locations and direction of carpet; maintain uniformity of carpet direction and lay of pile. At doorways, center seams under the door in closed position.
   1. Bevel adjoining border edges at seams with hand shears.
   2. Level adjoining border edges.

D. Do not bridge building expansion joints with carpet.

E. Cut and fit carpet to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended by carpet manufacturer.

F. Extend carpet into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.

G. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on finish flooring as marked on subfloor. Use nonpermanent, nonstaining marking device.

H. Install pattern parallel to walls and borders.

3.04 CLEANING AND PROTECTION

A. Perform the following operations immediately after installing carpet:
   1. Remove excess adhesive, seam sealer, and other surface blemishes using cleaner recommended by carpet manufacturer.
   2. Remove yarns that protrude from carpet surface.
   3. Vacuum carpet using commercial machine with face-beater element.

B. Protect installed carpet to comply with CRI 104, Section 15, "Protection of Indoor Installations."

C. Protect carpet against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by carpet manufacturer.

END OF SECTION

SECTION 09 91 00 – PAINTING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section includes surface preparation and field painting of exposed exterior and interior items and surfaces.
   1. Surface preparation, priming, and finish coats specified in this Section are in addition to shop priming and surface treatment specified in other Sections.

B. Paint exposed surfaces, except where these Specifications indicate that the surface or material is not to be painted or is to remain natural. If an item or a surface is not specifically mentioned, paint the item or surface the same as similar adjacent materials or surfaces. If a color of finish is not indicated, Architect will select from a full range of colors and finishes available.
   1. Painting includes field painting of exposed bare and covered pipes and ducts (including color coding), hangers, exposed steel and iron supports, suspended ceiling tiles and suspension grids, and surfaces of mechanical and electrical equipment that do not have a factory-applied final finish. Painting shall include exposed mechanical registers and grills, hollow metal doors and frames, exposed structural members and fabricated steel, underside of standing seam roof systems.

C. Do not paint prefinished items, concealed surfaces, finished metal surfaces, operating parts, and labels, unless otherwise noted.
   1. Prefinished items include the following factory-finished components:
      a) Acoustical wall panels, uon
      b) Metal toilet enclosures.
      c) Metal lockers.
      d) Elevator entrance doors and frames.
      e) Elevator equipment.
      f) Light fixtures (Not including trims).
      g) Drinking Fountains.
      h) Fire Extinguisher Cabinets
   2. Concealed surfaces include walls or ceilings in the following generally inaccessible spaces:
      a) Furred areas.
      b) Ceiling plenums.
      c) Pipe spaces.
      d) Duct shafts.
      e) Elevator shafts.
   3. Finished metal surfaces include the following:
      a) Anodized aluminum, UON.
      b) Stainless steel.
      c) Chromium plate.
      d) Copper and copper alloys.
      e) Bronze and brass.
   4. Operating parts include moving parts of operating equipment and the following:
      a) Valve and damper operators.
      b) Linkages.

c) Sensing devices.
d) Motor and fan shafts.

5. Labels: Do not paint over UL, FMG, or other code-required labels or equipment name, identification, performance rating, or nomenclature plates.

D. Related Sections include the following:
1. Division 5 Section "Structural Steel" for shop priming structural steel.
2. Division 5 Section "Metal Fabrications" for shop priming ferrous metal.
3. Division 8 Section "Steel Doors and Frames" for factory priming steel doors and frames.
4. Division 9 Section "Gypsum Board Assemblies" for surface preparation of gypsum board.

1.03 DEFINITIONS

A. General: Standard coating terms defined in ASTM D 16 apply to this Section.
1. Semigloss refers to medium-sheen finish with a gloss range between 35 and 70 when measured at a 60-degree meter.
2. Full gloss refers to high-sheen finish with a gloss range more than 70 when measured at a 60-degree meter.

1.04 SUBMITTALS

A. Product Data: For each paint system indicated. Include block fillers and primers.
1. Material List: An inclusive list of required coating materials. Indicate each material and cross-reference specific coating, finish system, and application. Identify each material by manufacturer's catalog number and general classification.
2. Manufacturer's Information: Manufacturer's technical information, including label analysis and instructions for handling, storing, and applying each coating material.

B. Samples for Verification: For each color and material to be applied, with texture to simulate actual conditions, on representative Samples of the actual substrate.
1. Provide stepped Samples, defining each separate coat, including block fillers and primers. Use representative colors when preparing Samples for review. Resubmit until required sheen, color, and texture are achieved.
2. Provide a list of materials and applications for each coat of each Sample. Label each Sample for location and application.
3. Submit Four samples on the following substrates for Architect's review of color and texture only:
a) Concrete: 4-inch- (100-mm-) square samples for each color and finish.
b) Stained or Natural Wood: 4-by-8-inch (100-by-200-mm) Samples of natural- or stained-wood finish on representative surfaces.

1.05 QUALITY ASSURANCE

A. Applicator Qualifications: A firm or individual experienced in applying paints and coatings similar in material, design, and extent to those indicated for this Project, whose work has resulted in applications with a record of successful in-service performance.

B. Source Limitations: Obtain for each coating system from the same manufacturer as the finish coats.

C. Benchmark Samples (Mockups): Provide a full-coat benchmark finish sample for each type of coating and substrate required. Comply with procedures specified in PDCA P5. Duplicate finish of approved sample Submittals.
1. Architect will select one room or surface to represent surfaces and conditions for application of each type of coating and substrate.

a) Wall Surfaces: Provide samples on at least 5 sq. ft..
b) Small Areas and Items: Architect will designate items or areas required.

2. Apply benchmark samples, according to requirements for the completed Work, after permanent lighting and other environmental services have been activated. Provide required sheen, color, and texture on each surface.
   a) After finishes are accepted, Architect will use the room or surface to evaluate coating systems of a similar nature.
3. Final approval of colors will be from benchmark samples.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project site in manufacturer's original, unopened packages and containers bearing manufacturer's name and label and the following information:
   1. Product name or title of material.
   2. Product description (generic classification or binder type).
   3. Manufacturer's stock number and date of manufacture.
   4. Contents by volume, for pigment and vehicle constituents.
   5. Thinning instructions.
   6. Application instructions.
   7. Color name and number.
   8. VOC content.

B. Store materials not in use in tightly covered containers in a well-ventilated area at a minimum ambient temperature of 45 deg F (7 deg C). Maintain storage containers in a clean condition, free of foreign materials and residue.
   1. Protect from freezing. Keep storage area neat and orderly. Remove oily rags and waste daily.

1.07 PROJECT CONDITIONS

A. Apply waterborne paints only when temperatures of surfaces to be painted and surrounding air are between 50 and 90 deg F (10 and 32 deg C).

B. Apply solvent-thinned paints only when temperatures of surfaces to be painted and surrounding air are between 45 and 95 deg F (7 and 35 deg C).

C. Do not apply paint in snow, rain, fog, or mist; or when relative humidity exceeds 85 percent; or at temperatures less than 5 deg F (3 deg C) above the dew point; or to damp or wet surfaces.
   1. Painting may continue during inclement weather if surfaces and areas to be painted are enclosed and heated within temperature limits specified by manufacturer during application and drying periods.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Products: Subject to compliance with requirements.
   1. Benjamin Moore & Co. (Benjamin Moore).
   2. Dunn Edwards Paints

2.02 PAINT MATERIALS, GENERAL

A. Material Compatibility: Provide block fillers, primers, and finish-coat materials that are compatible with one another and with the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.

B. Material Quality: Provide manufacturer's best-quality paint material of the various coating types specified that are factory formulated and recommended by manufacturer for application indicated. Paint-material containers not displaying manufacturer's product identification will not be acceptable.
   1. Proprietary Names: Use of manufacturer's proprietary product names to designate colors or materials is not intended to imply that products named are required to be used to the exclusion of equivalent products of other manufacturers. Furnish manufacturer's material data and certificates of performance for proposed substitutions.

C. Colors: As selected by Architect from manufacturer's full range. Contractor shall assume for bidding purposes that a min. of 6 interior colors and 6 exterior colors will used at various locations and quantities throughout the project.

2.03 EXTERIOR PRIMERS

A. Exterior Ferrous-Metal Primer: Factory-formulated rust-inhibitive metal primer for exterior application.
   1. Benjamin Moore; Moore's IMC Alkyd Metal Primer No. M06: Applied at a dry film thickness of not less than 2.0 mils (0.051 mm).

2.04 INTERIOR PRIMERS

A. Interior Gypsum Board Primer: Factory-formulated latex-based primer for interior application.
   1. Benjamin Moore; Moorcraft Super Spec Latex Enamel Undercoater & Primer Sealer No. 253: Applied at a dry film thickness of not less than 1.2 mils (0.030 mm).

B. Interior Ferrous-Metal Primer: Factory-formulated quick-drying rust-inhibitive alkyd-based metal primer.
   1. Benjamin Moore; Moore's IMC Alkyd Metal Primer No. M06: Applied at a dry film thickness of not less than 2.0 mils (0.051 mm).

2.05 EXTERIOR FINISH COATS

   1. Exterior Semigloss Acrylic Enamel: Factory-formulated semigloss waterborne acrylic-latex enamel for exterior application.
   2. Benjamin Moore; Moorcraft Super Spec Latex House & Trim Paint No. 170: Applied at a dry film thickness of not less than 1.1 mils (0.028 mm).

2.06 INTERIOR FINISH COATS

A. Interior Acrylic Enamel: Factory-formulated eggshell & satin acrylic-latex enamel for interior application.
   1. Benjamin Moore; Moorcraft Super Spec Latex Eggshell & Satin Enamel: Applied at a dry film thickness of not less than 1.2 mils (0.031 mm).

2.07 INTERIOR WOOD STAINS AND VARNISHES

A. Open-Grain Wood Filler: Factory-formulated paste wood filler applied at spreading rate recommended by manufacturer.
   1. Benjamin Moore; Benwood Paste Wood Filler No. 238.

B. Interior Wood Stain: Factory-formulated alkyd-based penetrating wood stain for interior application applied at spreading rate recommended by manufacturer.
   1. Benjamin Moore; Benwood Penetrating Stain No. 234.

C. Clear Sanding Sealer: Factory-formulated fast-drying alkyd-based clear wood sealer applied at spreading rate recommended by manufacturer.
   1. ICI Dulux Paints; 1902-0000 WoodPride Interior Satin Polyurethane Varnish.

D. Interior Alkyd- or Polyurethane-Based Clear Satin Varnish: Factory-formulated alkyd- or polyurethane-based clear varnish.
   1. Benjamin Moore; Benwood Interior Wood Finishes Polyurethane Finishes Low Lustre No. 435.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Applicator present, for compliance with requirements for paint application.
   1. Proceed with paint application only after unsatisfactory conditions have been corrected and surfaces receiving paint are thoroughly dry.
   2. Start of painting will be construed as Applicator's acceptance of surfaces and conditions within a particular area.
   3. Notify Architect about anticipated problems when using the materials specified over substrates primed by others.

3.02 PREPARATION

A. General: Remove hardware and hardware accessories, plates, machined surfaces, lighting fixtures, and similar items already installed that are not to be painted. If removal is impractical or impossible because of size or weight of the item, provide surface-applied protection before surface preparation and painting.
   1. After completing painting operations in each space or area, reinstall items removed using workers skilled in the trades involved.

B. Cleaning: Before applying paint or other surface treatments, clean substrates of substances that could impair bond of the various coatings. Remove oil and grease before cleaning.
   1. Schedule cleaning and painting so dust and other contaminants from the cleaning process will not fall on wet, newly painted surfaces.

C. Surface Preparation: Clean and prepare surfaces to be painted according to manufacturer's written instructions for each particular substrate condition and as specified.
   1. Provide barrier coats over incompatible primers or remove and reprime.
   2. Cementitious Materials: Prepare concrete, concrete unit masonry, cement plaster, and mineral-fiber-reinforced cement panel surfaces to be painted. Remove efflorescence, chalk, dust, dirt, grease, oils, and release agents. Roughen as required to remove glaze. If hardeners or sealers have been used to improve curing, use mechanical methods of surface preparation.
      a) Use abrasive blast-cleaning methods if recommended by paint manufacturer.
      b) Determine alkalinity and moisture content of surfaces by performing appropriate tests. If surfaces are sufficiently alkaline to cause the finish paint to blister and burn, correct this condition before application. Do not paint surfaces if moisture content exceeds that permitted in manufacturer's written instructions.
      c) Clean concrete floors to be painted with a 5 percent solution of muriatic acid or other etching cleaner. Flush the floor with clean water to remove acid, neutralize with ammonia, rinse, allow to dry, and vacuum before painting.
   3. Wood: Clean surfaces of dirt, oil, and other foreign substances with scrapers, mineral spirits, and sandpaper, as required. Sand surfaces exposed to view smooth and dust off.

a) Scrape and clean small, dry, seasoned knots, and apply a thin coat of white shellac or other recommended knot sealer before applying primer. After priming, fill holes and imperfections in finish surfaces with putty or plastic wood filler. Sand smooth when dried.
b) Prime, stain, or seal wood to be painted immediately on delivery. Prime edges, ends, faces, undersides, and back sides of wood, including cabinets, counters, cases, and paneling.
c) If transparent finish is required, backprime with spar varnish.
d) Backprime paneling on interior partitions where masonry, plaster, or other wet wall construction occurs on back side.
e) Seal tops, bottoms, and cutouts of unprimed wood doors with a heavy coat of varnish or sealer immediately on delivery.

4. Ferrous Metals: Clean ungalvanized ferrous-metal surfaces that have not been shop coated; remove oil, grease, dirt, loose mill scale, and other foreign substances. Use solvent or mechanical cleaning methods that comply with SSPC's recommendations.
   a) Touch up bare areas and shop-applied prime coats that have been damaged. Wire-brush, clean with solvents recommended by paint manufacturer, and touch up with same primer as the shop coat.

D. Material Preparation: Mix and prepare paint materials according to manufacturer's written instructions.
1. Maintain containers used in mixing and applying paint in a clean condition, free of foreign materials and residue.
2. Stir material before application to produce a mixture of uniform density. Stir as required during application. Do not stir surface film into material. If necessary, remove surface film and strain material before using.
3. Use only thinners approved by paint manufacturer and only within recommended limits.

E. Tinting: Tint each undercoat a lighter shade to simplify identification of each coat when multiple coats of same material are applied. Tint undercoats to match the color of the finish coat, but provide sufficient differences in shade of undercoats to distinguish each separate coat.

3.03 APPLICATION

A. General: Apply paint according to manufacturer's written instructions. Use applicators and techniques best suited for substrate and type of material being applied.
1. Paint colors, surface treatments, and finishes are indicated in the paint schedules.
2. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to formation of a durable paint film.
3. Provide finish coats that are compatible with primers used.
4. The term "exposed surfaces" includes areas visible when permanent or built-in fixtures, grilles, and similar components are in place. Extend coatings in these areas, as required, to maintain system integrity and provide desired protection.
5. Paint surfaces behind movable equipment and furniture the same as similar exposed surfaces. Before final installation of equipment, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
6. Paint interior surfaces of ducts with a flat, nonspecular black paint where visible through registers or grilles.
7. Paint back sides of access panels and removable or hinged covers to match exposed surfaces.
8. Finish exterior doors on tops, bottoms, and side edges the same as exterior faces.
9. Sand lightly between each succeeding enamel or varnish coat.

B. Scheduling Painting: Apply first coat to surfaces that have been cleaned, pretreated, or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.
   1. The number of coats and film thickness required are the same regardless of application method. Do not apply succeeding coats until previous coat has cured as recommended by manufacturer. If sanding is required to produce a smooth, even surface according to manufacturer's written instructions, sand between applications.
   2. Omit primer over metal surfaces that have been shop primed and touchup painted.
   3. If undercoats, stains, or other conditions show through final coat of paint, apply additional coats until paint film is of uniform finish, color, and appearance. Give special attention to ensure that edges, corners, crevices, welds, and exposed fasteners receive a dry film thickness equivalent to that of flat surfaces.
   4. Allow sufficient time between successive coats to permit proper drying. Do not recoat surfaces until paint has dried to where it feels firm, and does not deform or feel sticky under moderate thumb pressure, and until application of another coat of paint does not cause undercoat to lift or lose adhesion.

C. Application Procedures: Apply paints and coatings by brush, roller, spray, or other applicators according to manufacturer's written instructions.
   1. Brushes: Use brushes best suited for type of material applied. Use brush of appropriate size for surface or item being painted.
   2. Rollers: Use rollers of carpet, velvet-back, or high-pile sheep's wool as recommended by manufacturer for material and texture required.
   3. Spray Equipment: Use airless spray equipment with orifice size as recommended by manufacturer for material and texture required.

D. Minimum Coating Thickness: Apply paint materials no thinner than manufacturer's recommended spreading rate to achieve dry film thickness indicated. Provide total dry film thickness of the entire system as recommended by manufacturer.

E. Mechanical and Electrical Work: Painting of mechanical and electrical work is limited to items exposed in equipment rooms and occupied spaces.

F. Mechanical items to be painted include, but are not limited to, the following:
   1. Tanks that do not have factory-applied final finishes.
   2. Visible portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets.
   3. Mechanical equipment that is indicated to have a factory-primed finish for field painting.

G. Electrical items to be painted include, but are not limited to, the following:
   1. Panelboards.

H. Prime Coats: Before applying finish coats, apply a prime coat, as recommended by manufacturer, to material that is required to be painted or finished and that has not been prime coated by others. Recoat primed and sealed surfaces where evidence of suction spots or unsealed areas in first coat appears, to ensure a finish coat with no burn-through or other defects due to insufficient sealing.

I. Pigmented (Opaque) Finishes: Completely cover surfaces as necessary to provide a smooth, opaque surface of uniform finish, color, appearance, and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections will not be acceptable.

J. Stipple Enamel Finish: Roll and redistribute paint to an even and fine texture. Leave no evidence of rolling, such as laps, irregularity in texture, skid marks, or other surface imperfections.

K. Completed Work: Match approved samples for color, texture, and coverage. Remove, refinish, or repaint work not complying with requirements.

3.04 FIELD QUALITY CONTROL

A. Owner reserves the right to invoke the following test procedure at any time and as often as Owner deems necessary during the period when paint is being applied:
   1. Owner will engage a qualified independent testing agency to sample paint material being used. Samples of material delivered to Project will be taken, identified, sealed, and certified in the presence of Contractor.
   2. Testing agency will perform appropriate tests as required.

3.05 CLEANING

A. Cleanup: At the end of each workday, remove empty cans, rags, rubbish, and other discarded paint materials from Project site.
   1. After completing painting, clean paint-spattered surfaces. Remove spattered paint by washing and scraping without scratching or damaging adjacent finished surfaces.

3.06 PROTECTION

A. Protect work of other trades, whether being painted or not, against damage from painting. Correct damage by cleaning, repairing or replacing, and repainting, as approved by Architect.

B. Provide "Wet Paint" signs to protect newly painted finishes. After completing painting operations, remove temporary protective wrappings provided by others to protect their work.
   1. After work of other trades is complete, touch up and restore damaged or defaced painted surfaces. Comply with procedures specified in PDCA P1.

3.07 EXTERIOR PAINT SCHEDULE

A. Concrete, Stucco, and Concrete Unit Masonry: Provide the following finish systems over exterior concrete, stucco, and brick masonry substrates:
   1. Acrylic-Enamel Finish: Two finish coats over a primer.
      a) Primer: Exterior concrete and masonry primer.
      b) Finish Coats: Exterior semigloss acrylic enamel.
   2. Clear concrete/masonry sealer
   3. Provide grafftti coat sealer at all masonry locations (interior & exterior)

B. Ferrous Metal: Provide the following finish systems over exterior ferrous metal. Primer is not required on shop-primed items.
   1. Semigloss Acrylic-Enamel Finish: Two finish coats over a rust-inhibitive primer.
      a) Primer: Exterior ferrous-metal primer.
      b) Finish Coats: Exterior semigloss acrylic enamel.

3.08 INTERIOR PAINT SCHEDULE

A. Gypsum Board: Provide the following finish systems over interior gypsum board surfaces:
   1. Eggshell Acrylic-Enamel Finish: Two finish coats over a primer.
      a) Primer: Interior gypsum board primer.
      b) Finish Coats: Interior eggshell acrylic enamel.
   2. Flat Acrylic-Enamel Finish: Two finish coats over a primer.
      a) Primer: Interior gypsum board primer.
      b) Finish Coats: Interior Flat acrylic enamel.

B. Ferrous Metal: Provide the following finish systems over ferrous metal:
   1. Semigloss Acrylic-Enamel Finish: Two finish coats over a primer.
      a) Primer: Interior ferrous-metal primer.
      b) Finish Coats: Interior semigloss acrylic enamel.

3.09 INTERIOR STAIN AND NATURAL-FINISH WOODWORK SCHEDULE

A. Stained Woodwork: Provide the following stained finishes over new interior woodwork:
   1. Alkyd-Based Stain Satin-Varnish Finish: Two finish coats of alkyd-based clear satin varnish over a sealer coat and interior wood stain. Wipe wood filler before applying stain.
      a) Stain Coat: Interior wood stain.
      b) Sealer Coat: Clear sanding sealer.
      c) Finish Coats: Interior alkyd- or polyurethane-based clear satin varnish.

END OF SECTION

SECTION 10 14 00 – SIGNAGE

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

1. This Section includes exterior and interior signage.

1.03 DEFINITIONS

A. ADA-ABA Accessibility Guidelines: U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines."

1.04 SUBMITTALS

A. Shop Drawings: Show fabrication and installation details for signs.

1. Show sign mounting heights, locations of supplementary supports to be provided by others, and accessories.
2. Provide message list, typestyles, graphic elements, including tactile characters and Braille, and layout for each sign.

B. Samples for Verification: For each of the following products and for the full range of color, texture, and sign material indicated, of sizes indicated:

1. Panel Signs: Not less than 12 inches square.
2. Accessories: Manufacturer's full-size unit.

C. Maintenance Data: For signs to include in maintenance manuals.

D. Warranty: Special warranty specified in this Section.

1.05 QUALITY ASSURANCE

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

B. Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.

C. Source Limitations for Signs: Obtain each sign type indicated from one source from a single manufacturer.

D. Regulatory Requirements: Comply with applicable provisions in ADA-ABA Accessibility Guidelines.

1.06 PROJECT CONDITIONS

A. Weather Limitations: Proceed with installation only when weather conditions permit installation of signs in exterior locations to be performed according to manufacturers' written instructions and warranty requirements.

B. Field Measurements: Verify recess openings by field measurements before fabrication and indicate measurements on Shop Drawings.

1.07 COORDINATION

A. Coordinate placement of anchorage devices with templates for installing signs.

1.02 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a) Deterioration of metal and polymer finishes beyond normal weathering.
b) Deterioration of embedded graphic image colors and sign lamination.

2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 SIGNS

A. Exterior Signs:

1. All building entrances that are accessible to and usable by persons with disabilities shall be identified with at least one standard sign (International accessibility symbol) with additional directions signs, as required, to be visible to persons along approaching pedestrian ways and paths-of-travel.

B. Interior Signs:

1. General: Each room shall be provided with Room Identification signage. All Signage shall comply with the California Building Code (CBC), Section 1117B.5 Signs and identification.
2. All doors within the building shall receive signage With California Braille identification (larger than typical ADA Braille). The Braille shall be grade 2 with 1/10th inch on centers within each cell with 2/10th inch between cells. Dots shall be raised 1/40th inch above background. Letters and numbers on signs shall have a width-to-height ratio of between 3:5 and 1:1 and a stroke with to height ration between 1:5 and 1:10. Signs shall be mounted 60” A.F.F. and 4”-6” from strike side of doors. Each toilet room shall have required identification signs (on Door and on adjacent wall), which contain the international symbol of accessibility in white on a blue background, color number 15090 in Federal Standard 595B.

2.02 MATERIALS

A. Aluminum Sheet and Plate: ASTM B 209, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with at least the strength and durability properties of Alloy 5005-H32.

B. Fiberglass Sheet: Molded, seamless, thermosetting, glass-fiber-reinforced polyester panels with a minimum tensile strength of 15,000 psi when tested according to ASTM D 638 and with a minimum flexural strength of 30,000 psi when tested according to ASTM D 790.

C. Acrylic Sheet: ASTM D 4802, Category A-1 (cell-cast sheet), Type UVA (UV absorbing).

D. Applied Vinyl: Die-cut characters from vinyl film of nominal thickness of 3 mils with pressure-sensitive adhesive backing, suitable for exterior applications.

2.03 PANEL SIGNS

A. Exterior Panel Signs: Provide smooth sign panel surfaces constructed to remain flat under installed conditions within a tolerance of plus or minus 1/16 inch measured diagonally from corner to corner, complying with the following requirements:

1. Aluminum Sheet: 0.125 inch thick.
2. Fiberglass Sheet: 0.125-inch- thick sheet.
3. Edge Condition: Bullnose.
4. Corner Condition: Square.
5. Mounting: As indicated.
6. Color: As selected by Architect from manufacturer's full range.

B. Tactile and Braille Sign: Manufacturer's standard process for producing text and symbols complying with ADA-ABA Accessibility Guidelines and with ICC/ANSI A117.1. Text shall be accompanied by Grade 2 Braille. Produce precisely formed characters with square-cut edges free from burrs and cut marks; Braille dots with domed or rounded shape.

1. Panel Material: Opaque acrylic sheet.
2. Raised-Copy Thickness: Not less than 1/32 inch.

C. Applied Vinyl: Die-cut characters from vinyl film of nominal thickness of 3 mils with pressure-sensitive adhesive backing.

2.04 ACCESSORIES

A. Anchors and Inserts: Provide nonferrous-metal or hot-dip galvanized anchors and inserts for exterior installations and elsewhere as required for corrosion resistance. Use toothed steel or lead expansion-bolt devices for drilled-in-place anchors. Furnish inserts, as required, to be set into concrete or masonry work.

2.05 FABRICATION

A. General: Provide manufacturer's standard signs of configurations indicated.

1. Welded Connections: Comply with AWS standards for recommended practices in shop welding. Provide welds behind finished surfaces without distortion or discoloration of exposed side. Clean exposed welded surfaces of welding flux and dress exposed and contact surfaces.
2. Mill joints to tight, hairline fit. Form joints exposed to weather to exclude water penetration.
3. Preassemble signs in the shop to greatest extent possible. Disassemble signs only as necessary for shipping and handling limitations. Clearly mark units for reassembly and installation, in location not exposed to view after final assembly.
4. Conceal fasteners if possible; otherwise, locate fasteners where they will be inconspicuous.

2.06 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.07 ALUMINUM FINISHES

A. Color Anodic Finish: Manufacturer's standard Class 1 integrally colored or electrolytically deposited color anodic coating, 0.018 mm or thicker, in black applied over a polished (buffed) mechanical finish, complying with AAMA 611.

2.08 ACRYLIC SHEET FINISHES

A. Colored Coatings for Acrylic Sheet: For copy and background and frame colors, provide colored coatings, including inks, dyes, and paints, that are recommended by acrylic manufacturers for optimum adherence to acrylic surface and that are UV and water resistant for five years for application intended.

PART 3 - EXECUTION

3.01 EXAMINATION

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

B. Verify that items, including anchor inserts, are sized and located to accommodate signs.

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

3.02 INSTALLATION

A. Locate signs and accessories where indicated, using mounting methods of types described and complying with manufacturer's written instructions.

1. Install signs level, plumb, and at heights indicated, with sign surfaces free of distortion and other defects in appearance.
2. Interior Wall Signs: Install signs on walls adjacent to latch side of door where applicable. Where not indicated or possible, such as double doors, install signs on nearest adjacent walls. Locate to allow approach within 3 inches of sign without encountering protruding objects or standing within swing of door.

B. Wall-Mounted Signs: Comply with sign manufacturer's written instructions except where more stringent requirements apply.

1. Two-Face Tape: Mount signs to smooth, nonporous surfaces. Do not use this method for vinyl-covered or rough surfaces.

3.03 CLEANING AND PROTECTION

A. After installation, clean soiled sign surfaces according to manufacturer's written instructions. Protect signs from damage until acceptance by Owner.

END OF SECTION

SECTION 10 21 13 – TOILET COMPARTMENTS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section includes solid color reinforced composite-core units as follows:
   1. Toilet Enclosures: Floor anchored.
   2. Urinal Screens: Wall hung.

B. Related Sections include the following:
   1. Division 10 "Toilet and Bath Accessories" for toilet tissue dispensers, grab bars, purse shelves, and similar accessories.

1.03 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

1.04 QUALITY ASSURANCE

A. Comply with requirements in CID-A-A-60003, "Partitions, Toilets, Complete."

1.05 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of walls, columns, ceilings, and other construction contiguous with toilet compartments by field measurements before fabrication and indicate measurements on Shop Drawings.
   1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating toilet compartments without field measurements. Coordinate wall, floor, ceilings, and other contiguous construction to ensure that actual dimensions correspond to established dimensions.

PART 2 - PRODUCTS

2.01 SOLID COLOR PLASTIC UNITS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. High Density Polyethylene by Scranton Products, or approved equal.

B. Door, Panel and Pilaster Construction: Solid color throughout with eased and polished edges. Provide minimum 3/4-inch- (19-mm-) thick doors and pilasters and minimum 1/2-inch- (13-mm-) thick panels.
   1. Color: Refer to finish plans

C. Pilaster Shoes: Stainless steel, ASTM A 666, Type 302 or 304, not less than 0.0312 inch (0.8 mm) specified thickness and 3 inches (75 mm) high, finished to match hardware.

D. Brackets (Fittings):
   1. Stirrup Type: Ear or U-brackets, stainless steel.

2.02 ACCESSORIES

A. Hardware and Accessories: Manufacturer's standard design, heavy-duty operating hardware and accessories.
   1. Material: Stainless steel.

B. Overhead Bracing: Manufacturer's standard continuous, extruded-aluminum head rail with antigrip profile and in manufacturer's standard finish.

C. Anchorages and Fasteners: Manufacturer's standard exposed fasteners of stainless steel or chrome-plated steel or brass, finished to match hardware, with theft-resistant-type heads. Provide sex-type bolts for through-bolt applications. For concealed anchors, use hot-dip galvanized or other rust-resistant, protective-coated steel.

2.03 FABRICATION

A. Overhead-Braced Units: Provide manufacturer's standard corrosion-resistant supports, leveling mechanism, fasteners, and anchors at pilasters to suit floor conditions. Make provisions for setting and securing continuous head rail at top of each pilaster. Provide shoes at pilasters to conceal supports and leveling mechanism.

B. Floor-Anchored Units: Provide manufacturer's standard corrosion-resistant anchoring assemblies complete with threaded rods, lock washers, and leveling adjustment nuts at pilasters for structural connection to floor. Provide shoes at pilasters to conceal anchorage.

C. Doors: Unless otherwise indicated, provide 24-inch- (610-mm-) wide in-swinging doors for standard toilet compartments and 36-inch- (914-mm-) wide out-swinging doors with a minimum 32-inch- (813-mm-) wide clear opening for compartments indicated to be accessible to people with disabilities.
   1. Hinges: Manufacturer's standard self-closing type that can be adjusted to hold doors open at any angle up to 90 degrees.
   2. Latch and Keeper: Manufacturer's standard recessed latch unit designed for emergency access and with combination rubber-faced door strike and keeper. Provide units that comply with accessibility requirements of authorities having jurisdiction at compartments indicated to be accessible to people with disabilities.
   3. Coat Hook: Manufacturer's heavy duty combination hook and rubber-tipped bumper, sized to prevent door from hitting compartment-mounted accessories.
   4. Door Bumper: Manufacturer's heavy duty rubber-tipped bumper at out-swinging doors.
   5. Door Pull: Manufacturer's heavy duty unit at out-swinging doors that complies with accessibility requirements of authorities having jurisdiction. Provide units on both sides of doors at compartments indicated to be accessible to people with disabilities.
   6. Shower stall doors: Bottom of door to be 12” above finish floor max. Top of door to be 72” above finish floor min.

PART 3 - EXECUTION

3.01 INSTALLATION

A. General: Comply with manufacturer's written installation instructions. Install units rigid, straight, level, and plumb. Secure units in position with manufacturer's recommended anchoring devices.
   1. Maximum Clearances:
      a) Pilasters and Panels: 1/2 inch (13 mm).

b) Panels and Walls: 1 inch (25 mm).

2. Stirrup Brackets: Secure panels to walls and to pilasters with not less than two brackets attached near top and bottom of panel.
   a) Locate wall brackets so holes for wall anchors occur in masonry or tile joints.
   b) Align brackets at pilasters with brackets at walls.

B. Overhead-Braced Units: Secure pilasters to floor and level, plumb, and tighten. Secure continuous head rail to each pilaster with not less than two fasteners. Hang doors to align tops of doors with tops of panels and adjust so tops of doors are parallel with overhead brace when doors are in closed position.

C. Floor-Anchored Units: Set pilasters with anchors penetrating not less than 2 inches (50 mm) into structural floor, unless otherwise indicated in manufacturer's written instructions. Level, plumb, and tighten pilasters. Hang doors and adjust so tops of doors are level with tops of pilasters when doors are in closed position.

D. Wall-Hung Urinal Screens: Attach with anchoring devices to suit supporting structure. Set units level and plumb and to resist lateral impact.

3.02 ADJUSTING

A. Hardware Adjustment: Adjust and lubricate hardware according to manufacturer's written instructions for proper operation. Set hinges on in-swinging doors to hold doors open approximately 30 degrees from closed position when unlatched. Set hinges on out-swinging doors to return doors to fully closed position.

END OF SECTION

SECTION 10 28 00 – TOILET AND BATH ACCESSORIES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section includes the following:
   1. Toilet and bath accessories.

B. Related Sections include the following:
   1. Division 10 Section "Toilet Compartments" for compartments and screens.

1.03 SUBMITTALS

A. Product Data: Include construction details, material descriptions and thicknesses, dimensions, profiles, fastening and mounting methods, specified options, and finishes for each type of accessory specified.

B. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required. Use designations indicated in the Toilet and Bath Accessory Schedule and room designations indicated on Drawings in product schedule.

1.04 QUALITY ASSURANCE

A. Source Limitations: Provide products of same manufacturer for each type of accessory unit and for units exposed to view in same areas, unless otherwise approved by Architect.

B. Product Options: Accessory requirements, including those for materials, finishes, dimensions, capacities, and performance, are established by specific products indicated in the Toilet and Bath Accessory Schedule.
   1. Other manufacturers' products with equal characteristics may be considered. See Division 1 Section "Substitutions."
   2. Do not modify aesthetic effects, as judged solely by Architect, except with Architect's approval. Where modifications are proposed, submit comprehensive explanatory data to Architect for review.

1.05 COORDINATION

A. Coordinate accessory locations with other work to prevent interference with clearances required for access by disabled persons, proper installation, adjustment, operation, cleaning, and servicing of accessories.

B. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying the Work.

1.06 WARRANTY

A. General Warranty: Special warranty 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. Manufacturer's Mirror Warranty: Written warranty, executed by mirror manufacturer agreeing to replace mirrors that develop visible silver spoilage defects within minimum warranty period indicated.
   1. Minimum Warranty Period: 15 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Bobrick Washroom Equipment, Inc. (Model numbers indicated)

B. American Specialities, Inc

C. Bradley Corporation

2.02 MATERIALS

A. Stainless Steel: ASTM A 666, Type 304, with No. 4 finish (satin), in 0.0312-inch (0.8-mm) minimum nominal thickness, unless otherwise indicated.

B. Brass: ASTM B 19, leaded and unleaded flat products; ASTM B 16 (ASTM B 16M), rods, shapes, forgings, and flat products with finished edges; ASTM B 30, castings.

C. Sheet Steel: ASTM A 366/A 366M, cold rolled, commercial quality, 0.0359-inch (0.9-mm) minimum nominal thickness; surface preparation and metal pretreatment as required for applied finish.

D. Galvanized Steel Sheet: ASTM A 653/A 653M, G60 (Z180).

E. Chromium Plating: ASTM B 456, Service Condition Number SC 2 (moderate service), nickel plus chromium electrodeposited on base metal.

F. Baked-Enamel Finish: Factory-applied, gloss-white, baked-acrylic-enamel coating.

G. Mirror Glass: ASTM C 1036, Type I, Class 1, Quality q2, nominal 6.0 mm thick, with silvering, electroplated copper coating, and protective organic coating complying with FS DD-M-411.

H. Galvanized Steel Mounting Devices: ASTM A 153/A 153M, hot-dip galvanized after fabrication.

I. Fasteners: Screws, bolts, and other devices of same material as accessory unit, tamper and theft resistant when exposed, and of galvanized steel when concealed.

2.03 FABRICATION

A. General: One, maximum 1-1/2-inch- (38-mm-) diameter, unobtrusive stamped manufacturer logo, as approved by Architect, is permitted on exposed face of accessories. On interior surface not exposed to view or back surface of each accessory, provide printed, waterproof label or stamped nameplate indicating manufacturer's name and product model number.

B. General: Names or labels are not permitted on exposed faces of accessories. On interior surface not exposed to view or on back surface of each accessory, provide printed, waterproof label or stamped nameplate indicating manufacturer's name and product model number.

C. Surface-Mounted Toilet Accessories: Unless otherwise indicated, fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with continuous stainless-steel hinge. Provide concealed anchorage where possible.

D. Recessed Toilet Accessories: Unless otherwise indicated, fabricate units of all-welded construction, without mitered corners. Hang doors and access panels with full-length, stainless-steel hinge. Provide anchorage that is fully concealed when unit is closed.

E. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six keys to Owner's representative.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.

B. Secure mirrors to walls in concealed, tamper-resistant manner with special hangers, toggle bolts, or screws. Set units level, plumb, and square at locations indicated, according to manufacturer's written instructions for substrate indicated.

C. Install grab bars to withstand a downward load of at least 250 lbf (1112 N), when tested according to method in ASTM F 446.

3.02 ADJUSTING AND CLEANING

A. Adjust accessories for unencumbered, smooth operation and verify that mechanisms function properly. Replace damaged or defective items.

B. Remove temporary labels and protective coatings.

C. Clean and polish exposed surfaces according to manufacturer's written recommendations.

3.03 TOILET AND BATH ACCESSORY SCHEDULE

A. Combination Towel Dispenser/Waste Receptacle, B-3803 (1 per restroom):
   1. Recessed Type: Designed for nominal 6-inch (100-mm) wall depth with continuous, seamless wall flange; towel dispenser in unit's upper compartment designed to dispense minimum of 600 C-fold or 800 multifold paper towels; waste receptacle in unit's lower compartment with minimum 6-gal. capacity, reusable, vinyl liner; and flush doors on upper and lower compartments with continuous hinges and tumbler locksets.

B. Grab Bars, B-6806: Back wall: 36 inches, Side wall: 48 inches.
   1. Stainless-Steel Nominal Thickness: Minimum 0.05 inch (1.3 mm).
   2. Mounting: Concealed with manufacturer's standard flanges and anchors.
   3. Gripping Surfaces: Manufacturer's standard slip-resistant texture.
   4. Outside Diameter: 1-1/2 inches (38 mm) for heavy-duty applications.

C. Mop and Broom Holder, B-239 (1 per ea Janitor Room):

1. Mop and Broom Holder with Utility Shelf: 36-inch- (914-mm-) long unit fabricated of minimum nominal 0.05-inch- (1.3-mm-) thick stainless steel with shelf; support brackets for wall mounting; three hooks for wiping rags; four spring-loaded, rubber hat, cam-type, mop/broom holders mounted on front of shelf; and approximately 1/4-inch- (6-mm-) diameter, stainless-steel rod suspended beneath shelf for drying rags.

D. Toilet Tissue Dispenser, B-2888 (1 per ea. toilet stall)

E. Toilet Seat Cover Dispenser, B-221 (1 per ea. toilet stall)

F. Sanitary Napkin Receptacle, B-254 (1 per ea. women's toilet stall)

G. Soap Dispenser, B-8221 (1 per ea. lavatory basin)

END OF SECTION

SECTION 10 51 00 - LOCKERS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Lockers of the following types:
   1. Standard duty metal lockers, Traditional Collection

1.02 REFERENCES

A. ADAAG - American with Disabilities Act, Accessibility Guidelines.

B. ANSI A117.1 - Accessible and Usable Buildings and Facilities.

C. ASTM International (ASTM):
   1. ASTM A 1008 - Standard Specification for Steel Sheet, Carbon, Cold-Rolled, Commercial Quality.
   2. ASTM D 4976 - Standard Specification for Polyethylene Plastics Molding and Extrusion Materials.
   3. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

1.03 SUBMITTALS

A. Manufacturer's data sheets on each product to be used, including:
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Installation methods.

B. Shop Drawings: Provide layout and elevations of lockers with overall dimensions. Field verify dimensions.

C. Maintenance Data: For adjusting, repairing, and replacing locker doors and latching mechanisms.

D. Verification Samples: For finish product specified, two samples, minimum size 6 inches (150 mm) square, representing actual product and color selected.

1.04 QUALITY ASSURANCE

A. Provide all lockers from a single manufacturer

1.05 DELIVERY, STORAGE AND HANDLING

A. Inspect lockers upon receipt for visible damage. Further inspection if necessary for hidden damage.

B. Store products in manufacturer's unopened packaging until ready for installation.

C. Sequence deliveries to avoid project delays, but minimize on-site storage.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Acceptable Manufacturer: ASI Storage Solutions, which is located at: 2171 Liberty Hill Rd.; Eastanollee, GA 30538; Tel: 706-827-2720; Fax: 706-827-2710; Email:request info (info@asi-storage.com); Web:asistorage.com

2.02 MATERIALS

A. Steel: Prime grade mild cold-rolled sheet steel free from surface imperfection, capable of taking a powder coating finish.
   1. Hooks: Zinc plated forged steel, ball ends.
   2. Bolts and Nuts: Zinc plated truss fin head bolts, hex nuts.
   3. Rivets.

2.03 STANDARD DUTY METAL LOCKERS

A. Standard Duty Metal Lockers:
   1. Acceptable Product: ASI Storage Solutions Traditional Collection.
   2. Type of Lockers: Knocked Down.
   3. Heights do not include 6” concrete curb.
   4. Single Tier:
      a) Height: 72 inches (1981 mm).
      b) Size: 18 inches (457 mm) wide by 18 inches (457 mm) deep.
   5. Material: Steel parts shall be mild cold rolled commercial quality steel, ASTM A1008.
   6. Finish: Steel surfaces shall be power washed, phosphate treated and finished with an electrostatically applied 2 mm thick hybrid epoxy/polyester powder coating and baked.
   7. Construction: Lockers shall be built on a unitized principle with common intermediate uprights separating units.
   8. Door Frames: 16 gauge formed in a channel shape. Vertical members shall have additional flange to provide a continuous door strike. Cross frame members; 16 gauge channel shaped.
   9. Doors: Knocked Down: 16 gauge with louvers, channel shaped on both the lock and hinge side, with angle formations across the top and bottom.
   10. Body:
      a) Bottoms: 16 gauge.
      b) Tops, Sides and Shelves, Knocked Down: 24 gauge.
      c) Backs: 18 gauge.
      d) Bolt spacing shall not exceed 9 inches (228 mm) o.c.
      e) Hood: sloping
   11. Hinges: Full length 16 gauge continuous piano type, riveted to both door and frame.
   12. Handles: One-piece 20 gauge deep drawn stainless steel cup designed to accommodate locks.
   13. Latching: 1-3 Tiers Lifting trigger 14 gauge steel, attached to the latching channel. Trigger shall have a padlock eye for use with 9/32 inch (7 mm) diameter padlock shackle. Doors to have latch clip engaging frame at three points on doors over 42 inches (1.067 m) high and two points on all other doors. Locking device to be positive automatic type, whereby locker door may be locked when open, then closed without unlocking.
   14. A rubber silencer shall be firmly secured to the frame at each latch hook.
   15. Interior Equipment:
      a) Single tier lockers 48 inches (1.219 m) or higher shall have a shelf.
      b) Single tier lockers 18 (457 mm) inches deep or more shall have a coat rod instead of a ceiling hook.
   16. Number Plates: Each locker shall have a polished aluminum number plate riveted to door face with black numerals1/2 inch (12 mm) high.
   17. Assembly:
      a) Knocked Down: All locker components shall be assembled with nuts and bolts.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Do not begin installation until substrates and bases have been properly prepared.

B. If substrate and bases are the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 INSTALLATION

A. Install lockers and accessories at locations shown in accordance with manufacturer's instructions.

B. Install lockers level and plumb with flush surfaces and rigid attachment to anchoring surfaces.

C. Anchor lockers to floor and wall at 48 inches (1.219 m) or less, as recommended by the manufacturer.

D. Fasten adjoining locker units together to provide rigid installation.

3.03 ADJUSTING AND CLEANING

A. Adjust doors and latches to operate without binding. Verify that latches are operating satisfactorily.

B. Touch-up factory-finish and repair or replace damaged products before Substantial Completion.

3.04 PROTECTION

A. Protect installed products until completion of project.

END OF SECTION

SECTION 10 52 20 – FIRE PROTECTION CABINETS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A Section Includes:

1 Fire-protection cabinets for the following:

a Portable fire extinguishers.

B Related Requirements:

1 Section 10523 "Fire Extinguishers."

1.03 PREINSTALLATION CONFERENCE

A Preinstallation Conference: Conduct conference at Project site.

1 Review methods and procedures related to fire-protection cabinets including, but not limited to, the following:

a Schedules and coordination requirements.

1.04 ACTION SUBMITTALS

A Product Data: For each type of product. Show door hardware, cabinet type, trim style, and panel style. Include roughing-in dimensions and details showing recessed-, semirecessed-, or surface-mounting method and relationships of box and trim to surrounding construction.

1 Show location of knockouts for hose valves.

B Shop Drawings: For fire-protection cabinets. Include plans, elevations, sections, details, and attachments to other work.

C Samples: For each type of exposed finish required.

D Samples for Initial Selection: For each type of exposed finish required.

E Samples for Verification: For each type of exposed finish required, prepared on Samples 6 by 6 inches (150 by 150 mm) square.

F Product Schedule: For fire-protection cabinets. Indicate whether recessed, semirecessed, or surface mounted. Coordinate final fire-protection cabinet schedule with fire-extinguisher schedule to ensure proper fit and function. Use same designations indicated on Drawings.

1.05 CLOSEOUT SUBMITTALS

A Maintenance Data: For fire-protection cabinets to include in maintenance manuals.

1.06 COORDINATION

A Coordinate size of fire-protection cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated.

B Coordinate sizes and locations of fire-protection cabinets with wall depths.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

1 Fire-Rated Fire-Protection Cabinets: Listed and labeled to comply with requirements in ASTM E 814 for fire-resistance rating of walls where they are installed.

2 Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.02 FIRE-PROTECTION CABINET

A Cabinet Type: Suitable for fire extinguisher.

1 Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

2 Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1 Fire-End & Croker Corporation.
2 GMR International Equipment Corporation.
3 Guardian Fire Equipment, Inc.
4 JL Industries, Inc.; a division of the Activar Construction Products Group.
5 Larsens Manufacturing Company.
6 Modern Metal Products, Division of Technico Inc.
7 Nystrom, Inc.
8 Potter Roemer LLC.
9 Strike First Corporation of America.

B Cabinet Construction: Nonrated.

C Cabinet Material: Cold-rolled steel sheet.

1 Shelf: Same metal and finish as cabinet.

D Recessed Cabinet:

1 Trimless with Concealed Flange: Surface of surrounding wall finishes flush with exterior finished surface of cabinet frame and door, without overlapping trim attached to cabinet. Provide recessed flange, of same material as box, attached to box to act as drywall bead.
2 Trimless with Hidden Flange: Flange of same metal and finish as box overlaps surrounding wall finish and is concealed from view by an overlapping door.
3 Exposed Flat Trim: One-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend).

E Cabinet Trim Material: Same material and finish as door.

F Door Material: Steel sheet.

G Door Style: Vertical duo panel with frame.

G Door Glazing: Tempered float glass (clear).

H Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.

1 Provide manufacturer's standard.
2 Provide manufacturer's standard hinge permitting door to open 180 degrees.

I Accessories:

1 Mounting Bracket: Manufacturer's standard steel, designed to secure fire extinguisher to fire-protection cabinet, of sizes required for types and capacities of fire extinguishers indicated, with plated or baked-enamel finish.
2 Break-Glass Strike: Manufacturer's standard metal strike, complete with chain and mounting clip, secured to cabinet.
3 Lettered Door Handle: One-piece, cast-iron door handle with the word "FIRE" embossed into face.
4 Door Lock: Cam lock that allows door to be opened during emergency by pulling sharply on door handle.
5 Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as directed by Architect.

1 Identify fire extinguisher in fire-protection cabinet with the words "FIRE EXTINGUISHER."

1 Location: Applied to cabinet glazing.
2 Application Process: Decals.
3 Lettering Color: Black.

J Materials:

1 Cold-Rolled Steel: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B.

1 Finish: Baked enamel or powder coat.
2 Color: As selected by Architect from full range of industry colors and color densities.
2 Tempered Float Glass: ASTM C 1048, Kind FT, Condition A, Type I, Quality q3, 3 mm thick, Class 1 (clear).

2.03 FABRICATION

A Fire-Protection Cabinets: Provide manufacturer's standard box (tub) with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated.

1 Weld joints and grind smooth.
2 Provide factory-drilled mounting holes.
3 Prepare doors and frames to receive locks.
4 Install door locks at factory.

B Cabinet Doors: Fabricate doors according to manufacturer's standards, from materials indicated and coordinated with cabinet types and trim styles.

1 Fabricate door frames with tubular stiles and rails and hollow-metal design, minimum 1/2 inch (13 mm) thick.
2 Fabricate door frames of one-piece construction with edges flanged.
3 Miter and weld perimeter door frames.

C Cabinet Trim: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.

2.04 GENERAL FINISH REQUIREMENTS

A Comply with NAAMM's AMP 500, "Metal Finishes Manual for Architectural and Metal Products," for recommendations for applying and designating finishes.

B Protect mechanical finishes on exposed surfaces of fire-protection cabinets from damage by applying a strippable, temporary protective covering before shipping.

C Finish fire-protection cabinets after assembly.

D Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.01 EXAMINATION

A Examine roughing-in for cabinets to verify actual locations of piping connections before cabinet installation.

B Examine walls and partitions for suitable framing depth and blocking where recessed cabinets will be installed.

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

3.02 PREPARATION

A Prepare recesses for recessed fire-protection cabinets as required by type and size of cabinet and trim style.

3.03 INSTALLATION

A General: Install fire-protection cabinets in locations and at mounting heights indicated or, if not indicated, at heights acceptable to authorities having jurisdiction.

1 Fire-Protection Cabinets: 54” above finished floor to top of cabinet.

B Fire-Protection Cabinets: Fasten cabinets to structure, square and plumb.

1 Unless otherwise indicated, provide recessed fire-protection cabinets. If wall thickness is inadequate for recessed cabinets, provide semirecessed fire-protection cabinets.
2 Provide inside latch and lock for break-glass panels.
3 Fasten mounting brackets to inside surface of fire-protection cabinets, square and plumb.
4 Fire-Rated Cabinets:

a Install cabinet with not more than 1/16-inch (1.6-mm) tolerance between pipe OD and knockout OD. Center pipe within knockout.
b Seal through penetrations with firestopping sealant as specified in Section 07841 "Through-Penetration Firestop Systems."

C Identification: Apply **decals** at locations indicated.

3.04 ADJUSTING AND CLEANING

A Remove temporary protective coverings and strippable films, if any, as fire-protection cabinets are installed unless otherwise indicated in manufacturer's written installation instructions.

B Adjust fire-protection cabinet doors to operate easily without binding. Verify that integral locking devices operate properly.

C On completion of fire-protection cabinet installation, clean interior and exterior surfaces as recommended by manufacturer.

D Touch up marred finishes, or replace fire-protection cabinets that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by fire-protection cabinet and mounting bracket manufacturers.

E Replace fire-protection cabinets that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION

SECTION 10 52 30 – FIRE EXTINGUISHERS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A Section includes portable, hand-carried fire extinguishers and mounting brackets for fire extinguishers.

B Contractor-Furnished Material: Hand-carried fire extinguishers.

C Related Requirements:

1 Section 10522 "Fire Protection Cabinets."

1.03 PREINSTALLATION MEETINGS

A Preinstallation Conference: Conduct conference at Project site.

1 Review methods and procedures related to fire extinguishers including, but not limited to, the following:

a Schedules and coordination requirements.

1.04 ACTION SUBMITTALS

A Product Data: For each type of product. Include rating and classification, material descriptions, dimensions of individual components and profiles, and finishes for fire extinguisher and mounting brackets.

B Product Schedule: For fire extinguishers. Coordinate final fire-extinguisher schedule with fire-protection cabinet schedule to ensure proper fit and function. Use same designations indicated on Drawings.

1.05 INFORMATIONAL SUBMITTALS

A Warranty: Sample of special warranty.

1.06 CLOSEOUT SUBMITTALS

A Operation and Maintenance Data: For fire extinguishers to include in maintenance manuals.

1.07 COORDINATION

A Coordinate type and capacity of fire extinguishers with fire-protection cabinets to ensure fit and function.

1.08 WARRANTY

A Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace fire extinguishers that fail in materials or workmanship within specified warranty period.

1 Failures include, but are not limited to, the following:
a Failure of hydrostatic test according to NFPA 10.
b Faulty operation of valves or release levers.

2 Warranty Period: Six years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."

B Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.

1 Provide fire extinguishers approved, listed, and labeled by FM Global.

2.02 PORTABLE, HAND-CARRIED FIRE EXTINGUISHERS

A Fire Extinguishers: Type, size, and capacity for each fire-protection cabinet and mounting bracket indicated.

1 Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2 Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

a Amerex Corporation.
b Ansul Incorporated.
c Badger Fire Protection.
d Buckeye Fire Equipment Company.
e Fire End & Croker Corporation.
f Guardian Fire Equipment, Inc.
g JL Industries, Inc.; a division of the Activar Construction Products Group.
h Kidde Residential and Commercial Division; Subsidiary of Kidde plc.
i Larsens Manufacturing Company.
j Moon American.
k Nystrom Building Products.
l Pem All Fire Extinguisher Corp.

m Potter Roemer LLC.
n Pyro-Chem; Tyco Safety Products.
o Strike First Corporation of America.

3 Valves: Manufacturer's standard.
4 Handles and Levers: Manufacturer's standard.
5 Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B, and bar coding for documenting fire-extinguisher location, inspections, maintenance, and recharging.

B Multipurpose Dry-Chemical Type in Steel Container: UL-rated 2-A:10-B:C, 5-lb (2.3-kg) nominal capacity, with monoammonium phosphate-based dry chemical in enameled-steel container.

C Clean-Agent Type in Steel Container: UL-rated 2-A:10-B:C, 14-lb (6.4-kg) nominal capacity, with HFC blend agent and inert material in enameled-steel container; with pressure-indicating gage.

PART 3 - EXECUTION

3.01 EXAMINATION

A Examine fire extinguishers for proper charging and tagging.

1 Remove and replace damaged, defective, or undercharged fire extinguishers.

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

3.02 INSTALLATION

A General: Install fire extinguishers and mounting brackets in locations indicated and in compliance with requirements of authorities having jurisdiction.

C Mounting Brackets: Fasten mounting brackets to surfaces, square and plumb, at locations indicated.

END OF SECTION

SECTION 10 67 00 - STORAGE EQUIPMENT

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
1. The work specified in this Section consists of furnishing and installing storage equipment at the locations as shown on the Contract Drawings.

B. Related Sections
1. Drawings, General Provisions, Special Provisions and Division 1 apply to the work of this section.
2. Division 5 – Structural Steel
3. Division 5 – Metal Fabrication
4. Division 9 – Paints and Coating
5. Section 11 00 50 – Basic Equipment Materials and Methods

1.02 REFERENCES

A. American Society for Testing and Materials (ASTM)
1. ASTM A 36/A 36 M Specification for Carbon Structural Steel

B. National Fire Protection Association (NFPA)
1. NFPA 30 Flammable and Combustible Liquids Code

C. Occupational Safety and Health Administration (CAL-OSHA)
1. 29 CFR 1910 Occupational Safety and Health Standards

1.03 QUALITY ASSURANCE

A. Model numbers indicated are to establish a minimum standard of quality only.

1.04 SUBMITTALS

A. Pursuant to the provision of the General Requirements, Division 1 and Section 11 00 50 Basic Equipment Material and Methods, the Contractor shall submit:
1. Material and Equipment List including details indicating quantities of storage equipment and unit dimensions;
2. Product Data including manufacturer's product descriptive literature and color chips for storage equipment types and color selection;
3. Shop Drawings; and
4. Installation instructions including bracing and anchoring details.

B. Submit written affidavits on the manufacture’s letterhead stating the manufactures post-consumer material content (35% min.) and pre-consumer material content (0% min).

1.05 JOB CONDITIONS

A. Paint storage equipment in manufacturer's standard finish of color selected by the County of Nevada Representative.

B. Units with damaged or missing parts or components will be rejected.

1.06 WARRANTY

A. Following completion, the Contractor shall provide the County of Nevada Representative with two (2) years of warranty as stipulated in Section 1 40 00 starting at project acceptance, covering all parts, materials, and labor. All warranty work shall be performed by a local manufacturer's representative at the Project Site location, who has capabilities of responding to all problems within 24 hours. Any shipping and delivery costs associated with the warranty of this equipment shall be the responsibility of the Contractor.

1.07 DELIVERY, STORAGE AND HANDLING

A. Deliver, store, and handle products without damaging them.
1. Receive, unload, check, protect, and store equipment in facilities suitable to keep it clean, dry, and free from damage, vandalism, and pilferage.
2. Pay demurrage charges and claims for damage resulting from unloading operations.
3. Examine equipment for visible and concealed damage. Report any damage to carrier, supplier, and County of Nevada Representative as soon as possible.

B. Protect equipment from loss, deterioration, and damage until work is complete.
1. Protect equipment during storage and prior to start-up.
2. Protect exposed finished surfaces with removable coating for film, cover openings to exclude dirt and fouling materials, and protect unfinished surfaces against rust, corrosion, and other damage.
3. Protect equipment from paint or coating spills and spots.

PART 2 - PRODUCTS

2.01 STORAGE SHELVING

A. Equipment Item No.'s TC-1, PR-1 and SS-5:

B. Acceptable Manufacturers:
1. Products of the following manufacturer are specified as the standard of quality for the storage shelving:
a. Lyon Metal Products
P.O. Box 671
Aurora, IL 60507-0671
Telephone: (708) 892-8941
2. Products of equal quality and utility of the following manufacturers will be accepted:
a. Equipto
225 S. Highland Avenue
Aurora, IL 60507
Telephone: (708) 859-1000
b. Stanley Vidmar, Inc.
P.O. Box 1151
11 Grimmes Road
Allentown, PA 18105
Telephone: (800) 523-9462

C. Construction Features:
1. 16 gauge uprights high capacity shelves, 600 pound shelf.
2. Adjustable on 1-1/2 inch centers.
3. Shelf construction 22 gauge steel
4. Closed shelving.
5. 6 shelves per unit.

6. Standalone shelving.

D. Dimensions:
1. Overall Size:
a. 36 inches wide x 18 inches deep x 84 inches high; six shelves each.

E. Provide standalone storage shelving Model Number 8744M as manufactured by Lyon Metal Products with the above minimal requirements or approved equal.

2.02 LIBRARY RACK

A. Equipment Item No. PR-7:

B. Acceptable Manufacturers:
1. Products of the following manufacturer are specified as the standard of quality for the storage shelving:
a. Lyon Metal Products
P.O. Box 671
Aurora, IL 60507-0671
Telephone: (708) 892-8941
2. Products of equal quality and utility of the following manufacturers will be accepted:
a. Equipto
225 S. Highland Avenue
Aurora, IL 60507
Telephone: (708) 859-1000
b. Stanley Vidmar, Inc.
P.O. Box 1151
11 Grimmes Road
Allentown, PA 18105
Telephone: (800) 523-9462

C. Construction Features:
1. 16 gauge uprights high capacity shelves, 600 pound shelf.
2. Adjustable on 1-1/2 inch centers.
3. Shelf construction 22 gauge steel.
4. Closed shelving.
5. 6 shelves per unit.
6. Standalone shelving.

D. Dimensions:
1. Overall Size:
a. 36 inches wide x 12 inches deep x 84 inches high; four adjustable shelves.

E. Provide standalone storage shelving Model Number 8745M as manufactured by Lyon Metal Products with the above minimal requirements or approved equal.

2.03 FLAMMABLE MATERIALS CABINET

A. Equipment Item No. SS-4

B. Acceptable Manufacturers:
1. Products of the following manufacturer are specified as the standard of quality for the flammable material cabinet:

a. Lyon Metal Products
P.O. Box 671
Aurora, IL 60507-0671
Telephone: (708) 892-8941

2. Products of equal quality and utility of the following manufacturers will be accepted:
a. Equipto
225 S. Highland Avenue
Aurora, IL 60507
Telephone: (708) 859-1000
b. Stanley Vidmar, Inc.
P.O. Box 1151
11 Grimmes Road
Allentown, PA 18105
Telephone: (800) 523-9462

C. Design Requirements:
1. Design Flammable Material Cabinet to meet requirements of OSHA and NFPA 30.

D. Construction Features:
1. Yellow caution enamel painted cabinet with manufacturer's label "FLAMMABLE - KEEP FIRE AWAY" in red (size per manufacturer) on both doors.
2. Two adjustable galvanized steel shelves on ½ inch centers.
3. 18 gauge steel double wall construction with 1-1/2 inch insulation air space between walls.
4. Screened flame arrestor vents on each side, threaded and fitted with 2 inch steel plugs.
5. Positive grounding attachment on each side.
6. Adjustable zinc-plated leveling feet.
7. Two full length swinging hinged doors with 3-point latch and built-in flat key lock.
8. 2 inch deep pan-type bottom.

E. Dimensions and Capacities:
1. Size: 43 inches wide x 18 inches deep x 65 inches high.
2. Capacity: 45 gallons.
3. Load capacity of 350 lbs. per shelf
4. Approximate shipping weight: 370 pounds fully assembled.

F. Provide Flammable Material Cabinet, Model No. 5444N, as manufactured by Lyon Metal Products, Inc. with the above minimal requirements, or approved equal.

2.04 DRUM CONTAINMENT PALLET

A. Equipment Item Nos. LR-1 (4-drum pallet), LR-2

B. Acceptable Manufacturers:
1. Products of the following manufacturer are specified herein as the standard of quality for the drum containment pallet:
a. New Pig
Customer Service
One Pork Avenue/P.O. Box 304
Tipton, PA 16634-0304
Telephone: (800) 621-7447
2. Products of equal quality and utility of the following manufacturer will be accepted:
a. Basco Container Products, Inc.
2595 Palmer Avenue

University Park, IL 60466
Telephone: (800) 776-3786

b. HSC Systems, Inc.
1025 South Linwood Avenue
Santa Ana, CA 92705
Telephone: (714) 542-6338

C. Construction Features:
1. All polyethylene construction.
2. Meet EPA, UFC and Federal Regulation 40 CFR-264.175.
3. Drum capacity: Four - 55 gallon drums
4. 9,000-pound load capacity.
5. Flow-thru sump design to allow liquids to pass freely between connected sumps.
6. Nonslip injection molded polyurethane grate design.
7. Provide drain for quick removal of fluids
8. Four way fork lift access capable
9. Provide two grates 52 inch L x 26 inch W.
10. Translucent white sidewalls for ease of inspection.
11. Provide LR-2 Poly Ramp Removable Platform Units Model No. PAK726 (two total):
a) Light weight polyurethane construction.
b) Steel clams to secure ramp to pallet.
c) Ribbed surface for safe traction.
d) Edge guards for drum dolly safety.

D. Dimensions:
1. Outside dimensions: 62 ½ inches long by 62 ½ inches wide by 8 ¾ inches high.
2. Sump capacity: 75 gallons.
3. Weight: 140 lbs.

E. The drum containment pallet shall be Model PAK672-BK-WOD with Poly ramp Model PAK726 as manufactured by New Pig with the above minimal requirements or approved equal.

2.05 USED BATTERY CONTAINMENT PALLET

A. Equipment Item No. BR-6

B. Acceptable Manufacturers:
1. Products of the following manufacturer are specified herein as the standard of quality for the drum containment pallet:
a. New Pig
Customer Service
One Pork Avenue/P.O. Box 304
Tipton, PA 16634-0304
Telephone: (800) 621-7447
2. Products of equal quality and utility of the following manufacturer will be accepted:
a. Basco Container Products, Inc.
2595 Palmer Avenue
University Park, IL 60466
Telephone: (800) 776-3786
b. HSC Systems, Inc.
1025 South Linwood Avenue
Santa Ana, CA 92705
Telephone: (714) 542-6338

C. Construction Features:
1. 55% Post-Industrial Recycled Polyethylene

2. Sump Capacity: 8 Gallons
3. Containment Type: Tray and Grate
4. Heavy duty walls and ribbed bottom tray
5. Heavy duty grate

D. Dimensions and capacities:
1. Overall: 25.25” W x 49.25” L x 3.25” H
2. Interior Dimensions: 48” L x 24” W
3. Weight: 25.5 lbs.
4. Capacity: 8-gallon containment

E. Color: Black

F. The used battery storage containment pallet shall be Model PAK 123-BK with grate as manufactured by New Pig with the above minimal requirements or approved equal.

2.06 BATTERY STORAGE BENCH

A. Equipment Item No. BR-1

B. Acceptable Manufacturers:
1. Products of the following manufacturer are specified herein as the standard of quality for the Battery Storage Bench:
a. Battery handling Systems
P.O. Box 28990
St. Louis, MO 63132
800-BHS-9500
www.BHS1.com

2. Products of equal quality and utility meeting the specification requirements will be permitted and accepted.

C. Construction Features:
1. Heavy duty frame construction
2. Hardwood decking – Model HBS-WI
3. Charger shelf – Model HBS-RWD
4. CR-1 Cable Retractor mounting holes
5. SB Connector mounting holes
6. Drip Pan Kit – Model DP
7. Wood Sideways -Model (WS) installed as part of bench.
8. Charger anchoring slots
9. Dust rail constructed of tapered angle in center of stand to prevent accumulation of debris.

D. Capacities and Dimensions
1. Station Dimensions: 60” L x 51.5” W x 66” H
2. Shelf Dimensions: 60” L x 26” W.
3. Deck Depth: 40” Deep
4. Dimension from Floor to Plastic Interlay: 12”

E. The Battery Storage Bench shall me Model No. HBS-60 with charger shelf as manufactured by Battery Handling Systems (BHS) or approved equal with the above minimal requirements.

2.07 GAS CYLINDER STORAGE

A. Equipment Item No. PR-3

B. Acceptable Manufacturers:
1. Products of the following manufacturer are specified as the standard of quality for the bin storage unit:
   a. ULine
      2950 Jurupa Street
      Los Angeles, CA 91761
      Telephone: (800) 295-5510
2. Products of equal quality and utility of the following manufacturers will be accepted:
   a. C&H Distributing, Inc.
      770 South 70th Street
      P.O. Box 14770
      Milwaukee, WI 53214-0770
      Telephone: (800) 558-9966

C. Design Requirements:
1. Vertical Cylinder Rack with vertical doors.
2. 10 Cylinder Capacity.
3. 14 gauge roof with 13 gauge expanded metal body.
4. Angle iron frame all welded construction.
5. Built for indoor use.
6. Yellow powder coat finish.
7. “Flammable Keep Fire Away” sign painted red letters on front of cabinet
8. Padlock hasp for secured storage.
9. Legs with pre-drilled mounting plates to secure to floor.
10. Meets CAL-OSHA 1910.110 Requirements.
11. Color: Safety Yellow with manufacturer’s specified Red warning letters.

D. Dimensions and Capacities:

1. Overall Dimensions: 32 inches wide x 40 inches deep x by 71 inches high.
2. Weight: 178 pounds.

E. Gas Cylinder Storage unit shall be Model #H-5656 as supplied by ULine with the above minimal requirements or approved equal.

2.08 SHOP DESK WITH STOOL

A. Equipment Item No. PR-5

B. Acceptable Manufacturers:
1. Products of the following manufacturer are specified as the standard of quality for the Shop Desk with Stool:
   a. Lyon Metal Products
      P.O. Box 671
      Aurora, IL 60507-0671
      Telephone: (708) 892-8941
2. Products of equal quality and utility of the following manufacturers will be accepted:
   a. Stanley Vidmar
      P.O. Box 1151
      11 Grammes Road
      Allentown, PA 18105
   b. Equipto

225 S. Highland Avenue
Aurora, IL 60507
Telephone: (708) 859-1000

C. Construction Features:
1. Heavy gauge steel top, sides and legs
2. Writing surface with hinged storage space, lockable compartment.
3. Bolted heavy duty lower shelf
4. Swivel casters: 2.5” diameter with foot control locking lever.
5. Stool Requirements:
a) Contoured seat 16.5” W x 16.5” D of self skinning foam
b) Padded backrest 15.5” W x 12.5” H
c) Adjustable back
d) Seat adjustment from 21” to 31”
e) Tubular bottom steel base with glides
f) Polyurethane seat
g) Stool shall be Item No. WBB271767 as supplied by Global Industrial or approved equal with the above minimal requirements.

D. Desk Dimensions:
1. Overall Size: 34.5” W x 30” Deep
2. Drawer: 22.75” W x 27.5” D x 3.5” H

E. Shop Desk with Stool shall be Model No. 2254 as manufactured by Lyon Metal Products with the above minimal requirements or approved equal.

2.09 HYDRAULIC PALLET JACK

A. Equipment Item Nos. PR-6

B. Acceptable Manufacturers:
1. Products of the following manufacturer are specified as the standard of quality for the modular cabinets:
a. Dayton
As supplied by Grainger Branch 449
570 South Alameda Street
Los Angeles, CA 90013-1726
Telephone: 800-472-4643

2. Products of equal quality and utility of the following manufacturers will be accepted:
a. Uline
2950 Jurupa Street
Ontario, CA 91761
Telephone: 800-295-5510
b. Global Industrial
Telephone: 888-277-6995

C. Construction Features:
1. Steel construction
2. Pallet jack operation: Manual
3. Main wheel size: 7 “
4. Wheel material: Polyurethane
5. Roller material: Polyurethane
6. Ball bearings
7. Steering Arc: 210 degrees
8. 16 internal grease fittings

9. Cushion grip handle

D. Capacity and Dimensions:
   1. Fork height lowered: 2-15/16”
   2. Fork height raised: 7-3/4”
   3. Width across forks: 27”
   4. Width between forks: 14-3/8”
   5. Fork length: 36”
   6. Fork width: 6-5/16”
   7. Overall size: 50” L x 27” W x 48” H
   8. Wheelbase: 37”
   9. Capacity: 5,500 lbs.

E. Finish: Powder Coat Finish/Red

F. Provide Pallet Jack Model No. 2TUR7 as manufactured by Dayton with the above minimal requirements or approved equal.

2.10 SIGN STORAGE RACK

A. Equipment Item No. SS-6

B. Acceptable Manufacturers:
   1. Products of the following manufacturer are specified as the standard of quality for the Sign Rack:
      a. Equipto
         225 S. Highland Avenue
         Aurora, IL 60507
         Telephone: (610) 253-2775
         Supplier: McMurray Stern/Jim Burkart (562) 547-4798

   2. Products of equal quality and utility of the following manufacturers will be accepted:
      a. Lyon Metal Products
         P.O. Box 671
         Aurora, IL 60507-0671
         Telephone: (708) 892-8941
      b. Approved Equal

C. Construction Features:
   1. Shelf to be 18 gauge steel double flanged box with formed edges on all sides, Model #6232 VG
   2. Top and bottom 12 gauge steel double entry beams to provide pass through access to both sides of unit
   3. Uprights to be double flanged with tapered bracket slots punched at 1 ½ inch centers for vertical shelf adjustments, Model #5022 VG
   4. Shelf fastening shall be slip-in shelf brackets to reinforce and securely lock shelf in place all 4 corners.
   5. Provide with solid end panels Model #VGEP2478 and double entry beams Model #9403 VG.
   6. Provide means for seismic bracing and anchoring to meet the local, state and national codes having jurisdiction. Provide all hardware for proper anchoring. Seismic anchor plate Model # 190319A (left), #190320A (right), #190317A (center).
   7. Each opening shall be provided with 18 gauge steel full height and full depth dividers minimum 37 ½ inches high. Dividers at 8 ½ inches on center, Model #810324-2
   8. Finish: Durable enamel in manufacturer’s standard color.

D. Capacities and Dimensions:
   1. Shelving to be double tier shelving 37 ½ inches high.
   2. Spacers between sections to be 8 ½ inches full height (4 per section, four sections per unit, two top and two bottom).
   3. Total Unit Dimensions: 72 inches W 48 inches D x 78 inches H
   4. Shelf Section Capacity: 670 lbs.
   5. Unit Weight: 720 lbs.

E. Sign Storage Rack shall be Model Equipto V-Grip Shelving with accessories as manufacturer by Equipto or approved equal with the above minimal requirements

2.11 PEG BOARD

A. Equipment Item No.'s TC-3 and PR-4

B. Acceptable Manufacturers:
   1. Products of the following manufacturer are specified as the standard of quality for the Peg Board and Accessories:
      a. Global Industrial
         2505 Mill Center Parkway
         Suite 100
         Buford, GA 30518
         Telephone: (888)978-7759
      b. Approved Equal

C. Construction Features:
   1. Panel Sections to be steel pegboard 24 inches H x 48 inches W for a total of four sections per unit. Final installed unit 96 inches W x 48 inches H
   2. Alligator board with formed edges – Steel construction.
   3. Provide chrome plated hardware kits as required. At minimum, provide kits to satisfy the required hardware below:
      a. 50 Single peg hooks.
      b. 50 double peg hooks.
      c. 50 small curved hooks.
      d. 50 standard curved hooks.
   4. Provide all mounting hardware Model H-4292
   5. Location as shown on plans.
   6. Color/Finish: Steel.

D. Pegboard shall be Model #H-4293 as required for total sizes specified with hardware as specified as manufactured by Global Industrial or approved equal with the above minimal requirements.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install units in a rigid assembly with each member plumb and in true alignment. Execute component assembling in accordance with the directions and recommendations of the product manufacturers.

B. Attached units as required to meet any and all Seismic Design Category requirements as stipulated in all codes having jurisdiction in the State of California and the County of Nevada. These shall include, but not limited to racks, shelving unit sections; bar rack; tire storage; at

minimal. If foot plates are part of the units specified, Contractor shall anchor the unit using the sufficient number of anchors as shown on all the footplates provided.

C. Install units at locations as shown on the drawings.

D. Repair all surfaces where the finish has been marred or scratched during installation with paint approved by the manufacturer to the satisfaction of the County of Nevada Representative.

E. Install all required electrical and mechanical utilities to satisfy the proper installation requirements of the storage equipment in this section requiring utilities. Contractor is to coordinate between contract documents and approved shop drawings for proper installation.

3.02 FIELD QUALITY CONTROL

A. Provide the services of a qualified manufacturer's representative to perform the following:
1. Supervise installation.

END OF SECTION

SECTION 10 71 13 – EXTERIOR SUN SHADE DEVICES

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: Design, fabrication, and installation of welded extruded aluminum sun control assemblies.

B. Products furnished but not installed under this section: anchors.

1.02 REFERENCES

A. American Architectural Manufacturers Association (AAMA):

1. AAMA 611, Voluntary Specification for Anodized Architectural Aluminum.

B. American Society for Testing and Materials (ASTM):

1. ASTM B 209, Specification for Aluminum and Aluminum- Alloy Sheet and Plate.
2. ASTM B 221, Specification for Aluminum and Aluminum- Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
3. ASTM D 1187, Specification for Asphalt-Base Emulsions for Use as Protective Coatings for Metal.

C. American Welding Society (AWS):

1. ANSI/AWS D1.2, Structural Welding Code - Aluminum.
2. ANSI/AWS D1.3, Structural Welding Code - Aluminum.

D. The Society for Protective Coatings (SSPC):

1. SSPC-Paint 12, Cold-Applied Asphalt Mastic (Extra Thick Film).

1.03 SYSTEM DESCRIPTION

A. Design Requirements: Provide sun control devices capable of withstanding the effects of loads and stresses from dead loads, live loads, snow loads, snow drift loads, wind loads, and normal thermal movement without evidencing permanent deformation of assembly or components including blades, frames, and supports; noise or metal fatigue caused by blade rattle or flutter; or permanent damage to fasteners and anchors. Comply with applicable codes.

1.04 SUBMITTALS

A. Product Data: Manufacturer’s product information, specifications, and installation instructions for sun control devices, anchors, and accessories.

B. Shop Drawings: Include plan dimensions, elevations, and details. Include details showing profiles, angles and spacing of blades, frames and supports. Include unit dimensions related to supporting and adjoining structure. Include anchorage details and locations.

C. Samples:

1. Verification: 3-inch-square samples of each finish specified.

D. Design Data: Design calculations bearing the seal of a Registered Professional Engineer, licensed in the state where the project is located. Include a comprehensive analysis of design loads, including dead loads, live loads, seismic loads, wind loads, and thermal movement.

Identify the moment and shear forces transferred to the structure or supports through the installation connections.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: At least ten years experience in the design, fabrication, and erection of sun control devices.

B. Installer Qualifications: Have sun control devices installed by manufacturer, third party installation is not acceptable.

1.06 PROJECT CONDITIONS

A. Field Measurements: Verify actual supporting and adjoining construction by field measurements before fabrication. Indicate recorded measurements on Shop Drawings. Coordinate construction to ensure that sun control devices fit properly to supporting and adjoining construction and coordinate schedule with construction progress to avoid delaying the Work.

PART 2 - PRODUCT

2.01 MANUFACTURERS

A. The design is based on products fabricated by: B&C Awnings, Inc., 3082 E. Miraloma Ave., Anaheim, CA, 714-632-3303, or an approved equal.
   1. Substitutions: Comparable products of other manufacturers will be considered under standard substitution procedures.

2.02 MATERIALS

A. Aluminum Extrusions: ASTM B 221, 6063 alloy, T5 or T52 temper.

B. Aluminum Sheet: ASTM B 209, 3003 or 5005 alloy, temper as required for forming or as recommended by metal producer for specified finish.

C. Aluminum Castings: ASTM B 26, alloy 319.

D. Fasteners: Same basic metal and alloy as fastened metal or 300 series stainless steel, unless otherwise indicated. Do not use metals that are incompatible with joined materials.

E. Anchors and Inserts: Type, size, and material required for loading and installation indicated. Use non-ferrous metal or hot-dip galvanized anchors and inserts for exterior installations and elsewhere, as needed, for corrosion resistance.

F. Bituminous Paint: One of the following:

   1. Cold-applied asphalt mastic: SSPC-Paint 12, containing non asbestos.
   2. Cold-applied asphalt emulsion: ASTM D 1187.

2.03 FABRICATION

A. General:

   1. Assemble sun control devices in shop to minimize field splicing and assembly.
   2. Assemble sun control devices using mechanical fasteners or welding only. Join components with a minimum of two filet welds, each 1-inch-long, produced with the Pulse Gas Metal Arc Welding (GMAW/MIG) process with a minimum 0.125 inch, throat. Comply with AWS D1.2 and D1.3.
   3. Maintain equal sun control blade spacing, including separation between blades and frames to produce uniform appearance.

4. Provide supports, anchorages, and accessories required for complete assembly.
5. Join frame members to one another and to fixed sun control blades with mechanical fasteners, concealed when possible. Bolt connections between frame members only as necessary.

C. Components:

1. Blades: 6” aluminum plate blade.
2. Outriggers: 6” tapered Manufacturer’s recommended standard, aluminum.
3. Fascia: 6” aluminum channel.

D. Factory Finishing: Finish designations prefixed by AA comply with system established by the AAMA for designating aluminum finishes.

THE EQUIVALENT ALCOA NUMBER FOR BELOW IS 204 R1.

1. Class I, Clear Anodic Finish: AA-M12C22A41 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matted, Anodic Coating: Architectural Class I, clear coating 0.7 mils or thicker),complying with AAMA 611.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verification of Conditions: Verify that all cement plaster, metal siding, masonry, and roofing work in the vicinity is complete and cleaned.

3.02 ERECTION

A. Install sun control devices level, plumb, and in indicated alignment with adjacent work.

B. Conceal anchorages where possible. Provide stainless steel/neoprene washers fitted to screws where required to protect metal surfaces and to make connections weathertight.

C. Repair damaged finishes so that no evidence remains of corrective work. Return items that cannot be refinished in the field to the shop. Make required alterations and refinish entire unit or replace unit.

D. Protect galvanized and nonferrous metal surfaces from corrosion or galvanic action by applying a heavy coating of bituminous paint to surfaces that will be in contact with concrete, masonry, or dissimilar materials.

3.02 CLEANING

A. Clean all protective cover components promptly after installation.

3.04 PROTECTION

A. Protect materials during and after installation.

END OF SECTION

SECTION 11 00 50 - BASIC EQUIPMENT MATERIAL AND METHODS

PART 1 - GENERAL

1.01 SUMMARY

A. The requirements of this Section shall apply to Divisions 11 and 14 Equipment Specifications, as well as to Section 10 67 00.

B. Furnish and install as directed by the County of Nevada Representative all equipment, as specified, complete and ready for operation. Each item shall be specifically designed for the intended function. Provide necessary accessories, items of equipment, mechanical, electrical and structural items, whether specified or not in order to provide properly installed and functional equipment. Contractor is required to coordinate all installation requirements with manufacturer's shop drawings for final dimensions and utility requirements.

C. Equipment shall be suitable for installation in the new Fleet Maintenance Facility as shown and required by the Contract Documents. Any modification or redesign to the building structure or utilities because of an alternate equipment selection by the Contractor shall be provided by the Contractor at no additional cost to the County of Nevada and shall be as approved by the County of Nevada Representative. All alternate equipment selections or proposed substitutions must be submitted and approved in accordance with the provisions of Division 1 - General Requirements.

D. In all cases where a device or part of the equipment is referred to in the singular number, it is intended that such reference shall apply to as many such devices as are required to complete the installation.

E. There will be no separate payment for the work of this Section.

F. Related Sections:
1. Drawing, General Provisions, Special Provisions and Division 1 apply to the work of this section.
2. Division 1 - Submittal Procedures.
3. Section 09 90 00 – Painting and Coatings
4. Section 10 67 00 – Storage Equipment
5. Section 11 14 60 – Fluid Dispensing Equipment
6. Section 11 14 80 – Vehicle Exhaust Reel System
7. Section 11 51 00 – Shop Work Stations
8. Section 11 52 00 – Shop Equipment
9. Section 11 53 50 – Cleaning Equipment
10. Section 11 95 00 Fall Protection Equipment
11. Section 14 45 00 – Vehicle Lifts
12. Division 23 – Mechanical
13. Division 26 – Electrical

1.02 REFERENCES

A. Work shall conform to Federal, State and local governing rules and regulations and ordinances, including the governing Building Codes, CAL OSHA and NFPA requirements, and shall pass inspection by the authorities having jurisdiction.

1.03 QUALITY ASSURANCE

A. General:

1. All articles, materials, fittings, equipment and appurtenances incorporated in the work shall be new and unused, free from defects and imperfections, of first grade commercial quality, and shall, as far as practicable, be manufacturer's standard make. Manufacturers shall have proven experience in the design and manufacture of specified items, suitable for the purpose intended and subject to approval by the County of Nevada Representative.
2. When two or more items of equipment are required, they shall be products of a single manufacturer.
3. All work shall be performed in a neat and workmanlike manner by workers skilled in their respective trades, and all materials and equipment shall be installed as recommended by the manufacturers and in accordance with specified codes and standards. And approved shop drawings.
4. Touch-up or repaint to match original finish, all factory finishes or painted equipment and materials which are scratched or marred during shipment or installation.
5. For purposes of designating type and quality of work for Divisions 11, 14 and section 10 67 00 - Storage Equipment, the Specifications are based on the requirements listed in Part 2 - Products.

B. Substitutions: Requests for approval of equipment items other than those specified herein shall be made in accordance with the Special Provisions, and Division 1 - General Requirements.

C. Permits and Tests: Obtain all necessary permits from the State of California and other authorities having jurisdiction, make application and file all drawings required for such permits, and pay all fees. Arrange for inspections and tests required by governing authorities and by the County of Nevada Representative, and pay all costs connected therewith. Obtain and file with the County of Nevada Representative written evidence that all the above requirements have been met.

D. Furnish proof that the Installing Contractor is licensed by the State of California.

E. Certifications: Obtain all necessary certifications from suppliers and testing agencies as required by the Contract and pay all fees related to obtaining them.

1.04 SUBMITTALS

A. Pursuant to the provisions of the General Requirements and Division 1, the Contractor shall submit the following as they relate to the maintenance equipment specified under these sections for Division 11, Division 14 and Section 10 67 00:
   1. Material and Equipment List.
   2. Product data (e.g., catalog cuts, manufacturer’s data, manufacturer’s certificate of conformance or compliance, certified test report, samples).
   3. Shop Drawings and Installation Instructions including the following:
      a. Layout drawings showing equipment, elevations, conduit runs, utilities and hook-ups, and all required dimensions. Drawings shall show plan and elevation views of all required conduit and piping runs. Equipment drawings shall clearly indicate all maintenance access points.
      b. Foundation and structural support drawings including anchor bolt plan and elevation. Verify that the pit configuration meets the requirements of the new equipment.
      c. Utility connection plan.
      d. Electrical equipment layout, with all motors, limit switches, solenoid valves, disconnects, control panels, emergency shut off switches, interlocks, accessories, all located and labeled.
      e. Piping systems including pipe routing, pipe and fittings, sizing, valving, lubricators, regulators, pumps, nozzles and accessories, fully noted and scheduled.

f. HVAC and exhaust air systems including duct routing, duct sizes, fittings, dampers, grilles, supports, etc., fully noted and scheduled including elevations, in addition to details of penetrations and equipment connections.

4. Schedule of Work as required by Division 1.
5. Operations Maintenance Manuals as required by this section and Division 1- General Requirements.
   a. General Requirements for Manuals:
      1) Manufacturer's operating manuals giving complete instructions relative to assembly, installation operation, adjustment, lubrication, maintenance, and carrying complete parts list every item of machinery and equipment.
      2) Manuals furnished may be manufacturer's standard publications in regard to size and binding provided they comply with specified requirements relative to quantity and quality of information and data.
      3) Manuals shall be bound in hard or flexible covers. Illustrations shall be clear, and printed matter, including dimensions and lettering on drawings, shall be easily legible. If reduced drawings are incorporated into manuals, original lines and letters shall be heavier-up as necessary to retain their legibility after reduction. Larger drawings may be folded into manuals to page size.
   b. Format Manuals as follows:
      1) Title page: Include the name and function of the equipment, manufacturer's identification number, and the project Specifications number and title.
      2) Table of contents, in numerical order listing each section and subsection title of the O&M Manual with reference to the page on which each starts and a list of included diagrams and drawings.
      3) Index, in alphabetical order.
      4) Frontispiece: Recognition illustration of the equipment described in the O&M Manual.
      5) Manufacturer's literature describing each piece of equipment, including major assemblies and subassemblies, and giving manufacturer's model number and drawing number.
      6) Operation instructions including step-by-step preparation for starting, safe operation, shutdown and draining, and emergency requirements.
      7) Control diagrams, as-installed by the manufacturer.
      8) Sequence of operation by the control manufacturer.
      9) Wiring diagrams, as-installed and color codes, of electrical motor controllers, connections and interlock connections.
      10) Diagrammatic location, function and tag numbers of each valve.
      11) Maintenance instructions: Include step-by-step procedures for inspection, operation checks, cleaning, lubrication, adjustments, repair, overhaul, disassembly, and reassembly of the equipment for proper safe operation of the equipment. Include list of special tools which are required for maintenance with the maintenance information.
      12) Possible breakdowns and repairs.
      13) Manufacturer's parts list of functional components, control diagrams and wiring diagrams, giving manufacturer's model number and manufacturer's part number.
      14) "Long-Lead-Time" spare parts list for spare parts not readily available on the local open market or for which it is anticipated ordering and delivery time will exceed 10 days.
      15) List of nearest local suppliers of all equipment parts.
      16) Lubrication schedule indicating type and frequency of lubrication.
      17) Manufacturer's warranty and guarantee data.
      18) Spare parts data as follows:
         a) Complete list of parts and supplies, with current unit prices and sources of supply.

b) List of parts and supplies that are either normally furnished at no extra cost with purchase of equipment, or specified herein to be furnished as part of Contract.
c) List of additional items recommended by manufacturer to assure efficient operation for period of 120 days.

19) Complete sufficient copies of manufacturer's preventive maintenance forms to properly address each equipment item and all major equipment components installed under this section.
20) Appendix: Include safety precautions, a glossary, and, if available at time of submittal, copies of test reports, and other relevant material not specified to be submitted.
21) Delete information on material or equipment not used in the work from the O&M Manual.

6. Training Program as required by this section and Division 1.
   a. General Requirements: Provide required training as outlined in this section.
      1) Maintenance management classes are to take place prior to substantial completion of the facility. Mechanics training will commence only after installation of machine is complete at the garage.
      2) Training shall be conducted at the new facility
      3) Hours for training are to be between 7:00am and 3:00 pm unless specifically permitted otherwise.
      4) County Personnel to be trained:
         a) Mechanics: Minimum 8 hours.
         b) Maintenance Personnel: Minimum 8 hours.
         c) Supervisors: Minimum 2 hours.
   b. Ensure that the instructors teaching these training courses are not only familiar with technical information, but able to utilize proper methods of instruction, training aids, audiovisuals, etc. to ensure effective presentations.
   c. Provide all training aids, audiovisual equipment and visual aids for the conduct of these courses.
   d. All training materials are to become the property of the County of Nevada at the conclusion of training.
   e. Submission and Approval of Training Plans:
      1) Meet with the County of Nevada Representative no later than three weeks prior to the start of formal training. At that time, submit lesson plans and an outline of training program, and demonstrate any training aids involved. Present handouts for approval and later provide handouts in a ratio of one per student. Each location shall receive a complete set of prints and schematics.
      2) Describe plans for meeting the specification training requirements. The County of Nevada Representative will approve and then coordinate and schedule all training involved with necessary personnel.
   f. Outline specific objectives for each of the required training courses. Provide a detailed schedule outlining the length and content of each of these sessions in accordance with the guidelines established.
      1) The course includes sessions in safety, machine operation, a comprehensive seminar on learning basic skills/knowledge of each operation. The course shall include both classroom and practical exercise sessions and is to provide the maintenance staff with the basic knowledge necessary to utilize all training materials.
      2) The training program shall include familiarization with safe equipment operation and performance and detailed instruction in operation, maintenance and test procedures.

   g. Sequence of Approval:
      1) Tentative Approval of Equipment: Before submittal of shop drawings, submit to the County of Nevada Representative for approval, drawings, specifications

and lists of equipment to be incorporated in the work. This list shall include catalog numbers, cuts, and such other descriptive data as may be required to assure compliance with these specifications. No consideration will be given to partial lists submitted from time to time. Approval of equipment will be tentative subject to submission of complete shop drawings indicating compliance with the Contract Documents.

2) Final Approval of Equipment: After receiving tentative approval of the equipment lists, submit shop drawings, product data and installation instructions for final approval.
3) Equipment substitutions must conform to the requirements of Division 1 – General Requirements.

h. Certificates:
1) Furnish an affidavit certifying that all materials and workmanship comply with the applicable code requirements.
2) Before final acceptance, furnish certificates of the authorities having jurisdiction.
3) Furnish factory certificates stating that all specification requirements relating to load capacities, pump capacities and fan capacities are provided.
4) Certify that the design of equipment items and systems complies with Seismic Use Group 1, Seismic Design Category B criteria.
a) Certification must be by a Professional Engineer registered in the State of California.
b) Supporting calculations must be submitted for review by the County of Nevada Representative.

1.05 JOB CONDITIONS

A. Within 60 days of the effective date of the Notice-to-Proceed, submit to the County of Nevada Representative for approval a detailed narrative explaining the quality control procedures to be utilized for the fabrication and installation of equipment. The narrative shall include details of the methods and procedures to be used to regulate the production of the equipment to assure compliance with the specified standards of quality. The narrative shall also include full information on the Contractor's methods of testing and inspection and shall identify the Contractor's representatives and their duties.

B. During the course of the work, the County of Nevada Representative will monitor the Contractor's approved quality control program to verify compliance. Any work undertaken, including the ordering and purchase of materials and supplies for the work, by the Contractor prior to approval of the Quality Control Program shall be at the Contractor's risk.

C. Certificates of Compliance: Upon delivery of the equipment, submit certificates of compliance. Each certificate shall be signed by an authorized representative of the manufacturer stating that the equipment complies in all respects with the Contract requirements.

D. General Design and Fabrication Requirements:
1. Equipment shall be designed, fabricated, installed and adjusted to secure the best commercially available results with respect to smooth, quiet, convenient and efficient operation, durability, economy of maintenance and operation, and the highest standards of safety.
2. It is not the intent of these Specifications to detail the design and fabrication of the several parts of the equipment, but it is expected that the type, material, design, workmanship and fabrication of each and every part shall be fully adequate for the service required, durable, properly coordinated with all other parts, in accordance with the best commercial standards and of the highest commercial efficiency. The components of electric circuits shall be of ample and proper size, design and material to avoid injurious heating and arcing, and all other objectionable effects which may reduce the efficiency of operation and economy of maintenance and upkeep below the best commercially

available results. Minimum requirements are given herein for the certain parts of equipment. Equivalent requirements approved by the County of Nevada Representative shall apply to such parts as are of special design, construction or material and to which the specified requirements are not directly applicable. These minimum requirements as a whole shall also be considered as establishing proportionate general minimum standards for all parts of the equipment.

3. The County of Nevada Representative may permit variations from the requirements of these Specifications to permit the use of the manufacturer's standard equipment, provided in his opinion such standard equipment is in every way adequate for the intended use and meets the full intent of these Specifications. All such variations proposed by the Contractor shall be called to the attention of the County of Nevada Representative in writing and shall be made only if approved in writing. All proposed substitutions must conform to the requirements of Division 1 – General Requirements.
4. Certain design limitation, tests, etc., are herein specified as a partial check on the adequacy of design, fabrication, and materials. These requirements do not cover all features necessary to insure satisfactory and approved operation of the equipment. Conformity with these requirements shall, in no way, supersede the general requirements as to satisfactory and efficient operation of the equipment.

E. Remove, relocate and repair any items that are necessary for the installation of the equipment, at no additional cost to the County of Nevada.

1.06 WARRANTY

A. Warranty: All equipment shall be warranted as a minimum in accordance with Division 1, General Requirements – Warranties and Guarantees and the following provisions:
1. The Contractor shall furnish a warranty covering all parts of the work performed, and all materials and equipment furnished hereunder by Contractor or his subcontractors or suppliers will be free from defects in design, material, workmanship and operation for a period of two years from the date of acceptance of the work unless otherwise noted differently on the individual specification sections.
2. Warranty shall provide for 24 hour parts availability and 24 hour response time. Supplier shall maintain an adequate parts stock such that equipment down times attributable to unavailable typical repair parts shall be 48 hours or less during the first five year period.
3. The Contractor shall repair or pay for the repair of any such defect at his own expense.
4. Work which has been abused or neglected is excluded from this warranty.
5. Furnish written warranties required by the respective sections of the Specifications for time stipulated therein. These warranties shall be in writing, on the Contractor's or supplier's letterhead and shall be included in the operations and maintenance manual(s) as specified in 1.04 of this section.
6. Major equipment components, (as required by the respective sections of the specifications) specifically those manufactured by other than the primary equipment supplier, shall be covered by their own respective warranties, which shall not be less than the suppliers mandated one year warranty or as noted on the specifications sections. These warranties shall also be included in the operations and maintenance manual(s).
7. Nothing in these requirements, conditions or specifications including the County of Nevada Representative's right to a complete inspection shall constitute a disclaimer to or limit, negate, exclude or modify in any way any warranty created hereunder.

1.07 NOISE AND VIBRATION ISOLATION

A. Operation of the equipment shall not exceed noise and vibration limits established by CAL OSHA, local code or other regulatory requirements. Where required, provide approved type noise and vibration isolation pads equipped with necessary bearing plates and bolts. Pads shall be specifically designed for the weights, speeds and vibration characteristics of the

equipment supported. The pads shall provide proper distribution of weight to avoid distortion of the bedplates.

B. Bolts and other fastenings in connection with these pads shall also be isolated.

1.08 SHOP PAINTING

A. Equipment shall be given one shop prime coat of approved rust-inhibitive paint containing at least 50 percent rust-inhibitive pigments and manufacturer's standard finish coat system. Shop drawings shall indicate brand and type of paint for both the prime coat and finish coat systems, as well as the color of all finish coats. All color selections must be approved by the County of Nevada Representative.

B. Special equipment painting requirements are outlined in the respective sections of Divisions 11 and 14, as well as Section 10 67 00.

C. Refer to Section 09 90 00 Painting and Coatings for specific requirements for painting interior and exterior galvanized surfaces and ferrous metal surfaces.

1.09 ELECTRICAL REQUIREMENTS

A. Electrical materials and devices shall conform to the standard of Underwriters' Laboratories, Inc. (UL). Where material standards have not been established by UL, standards of quality and performance shall be those of the specified manufacturers, subject to approval of the agencies having jurisdiction. Products that are not UL listed shall be tested in place to demonstrate that the item complies with FEP (Field Evaluated Product) UL requirements. The Contractor is responsible to include the costs for all such testing in his bid price and no additional compensation related to this testing will be provided.

B. Power supply for equipment shall be 480 volts, 3-phase, 60 hertz unless otherwise specified or as required by the specific piece of equipment.

C. Provide transformers for equipment as required to step down the specified supply voltage to provide lower voltage for controls and accessories and to provide voltage compatible with equipment as required.

D. Wiring shall be provided for complete installation of all equipment and accessories and shall be adequate for proper operation of equipment. Disconnect switch shall be provided for each equipment item requiring electric power. Disconnect switch shall meet the requirements of the respective equipment item manufacturer and these Specifications. Permanently label each disconnect switch to identify corresponding equipment item; labeling method shall conform to Division 1 and be subject to approval of the County of Nevada Representative. Contractor shall provide power wiring to line side of disconnect switch. Make connection to secondary side of disconnect switch and provide all wiring and conduit from this point, including wiring to controllers and starters. Provide 480 volt, 230 volt and 208 volt equipment, as required, with electric fusible disconnecting means, sized and fused as required for each equipment item. All disconnect switches shall be fused with 200,000 amp limiter fuses. Provide 120 volt equipment with electric thermal overload disconnecting means sized as required for each equipment item. Wire and cable for light, power and signal circuits shall conform to those specified in the National Electrical Code. In no case shall maximum current carried exceed that specified by National Electrical Code for type of conductor used. Provide conduit where required; all wiring and conduit shall be in accordance with the requirements of Division 26 - Electrical.

E. Motors:

1. Motors shall be high efficiency makes, each bearing the UL label and constructed to standard of NEMA, IEEE, ANSI, and AFBMA.
2. Motors shall be suitable for operation on the electrical service indicated.
3. Horsepower ratings and sizes shall be selected at 104°F ambient temperatures for open motors, with a service factor of 1.15 for open motors and unity service factor for totally enclosed or drip-proof motors. Provide motors with epoxy encapsulated insulation for severe usage in a corrosive atmosphere.
4. Motors rated one horsepower or greater shall have a full-load power factor of 85 percent or higher. Motors rated 25 horsepower and over shall be designed for reduced voltage starting.

F. Drives:
1. Guards shall be provided for each coupling and belt drive in conformance with applicable codes.
2. Belt drives shall have adjustable motor drive pulleys, and pulleys shall be replaced by the Contractor if required to properly operate the equipment.
3. Provide sliding motor bases where adjustable motor drive pulleys are provided.

1.10 GASKETS AND FASTENERS

A. Provide new gaskets wherever gasketed mating equipment items or pipe connections have been dismantled. Gaskets shall be in accordance with manufacturer's recommendations.

B. Replace all assembly bolts, studs, nuts and fasteners of any kind which are bent, flattened, corroded, or have their threads, heads or slots damaged.

C. Furnish all bolts, studs, nuts and other fasteners for make-up of all connections to equipment and replace any of these items damaged in storage, shipment or moving. Bolts shall comply with applicable SAE requirements including manufacturer's identification and certification of testing.

1.11 EQUIPMENT

A. Equipment, machinery and materials shall be as specified in Divisions 11 and 14, as well as Section 10 67 00.

B. Starters, controllers, disconnect switches and start-stop stations shall be provided for all equipment. Correct sizing of starters and disconnect switches shall be the joint responsibility of the Contractor and the equipment or apparatus manufacturer.
1. Electrical enclosures shall be NEMA 12 for indoor units and NEMA 4 for outdoor units unless otherwise noted by the County of Nevada Representative.
2. Starters shall be complete with two sets of auxiliary contacts; one set normally open; one set normally closed.
3. For motors 25 HP or greater provide auto transformer type reduced voltage starters.
4. Provide labels for all disconnects for the equipment furnished under respective section of work.

C. Control devices necessary for proper operation shall be provided and shall be located to permit efficient operation of the equipment, and where possible shall be grouped in a factory fabricated NEMA approved control panel complying with the Specifications.

D. Switches, lights and control functions shall be identified with commercially available touch pads. The touch pads shall be industrial type oil resistant, etc. that are used on CNC control panels. No decals will be accepted.

E. Piped services for equipment shall be terminated near the piece of equipment in a shut-off means. As part of the work of this Section, extend these piped services to the equipment and make the connections.

F. Provide piping, fittings, valves, connections, etc., of a type and size as recommended by the equipment manufacturer that will properly interface with the existing piped services.

G. All piping, valves, fittings, conduits and wiring required for the equipment installation shall be in accordance with the applicable portions of these Specifications.

1.12 INSTALLATION REQUIREMENTS

A. Furnish common and skilled labor, tools, rigging equipment, scaffolding, shims, dowels, and other materials necessary to make complete installation of equipment specified and indicated in the Contract Documents. Equipment Manufacturer shall provide on site representative during equipment installation.

B. Receive, unload, check and store equipment in suitable facilities. All equipment should be kept clean, dry, and free from damage and be marked and tagged with equipment item numbers.

C. Examine equipment for concealed damage and report any damage.

D. Be responsible for safety and protection from loss or damage of equipment received until work is complete.

E. Pay demurrage charges and claims for damage resulting from unloading operations.

F. Reassemble equipment items which were dismantled for shipment or moving. Assemble items which are delivered knocked down, or disassembled.

G. Coordinate the installation of equipment with the County of Nevada Representative.

H. Protect equipment during storage and prior to start-up, which shall include covering of openings, protection against rust and other damage, etc. Equipment may be stored outdoors only with approval of the County of Nevada Representative.

I. Furnish and install grout, shim material and miscellaneous steel necessary for brackets, anchors, or supports required in installation of equipment to include floor mounted and above roof mounted equipment.

J. Accomplish field machining that might be required to fit equipment together or to install equipment.

K. Lubricate apparatus before start-up per manufacturer’s specifications and recommendations, or as necessary.

L. Field check for clearance and interferences before fabrication or installation and relocate material and equipment furnished as required to eliminate interferences as approved by the County of Nevada Representative.

M. Details listed in these specifications are given for a better understanding of the work required by the Contractor, and do not place a limitation on the amount of work to be done nor do they relieve the Contractor of additional work that may be required for a complete installation.

N. All equipment must be installed and anchored at the identified locations as shown on the Equipment Drawings following specific Seismic Design guidelines per the Seismic codes having jurisdiction in the County of Nevada and the State of California.

O. Perform mechanical and electrical work required to install the equipment in accordance with the requirements of the jurisdictional authorities and the current applicable codes and standards of practice employed by these trades. Follow approved manufacturer's shop drawings for proper dimensions and location of required utilities.

P. The Contractor shall be responsible for the relocation of existing equipment from the existing fleet facility to be installed in the new facility. The Contractor shall be responsible to coordinate with the County of Nevada Representative, the decommissioning, relocation, and storage, installation at new location as shown on the contract documents including start-up and testing of the existing equipment. Contractor shall coordinate all utility connections and requirements and provide all miscellaneous fixtures as required for a proper installation of the relocated equipment to include new electrical, pneumatic, hydraulic components to connect the equipment. Any ventilation ducting, or drain connection required for the proper installation and operations of the existing equipment to be relocated shall be coordinated with the County of Nevada Representative and the Contract Documents.

The existing equipment to be relocated is identified on the Q drawings with light shade vs. the new equipment with dark shade and are also listed on drawing Q0.10 and Q0.20 – Equipment Schedule and marked as "Existing". Contractor shall be responsible for verifying proper quantity with the County of Nevada Representative and assume responsibility for the work as part of this contract. All equipment damaged during relocation shall be the responsibility of the Contractor to repair or replace in kind. Contractor shall assume that no existing equipment documentation is available for the existing equipment to be relocated.

All storage equipment to be relocated must be re-installed and anchored in the identified locations following specific Seismic Design guidelines per the Seismic codes having jurisdiction in the County of Nevada.

1.13 HOLES, OPENINGS AND INSERTS

A. Provide holes and openings in floors, walls, ceilings and roofs as required. Coordinate all holes and openings with reinforcement as required by Structural Contract Drawings. Also coordinate all holes and openings with sleeves and conduits from all other disciplines.

B. Core drill holes in existing work using dustless method. Grout holes in concrete walls, floor and roof slabs after installation of equipment, and leave them in a completely neat and sealed condition.

C. Install concrete inserts and flashings as required.

1.14 SETTING AND ALIGNING EQUIPMENT

A. Equipment shall be set and aligned in accordance with manufacturer's recommendations, approved shop drawings and applicable standards of trade practice.

B. Equipment shall be set true and level. Demonstrate adequate leveling of installed equipment.

C. Retighten bolted connections after installation.

1.15 CLEANING AND PROTECTION

A. Clean fabricated assemblies and equipment items thoroughly before and after operating and testing.

B. Protect equipment from damage, deterioration, paint or coating spills or spots, corrosion, or harm from any source.

1.16 CONCRETE FOUNDATIONS

A. Provide concrete foundations and steel supports for equipment as required for proper installation and operation. See General Equipment Notes on drawing #Q0.20 for Contractor's requirements for footings, foundations and steel supports. Contractor shall be responsible for any foundation and support modifications required due to requested substitutions to the specified equipment.

B. Concrete and reinforcement shall conform to Division 3 and Division 5.

C. Provide anchor bolts as required for equipment to be mounted. Size anchors for embedding in concrete and expansions anchors as recommended by the equipment manufacturer, in accordance with specified seismic criteria.

D. Provide grouting as necessary to stabilize equipment bases to concrete foundations.

E. Provide hard rubber shims and dampening pads as recommended by the equipment manufacturer for leveling of equipment and dampening of equipment vibration transmission.

1.17 EQUIPMENT TEST AND CHECK-OUT

A. Before Final Acceptance, the Contractor installed equipment and systems shall be tested in accordance with Division 1 (by a testing agency when required) in the presence of the County of Nevada Representative to his satisfaction and demonstrated to be correctly connected and installed. Submit a testing schedule to the County of Nevada Representative for approval prior to the start of the equipment test and check-out.

B. Testing and check-out procedures of the manufacturer shall be carried out completely.

C. Equipment tests shall not only be performed to demonstrate that the equipment has been properly installed and connected and operates properly but also to demonstrate that the equipment performs the work as described in Divisions 11 and 14 and Section 10 67 00 - Equipment Specifications.

D. Tested equipment found to be defective or inoperable to any extent shall be reported to the County of Nevada Representative immediately.

E. Any operating difficulty or defective item shall be repaired or replaced and put into proper operation by the Contractor immediately, at no additional expense to the County of Nevada.

F. Protect equipment and surrounding areas from damage resulting from testing operations. Clean-up spills or leakage from testing.

G. The Contractor shall bear all expenses of all tests, including the furnishing of all necessary instruments, lubricant, hydraulic fluids, supplies, data recorders, certificates and operating personnel. Provide and bear all expenses for fluid and power required to operate the equipment during the tests.

H. At the sole discretion of the County of Nevada Representative, the Contractor will be required to repeat any test at no additional cost to the County of Nevada.

1.18 MOTORS AND DRIVES

A. Motors and drives shall be checked carefully for correct rotation and alignment before placing equipment into operation.

B. Couplings shall be disconnected and realigned before placing into service or testing.

C. Belt drives shall be adjusted and worn belts replaced in sets. Speed adjustment shall be subject to approval of the County of Nevada Representative.

1.19 INSPECTION

A. Work will be inspected by the County of Nevada Representative periodically during the course of construction.

B. Provide for inspections by all those having jurisdiction over the work performed under Divisions 11 and 14 and Section 10 67 00 during the progress of the work.

C. At time of final inspection, furnish certificate or certificates of final approval by all those having jurisdiction as applicable.

1.20 FIELD PAINTING

A. Field painting equipment, including touch-up painting, if any, is included under this Section of Specifications. Normally, equipment shall be factory-finished as previously specified.

B. Where factory finishes are provided on equipment and no additional field painting is specified, all marred or damaged surfaces shall be touched up or refinished so as to leave a smooth, uniform finish at the time of final inspection.

1.21 EQUIPMENT START-UP

A. Unless otherwise specified in other Sections of these Specifications, all lubricants, cleaning compounds and similar operating materials will be furnished by the Contractor during start-up and testing.

B. After all equipment and systems have been installed, connected and tested, proceed with start-up.

PART 2 - PRODUCTS
Not Required

PART 3 - EXECUTION
Not Required

END OF SECTION

SECTION 11 14 60 - FLUID DISPENSING EQUIPMENT

PART 1 - GENERAL

1.01 SUMMARY

A. This Section specifies the Fluid Dispensing and Distribution System including air and electric reels and is defined to include, but not necessarily be limited to:
   1. Furnishing and installing all fluid dispensing system equipment at locations indicated on the Contract Drawings;
   2. Interfacing with the other work specified in these Contract Documents;
   3. Acceptance testing;
   4. Training of personnel; and
   5. Maintenance of the system during the warranty period;

B. The provisions of Section 11 00 50 apply to the work of this Section.

C. Related Work Specified Elsewhere:
   1. Division 1 – General Requirements
   2. Plumbing – Division 22
   3. Process Piping – 22 10 10
   3. Mechanical - Division 20.
   4. Electrical: Division 26.

1.02 QUALITY ASSURANCE

A. Model numbers indicated are to establish a minimum standard of quality. Any substitutions not meeting the minimum requirements shall be approved by the Nevada County Representative and substitution request submitted for review and approval.

B. Alternates and Substitutions: To be provided in accordance with requirements listed in Division 1 and Section 01 23 00.

1.03 SUBMITTALS

A. Submit shop drawings, catalog cuts and all manufacturers data covering all equipment covered in this section. If submitting catalog cuts, the contractor is responsible to assure that the models specified or submitted including all components or accessories associated with said equipment are highlighted or underlined. No generic information shall be accepted and will be rejected.

B. Product Submission and Shop Drawings: As specified in Section 11 00 50.
   1. Work includes furnishing and installation of heat actuated shut-off valves, shut-off valves, check valves, flexible hydraulic hose, distribution piping and fittings, fluid solenoid valves, pulse transmitters, fluid hose reel assemblies, control handles, meters, pump systems, mounting accessories, above ground tanks, tank leveling alarm system and all other work and material to provide an approved working installation as shown in the Contract Drawings and as specified.

C. Unless otherwise specified, any materials described, shown, reasonably implied, or obviously a part of the system and necessary to its complete finish and perfect operation shall be furnished and installed, without extra charge. The drawings and specifications are intended to supplement each other, and any item set forth in either shall be recognized as the same as if fully set forth in both.

D. The contractor shall be responsible for coordinating all of the materials and equipment to provide a complete fully operational fluid dispensing system. Information provided on the

Contract Drawings and specifications are requirements to be used as guidelines to assist the Contractor.

E. Where design information is not specifically noted on the Contract Drawings, it shall be the responsibility of the Contractor to develop such design information as required by the manufacturer for a complete operational system.

F. The various component parts shall function together as a workable fluid dispensing system, complete with everything necessary for its operation and with all equipment properly adjusted and in working order.

G. The Fluid Distribution system will require process piping to connect between the AST tank storage in the Lube/Compressor Room and the reel bank locations on the drawings. For process piping layouts and specifications see Process Piping Drawings and specification Division 22 – Plumbing.

H. Contractor shall provide complete maintenance and operation manuals for all of the fluid dispensing equipment listed in this section. See also section 11 00 50 – Basic Equipment Materials and Methods.

1.05 WARRANTY

A. Following completion, the Contractor shall provide the Nevada County Representative with two (2) years of warranty as stipulated in Section 01 40 00 starting at project acceptance, covering all parts, materials, and labor. All warranty work shall be performed by a local manufacturer's representative at the Project Site location, who has capabilities of responding to all problems within 24 hours. Any shipping and delivery costs associated with the warranty of this equipment shall be the responsibility of the Contractor.

1.06 DELIVERY, STORAGE AND HANDLING

A. Deliver, store, and handle products without damaging them.
1. Receive, unload, check, protect, and store equipment in facilities suitable to keep it clean, dry, and free from damage, vandalism, and pilferage.
2. Pay demurrage charges and claims for damage resulting from unloading operations.
3. Examine equipment for visible and concealed damage. Report any damage to carrier, supplier, and Nevada County Representative as soon as possible.

B. Protect equipment from loss, deterioration, and damage until work is complete.
1. Protect equipment during storage and prior to start-up.
2. Protect exposed finished surfaces with removable coating for film, cover openings to exclude dirt and fouling materials, and protect unfinished surfaces against rust, corrosion, and other damage.
3. Protect equipment from paint or coating spills and spots.

PART 2 - PRODUCTS

2.01 FLUID DISPENSING EQUIPMENT

A. Acceptable Manufacturer
1. Products of the following manufacturer are specified herein as the standard of quality for the Fluid Dispensing equipment:
a. Graco, Incorporated
3165 Garfield Avenue
Los Angeles, CA 90040
Telephone: (213) 722-4783
Distributor: Peterson Hydraulics
Telephone: (310) 323-3155

2. Products of equal quality and utility of the following manufacturers shall be accepted:
   a. Lincoln St Louis Lubrication Equipment
      4010 Goodfellow Blvd.
      St. Louis, MO 63120
      Telephone: (314) 679-4200
   b. Approved equal.

2.02 MOTOR OIL PUMP

A. Equipment Item No.'s LR-3, LR-4 and LR-5.

B. Provide tank mounted air operated stubby bare pump designed to draw fluid from an aboveground storage tank, and deliver over long supply lines to multiple reel installations to the Repair Bays with the following features:

1. Power Ratio: 6:1.
2. Maximum fluid pressure: 1,100 psi
3. Air motor effective diameter: 4.25 inches
4. Air operating range: 40-180 PSI
5. Approximate air consumption: 49.5 scfm
6. Continuous Duty Flow Rate: 6.8 GPM
7. Air inlet port hole: ½ npt
8. Fluid inlet port size: 1 ½ ntp
9. Fluid outlet port size: ¾ ntp
10. Hose and fitting kit model no. 222-068
11. Fluid shut-off valve model no. 108537
12. Thermal Relief Valve Kit Model No. 240-429
13. Aboveground 275 gallon (MO#1 - 15/40), 120 gallon (MO#2 - 5/20) and 120 gallon (MO#3 - 5/30) supply tank mounting kit as required for proper installation.
14. Thermal relief valve and fluid shut off valve located at pump.
15. Provide air filter, regulator, 200 PSI rated gauge, water separator and lubricator for airline connection.
16. Provide complete pump system as required for proper delivery to remote motor oil reels at 2 to 3 gallons per minute.
17. Provide ball valve on supply line at pump location for easy shut-off of fluid flow for maintenance and emergency situation.
18. For piping requirements, see process piping drawings and specifications in Division 22 – Plumbing.

C. Fire-Ball pump shall be rated to deliver full delivery flow to the reels up to 500 feet away as specified in the Manufacturer's data sheets.

D. Motor oil pump shall be Fire-Ball 425 Model No. 238108 with all above accessories as required for complete pumping system as manufactured by Graco, Inc. or approved equal with the above minimum requirements.

2.03 AUTOMATIC TRANSMISSION FLUID (ATF) PUMP

A. Equipment Item No. LR-6.

B. Provide wall mounted air operated stubby length bare pump designed to draw fluid from an aboveground storage tank, and deliver over long supply lines to multiple reel installations to Repair Bays with the following features:
1. Power Ratio: 6:1
2. Maximum fluid pressure: 1,100 PSI
3. Air motor effective diameter: 4.25 inches
4. Air operating range: 40-180 PSI
5. Approximate air consumption: 49.5 scfm
6. Air inlet port hole: ½ npt
7. Fluid inlet port size: 1 ½ npt
8. Fluid outlet port size: ¾ npt

9. Hose and fitting kit model no. 222068
10. Fluid shut-off valve model no. 108537
11. Thermal Relief Valve Kit model no. 240-429
12. ATF #1: pump (ATF#1 – Multipurpose DEX) supplied from a 55 gallon drum with wall mounting kit.
13. Thermal relief valve and fluid shut off valve located at pump
14. Provide air filter, regulator, 200 PSI rated gauge, water separator and lubricator for airline connection.
15. Provide complete pump system as required for proper delivery to ATF reels at 2 to 3 gallons per minute.
16. Provide ball valve on supply line at pump location for easy shut-off of fluid flow for maintenance and emergency situation.
17. Provide proper wall mounting kit for wall mounted pump as recommended by manufacturer.
18. For piping requirements, see process piping drawings and specifications in Division 22-Plumbing.

C. Fire-Ball pump shall be rated to deliver full delivery flow to the reels up to 500 feet away as specified in the Manufacturer's data sheets.

D. ATF pump shall be Fire-Ball 425 Model No. 238108 with all above accessories as required for complete pumping system as manufactured by Graco, Inc. or approved equal with the above minimum requirements.

2.04 COOLANT DELIVERY PUMP

A. Equipment Item No. LR-10.

B. Provide high flow low pressure diaphragm transfer pump to be wall mount design to draw cooling/antifreeze fluid from an aboveground storage tank and deliver to multiple reels over long supply lines to Repair Bays.
Provide with the following features:
1. Power Factor: 1:1 Aluminum 1 inch diaphragm pump.
2. Operate at max 100 PSI plant air.
3. Maximum REC (CPM): 276.
4. Continuous free flow rate: 50 gpm.
5. Air consumption: 64 scfm @ 100 PSI.
6. Air inlet: ½ npt.
7. Fluid inlet: 1 npt.
7. Suction hose kit: model no. 236054.
9. Suction hose kit as required for 120 gallon aboveground tank.
10. Thermal relief kit model no. 238-428.
11. Bung Adapter.
12. Low Level Cut-Off: model no. 203-688 .
13. Mounting accessories for wall mount installation, model no. 24C637.
14. Provide air filter, air regulator and 200 PSI rated gauge, water separator, and lubricator for airline connection.
15. Provide ball valve on supply line at pump location for easy shut-off of fluid flow for maintenance and emergency situation.
16. Aboveground 120 gallon supply tank mounting kit (Antifreeze/Coolant Multi Purpose)

C. Coolant diaphragm delivery pump shall be pump 1050A Part No. 647016 with all required accessories for proper installation as manufactured by Graco, Inc. or approved equal with the above minimum requirements.

2.05 USED OIL/COOLANT EVACUATION PUMP

A. Equipment item No.'s LD-21, LD-22, HD-19 and HD-20.

B. Construction Features:
1. Construction materials compatible with used oil and coolant/antifreeze.

2. Air operated.
3. 1050 - 1 inch diaphragm, self-priming pump.
4. Polypropylene construction.
5. 1:1 pressure ratio.
6. Capable of delivering up to 14 gpm to waste oil/coolant tank.
7. Wall brackets: model no. 24C637.
8. Air installation kit model no. 240684.
9. Fluid installation kit model no. 240685, including 4 ft. and 10 ft. hoses ball valves and fittings.
10. Drum style adapter kit model no. 240832
11. Compressed air line to pumps shall be equipped with a solenoid valve interconnected to the overfill alarm on the waste oil and coolant tanks. Compressed air to pumps to be shut off when tank reaches alarm level.

C. Pump directly connected to a drain line plumbed to a remote aboveground waste oil and coolant tank in the Lube/Pump Room. For pump locations see drawing Q1.10, for piping requirements see process piping drawings and Specifications on Division 22 –Plumbing.

D. Each pump to be supplied with air connection hose, airline filter, lubricator, regulator and 200 PSI rated gauge, quick disconnect air and fluid couplers, fluid evacuation hoses, and a shut-off valve for pump activation. Valve shall be located near the pump.

E. Pumps shall be mounted in tandem and labeled “Used Oil” and “Used Coolant” and plumbed to the appropriate waste fluid tank.

F. Provide wall hangers for siphon hoses (with quick disconnect couplers) when not in use.

H. Provide quick disconnect (male/female) coupler for proper connection to all components for equipment but not limited to LD-4, LD-5, HD-5, HD-6 and HD-10 to connect to evacuation pump. See detail on Industrial Equipment Drawings for reference.

I. Evacuation Pump shall be 1050A diaphragm pump with Wall Mounted Package Model No. 24E166 Oil Evacuation System as manufactured by Graco Lubrication Equipment, or approved equal with the above minimum requirements.

2.06 HYDRAULIC FLUID PUMP

A. Equipment Item No. LR-7.

B. Provide tank mounted air operated pump designed to draw fluid from a 275 gallon tank, and deliver over long supply lines to multiple reel installations to Repair Bays with the following features:
1. Power Ratio: 6:1
2. Maximum fluid pressure: 1,100 PSI
3. Air motor effective diameter: 4.25 inches
4. Air operating range: 40-180 PSI
5. Approximate air consumption: 49.5 scfm
6. Air inlet port hole: ½ npt
7. Fluid inlet port size: 1 ½ npt
8. Fluid outlet port size: ¾ npt
9. Hose and fitting kit model no. 222068
10. Fluid shut-off valve model no. 108537
11. Thermal Relief Valve Kit model no. 240-429
12. Pump is supplied from a 275 gallon tank (Hydraulic Fluid) with tank mounting kit.
13. Thermal relief valve and fluid shut off valve located at pump.
14. Provide air filter, regulator, 200 PSI rated gauge, water separator and lubricator for airline connection.
15. Provide complete pump system as required for proper delivery to Hydraulic Fluid reels at 2 to 3 gallons per minute.
16. Provide ball valve on supply line at pump location for easy shut-off of fluid flow for maintenance and emergency situation.

17. Provide proper tank mounting kit for pump as recommended by manufacturer.
18. For piping requirements, see process piping drawings and specifications in Division 22 – Plumbing.

C. Fire-Ball pump shall be rated to deliver full delivery flow to the reels up to 500 feet away as specified in the Manufacturer's data sheets.

D. Hydraulic Fluid pump shall be Fire-Ball 425 Model No. 238108 with all above accessories as required for complete pumping system as manufactured by Graco, Inc. or approved equal with the above minimum requirements.

2.07 GEAR OIL PUMP

A. Equipment Item No. LR-8.

B. Provide tank mounted air operated pump designed to draw fluid from a 120 gallon tank, and deliver over long supply lines to multiple reel installations to Repair Bays with the following features:
1. Power Ratio: 6:1
2. Maximum fluid pressure: 1,100 PSI
3. Air motor effective diameter: 4.25 inches
4. Air operating range: 40-180 PSI
5. Approximate air consumption: 49.5 scfm
6. Air inlet port hole: ½ npt
7. Fluid inlet port size: 1 ½ npt
8. Fluid outlet port size: ¾ npt
9. Hose and fitting kit model no. 222068
10. Fluid shut-off valve model no. 108537
11. Thermal Relief Valve Kit model no. 240-429
12. Pump is supplied from a 120 gallon tank (Hydraulic Fluid) with tank mounting kit.
13. Thermal relief valve and fluid shut off valve located at pump.
14. Provide air filter, regulator, 200 PSI rated gauge, water separator and lubricator for airline connection.
15. Provide complete pump system as required for proper delivery to Hydraulic Fluid reels at 2 to 3 gallons per minute.
16. Provide ball valve on supply line at pump location for easy shut-off of fluid flow for maintenance and emergency situation.
17. Provide proper tank mounting kit for pump as recommended by manufacturer.
18. For piping requirements, see process piping drawings and specifications in Division 22 – Plumbing.

C. Fire-Ball pump shall be rated to deliver full delivery flow to the reels up to 500 feet away as specified in the Manufacturer's data sheets.

D. Gear Oil pump shall be Fire-Ball 425 Model No. 238108 with all above accessories as required for complete pumping system as manufactured by Graco, Inc. or approved equal with the above minimum requirements.

2.08 CHASSIS GREASE PUMP (WITH ELEVATOR)

A. Equipment Item No. LR-9.

B. Provide elevator mounted air operated pump designed to draw fluid from a 55 gallon (400 pound) drum mounted on elevator base, and deliver over long supply lines to multiple reel installations to Repair Bays with the following features:
1. Power factor: 50:1 ratio.
2. Maximum fluid pressure: 8400 PSI.
3. Air motor effective diameter: 3 inch.
4. Operating Range: 30-140 PSI.
5. Continuous duty flow rate: 1.19 lbs./min.
6. Approximate air Consumption @100 psi: 22.8 cfm.
7. Air inlet: 3/8 npt

8. Material Inlet: Slotted.
9. Material outlet: 1/4 npt.
10. Provide elevator with pump, follower plate, hose, drum cover, base and connecting hoses.
11. High pressure relief valve as required.
12. Provide air filter, air regulator and 200 PSI rated gauge, water separator, and lubricator at local air line connection.

C. Chassis Grease pump shall be Model No. 226013 with all above accessories as required for complete pumping system as manufactured by Graco, Inc. or approved equal with the above minimum requirements.

2.09 WINDOW WASHER FLUID (MANUAL PUMP)

A. Equipment Item No. LR-11.

B. Provide a 55 gallon drum mounted, lever operated manual pump for the use with window wiper fluid. The pump shall be heavy duty and shall have the following qualities:

1. Composition: Body – Ryton Rod – 316 Stainless Steel with Viton seals.
2. To fit a standard 15-gallon to 55-gallon drums with 1.25” & 2” NTP Bung.
3. Flow Rate: maximum 14.4 ounce/stroke
4. Maximum viscosity: 40 weight fluid
5. Three handle pin location for different flow rates per stroke.
6. Color: Black
7. Weight: 3.3 lbs.

C. Acceptable manufacturer:
1. Products of the following manufacturer are specified herein as the standard of quality for the manual pump:
   a. New Pig - Zeeline
      P.O. Box 304
      Tipton, PA 16684-0304
      Telephone: (800) 493-4647
   b. Approved Equal

D. Manual fluid pump shall be Model No. DRM109 as manufactured by New Pig-Zeeline or approved equal with the above minimal requirements.

2.10 MOTOR OIL REEL

A. Equipment Item No. LD-10, LD-11, HD-7, HD-9

B. Provide a heavy duty, large capacity open hose reel with the following attributes:
1. Metal supports on both ends of the reel hub.
2. Weld and gusset double arms supporting both sides of the roller guide, which can be rotated 270 degrees.
3. Lube Hose:
   a) Lube hose to be 1/2” diameter by 50 foot long at 2,000 psi working pressure.
   b) Tube: Black oil resistant synthetic rubber (Nitrile)
   c) Cover: Black oil and abrasion resistant synthetic rubber (Modified Nitrile)
   d) One braid of high-tensile steel wire.
   e) Hose to be installed and coiled to Graco bare reel Model #HNM65B.
   f) Hose to be supplied and installed by same supplier prior to delivery to site.
   g) Coordinate hose connections with reel and metering valve connections prior to installation.
   h) Lube hose to be Model No.10C1A as manufactured by Dayco or approved equal.
4. Connecting inlet hose: 24 inches long: 1/2 inch inside diameter: 2,000 PSI working pressure.

5. Provide Matrix Type Electronic pre-set metering valve Model No. 256282 for the MO. Swivel cover and impact guards to be color coded, consistent throughout the facility. Provide rigid extension with non-drip quick close nozzles. Capacity: 60 quarts.
7. Mounting Accessories for overhead mount as required. Provide shop drawings for coordination. See Structural drawings for structural support.
8. Delivery flow to provide 2-3 gpm capacity.
9. Operating pressure: 2,000 PSI
10. Battery Requirement: rechargeable nickel-metal hydride 9.6 VDC.

C. Provide ball valve on supply line at reel location for easy shut-off of fluid flow for maintenance and emergency situation.

D. Motor Oil reel shall be XD Series Reel Model No. HSM65B with connecting inlet hose kit and electronic Matrix System pre-set Metering Valve with all above accessories as manufactured by Graco, Inc. or approved equal with the above minimum requirements.

2.11 AUTOMATIC TRANSMISSION FLUID (ATF) REEL

A. Equipment Item No. LD-12.

B. Same as specified in Article 2.10 (Motor Oil Reel).

C. Provide Matrix Type Electronic pre-set metering valve model no. 256482 with flexible extension with standard automatic non-drip quick close nozzle for the ATF Reel. Capacity 60 quarts.

2.12 HYDRAULIC FLUID REEL

A. Equipment Item No. HD-11.

B. Same as specified in Article 2.10 (Motor Oil Reel).

2.13 GEAR OIL REEL

A. Equipment Item No.'s LD-13, HD-12.

B. Same as specified in Article 2.10 (Motor Oil Reel).

2.14 CHASSIS GREASE REEL

A. Equipment Item No.'s LD-14, HD-13

B. Provide a heavy duty, large capacity open hose reel with the following attributes:
1. Metal supports on both ends of the reel hub.
2. Weld and gusset double arms supporting both sides of the roller guide, which can be rotated 270 degrees.
3. Lube Hose: 50 foot long: 3/8 inch inside diameter: 4000 psi working pressure.
4. Connecting inlet hose: 24 inches long: 3/8 inch inside diameter: 4000 PSI working pressure.
5. Grease Dispense Valve and Z Swivel
6. Mounting Accessories for overhead mount as required. See Structural drawings for structural support.
7. Hose inlet kit model no. 218550

C. Chassis Grease Reel Assembly shall be Model No. HSH55B fully complete with Grease Dispense Valve Model No. 242058 and Z Swivel Model No. 224569 as manufactured by Graco, Inc. or approved equal with the above minimum requirements

2.15 COOLANT REEL

A. Equipment Item No.'s LD-15 and HD-14

B. Provide a heavy duty, large capacity open hose reel with the following attributes:
   1. Metal supports on both ends of the reel hub.
   2. Weld and gusset double arms supporting both sides of the roller guide, which can be rotated 270 degrees.
   3. Fluid Hose: 50 foot long: 1/2 inch inside diameter: 300 PSI working pressure minimum.
   4. Connecting inlet hose: 24 inches long: 1/2 inch inside diameter. Rated at 300 PSI.
   5. Provide Matrix Type Electronic pre-set metering valve model no. 256482 with flexible extension with standard automatic non-drip quick close nozzle for the Coolant Reel.
   6. Mounting Accessories for overhead mount as required. Provide shop drawings for coordination. See Structural drawings for structural support.
   7. Delivery flow to provide 2-3 gpm minimum capacity.

C. Provide ball valve on supply line at reel location for easy shut-off of fluid flow for maintenance and emergency situation.

D. Coolant reel shall be XD Series Model No. HSL65B with connecting inlet hose kit and electronic Matrix System pre-set Metering Valve as manufactured by Graco, Inc. or approved equal with the above minimum requirements.

2.16 AIR REEL

A. Equipment Item No. LD-16, LD-16A, HD-15, HD-15A TS-2, WS-3

B. Provide a heavy duty, large capacity open hose reel with the following attributes:
   1. Metal supports on both ends of the reel hub.
   2. Weld and gusset double arms supporting both sides of the roller guide, which can be rotated 270 degrees.
   3. Dispenser hose: 50 foot long: ½ inch inside diameter: 300 PSI working pressure.
   4. Connecting inlet hose: 24 inches long: ½ inch inside diameter: 2,000 PSI working pressure.
   5. Outlet dispenser control: Heavy duty tire inflationary (236205), Safety blowgun (236211). Quick coupler to be ½ inch size unless requested differently by the Nevada County Representative.
   6. Provide all required mounting accessories for overhead mount reels and column mount reels as required. See equipment drawings Q1.10 and Q1.20 for locations. Provide shop drawings for coordination. See Structural drawings for structural support.

C. All air reels as listed above will be connected to the new air compressed system as shown on the Process Piping Drawings.

D. Contractor shall coordinate with Nevada County Representative, the user and the Air Distribution Drawings to assure that all quick disconnect drops in the facility are sized for the user's requirement. This should include required connections for the miscellaneous hand tools and impact and tire guns required at the site. Contractor to coordinate airline distribution drawings to assure appropriate size pipe is installed for proper operation.

E. Provide ball valve on supply line at reel location for easy shut-off of air line for maintenance and emergency situation.

F. Air reel shall be XD Series Model No. HSL65B as manufactured by Graco, Inc. or approved equal with the above minimum requirements.

2.17 HIGH PRESSURE AIR REEL

A. Equipment Item No. LD-17, HD-16, TS-6.

B. Provide a heavy duty, large capacity open hose reel with the following attributes:
   1. Metal supports on both ends of the reel hub.
   2. Weld and gusset double arms supporting both sides of the roller guide, which can be rotated 270 degrees.

3. Dispenser hose: 50 foot long: 3/4 inch inside diameter: 300 PSI working pressure.
4. Connecting inlet hose: 24 inches long: 3/4 inch inside diameter: 2,000 PSI working pressure.
5. Outlet dispenser control: Heavy duty tire inflationary (236205), Safety blowgun (236211). Quick coupler to be 3/4 inch size unless requested differently by the Nevada County Representative.
6. Provide all required mounting accessories for overhead mount reels and column mount reels as required. See equipment drawings Q1.10 and Q1.20 for locations. Provide shop drawings for coordination. See Structural drawings for structural support.

C. All air reels as listed above will be connected to the new air compressed system as shown on the Process Piping Drawings.

D. Contractor shall coordinate with Nevada County Representative, the user and the Air Distribution Drawings to assure that all quick disconnect drops in the facility are sized for the user's requirement. This should include required connections for the miscellaneous hand tools and impact and tire guns required at the site. Contractor to coordinate airline distribution drawings to assure appropriate size pipe is installed for proper operation.

E. Provide ball valve on supply line at reel location for easy shut-off of air line for maintenance and emergency situation.

F. Air reel shall be XD Series Model No. HSLD5B as manufactured by Graco, Inc. or approved equal with the above minimum requirements.

2.18 SERVICE LABELS

A. Provide service labels for all of the service reels and pumps included in these specifications. Labels to include Motor Oil – 5W30, 15/40, 0/20, ATF - Multipurpose DEX, Autran Syn 295, Coolant/Antifreeze Multipurpose 50/50 blend, Air, High Pressure Air, Electric, Used Oil Evacuation Pump and Used Coolant Evacuation Pump. Mount on unit, one per reel and one per pump. Coordinate the fluid names with Nevada County Representative prior to making and installing the labels to assure that the proper call outs are used.

B. Labels shall be mylar self-adhesive labels, 1 inch wide x 5 inches long minimum (tape ends when mounting), and/or metal label kits (3/4 inch wide x 4-1/4 inch long metal label and mounts).

C. Provide all mounting hardware to mount all labels on pumps and reels.

D. Service labels shall be as manufactured by Graco, Inc. or approved equal with the above minimum requirements.

E. Provide labels on hose reels just above control dispenser.

2.19 120 GALLON DOUBLE WALL ABOVEGROUND TANK

A. Equipment Item No.'s LR-13, LR-14, LR-16, LR-17 and LR-19.

B. Acceptable Manufacturer:
1. Products of equal quality and utility of the following manufacturers shall be accepted aboveground storage tanks.
   a. Containment Solutions
      5150 Jefferson Chemical Road
      Conroe, TX 77301
      Telephone: (800) 537-4730
      Distributor:

Mike Sands and Associates
101 South Kraemer Blvd. Suite 211
Placentia, CA 92870
Telephone: (714) 528-6182

2. Products of equal quality and utility of the following manufactures shall be accepted:
   a. Service Station Equipment Co., Inc.
      1829 East 55th Street
      Cleveland, OH 44103
      Telephone: (800) 362-1384
      (216) 431-6100

C. Construction Features - Provide a 120 gallon above ground tank with the following attributes:
1. Primary tank UL 142 listed.
2. Secondary tank UL 142 listed.
3. 360 degree steel outer steel secondary containment.
4. Manufacturer's 30 year warranty.
5. Placard, no smoking, combustible decal.
6. Tank label: Provide tank label with name of product to be stored in minimum 4 inch letters and easily readable location when tank is installed.
7. Finish paint coat white epoxy.
8. Mount on 2-inch supports for visual leak inspection.
9. Tanks shall be equipped with audible low level and overfill alarm and high and low level indicator. Provide high and low level switches to meet the requirements of the specifications. Used coolant tank LR-19 shall have alarm interconnected to solenoid valve on compressed air line to the used oil Evacuation Pumps. Compressed air to pumps are to be shut off when used fluid tanks reach alarm level. Coordinate with Plumbing drawings.
10. Tank shall be equipped with an interstitial monitor that will indicate the presence of a leak in the secondary containment. Provide with two – 2 inch interstitial fittings.
11. Tanks shall be rectangular in design.
12. Secondary containment tank shall provide a minimum of 110% secondary containment.
13. Secondary containment pressure tested in factory to UL142 specification at 3 PSI.
14. Tanks shall be equipped with emergency vents as required by NFPA 30
15. All tanks shall be grounded to the structure as per manufacturer's recommended requirements. Manufacturer shall provide suggested grounding tank details to the contractor as part of the installation requirements.
16. Seismic design anchoring shall be provided to all tanks per manufacturer's design requirements and per all seismic codes having jurisdiction.

D. Dimensions:
1. Overall: 3-foot, 2-inches long x 2-foot, 10-inches wide x 3-foot, 1-inches high.
2. 2 - 2-inch interstitial fittings.
3. 7-gallon overspill box as supplied by Hoover Lube Cube tanks with drain.
4. 2, - 4-inch emergency vents. One on primary space and one on secondary containment.
5. 2 inch gauge
6. 2 inch monitoring point
7. 1 - 2-inch vent with riser pipe.
8. 2-inch fill opening with flip top fill cap.
9. 2 inch spare

E. Utilities:
1. Electrical: 120V/1PH/60Hz service for audible overfill alarm

F. The 120-Gallon Aboveground Tanks shall be the 120-Gallon Lube Cube with secondary containment as manufactured by Containment Solutions or approved equal with the above minimum requirements.

2.20 280 GALLON, DOUBLE WALL ABOVEGROUND TANK

A. Equipment Item No.'s LR-12 and LR-15

B. Acceptable Manufacturers:

1. Products of the following manufacturer are specified herein as the standard of quality for the aboveground storage tanks.
   a. Containment Solutions
      5150 Jefferson Chemical Road
      Conroe, TX 77301
      Telephone: (800) 537-4730
      Distributor:
      Mike Sands and Associates
      101 South Kraemer Blvd. Suite 211
      Placentia, CA 92870
      Telephone: (714) 528-6182

2. Products of equal quality and utility of the following manufactures shall be accepted:
   a. Service Station Equipment Co., Inc.
      1829 East 55th Street
      Cleveland, OH 44103
      Telephone: (800) 362-1384
      (216) 431-6100

C. Construction Features - Provide a 280 gallon above ground tank with the following attributes:
1. Primary tank UL 142 listed.
2. Secondary tank UL 142 listed.
3. 360 degree steel outer steel secondary containment.
4. Manufacturer's 30 year warranty.
5. Placard, no smoking, combustible decal.
6. Tank label: Provide tank label with name of product to be stored in minimum 4 inch letters and easily readable location when tank is installed.
7. Finish paint coat white epoxy.
8. Mount on 2-inch supports for visual leak inspection.
9. Tanks shall be equipped with audible low level and overfill alarm and high and low level indicator. Provide high and low level switches as required to meet the requirement of the specifications.
10. Tank shall be equipped with an interstitial monitor that will indicate the presence of a leak in the secondary containment. Provide with two – 2 inch interstitial fittings.
11. Tanks shall be rectangular in design.
12. Secondary containment tank shall provide a minimum of 110% secondary containment.
13. Secondary containment pressure tested in factory to UL142 specification at 3 PSI.
14. Tanks shall be equipped with emergency vents as required by NFPA 30
15. All tanks shall be grounded to the structure as per manufacturer's recommended requirements. Manufacturer shall provide suggested grounding tank details to the contractor as part of the installation requirements.
16. Seismic design anchoring shall be provided to all tanks per manufacturer's design requirements and per all seismic codes having jurisdiction.

D. Dimensions:
1. Overall: 4-foot, 10-inches long x 2-foot, 10-inches wide x 4-foot, 1-inches high.
2. 2 - 2-inch interstitial fittings.
3. 7-gallon overspill box as supplied by Hoover Lube Cube tanks with drain.
4. 2, - 4-inch emergency vents. One on primary space and one on secondary containment.
5. 2 inch gauge
6. 2 inch monitoring point
7. 1 - 2-inch vent with riser pipe.
8. 2-inch fill opening with flip top fill cap.
9. 2 inch spare

E. Utilities:

1. Electrical: 120V/1PH/60Hz service for audible overfill alarm

F. The 280-Gallon Aboveground Tanks shall be the 280-Gallon Lube Cube with secondary containment as manufactured by Containment Solutions or approved equal with the above minimum requirements.

2.21 500 GALLON, DOUBLE WALL ABOVEGROUND TANK

A. Equipment Item No. LR-18.

B. Acceptable Manufacturers:
1. Products of the following manufacturer are specified herein as the standard of quality for the aboveground storage tanks.
   a. Containment Solutions
      5150 Jefferson Chemical Road
      Conroe, TX 77301
      Telephone: (800) 537-4730
      Distributor:
      Mike Sands and Associates
      101 South Kraemer Blvd. Suite 211
      Placentia, CA 92870
      Telephone: (714) 528-6182
2. Products of equal quality and utility of the following manufactures shall be accepted:
   a. Service Station Equipment Co., Inc.
      1829 East 55th Street
      Cleveland, OH 44103
      Telephone: (800) 362-1384
      (216) 431-6100

C. Construction Features - Provide a 500 gallon above ground tank with the following attributes:
1. Primary tank UL 142 listed.
2. Secondary tank UL 142 listed.
3. 360 degree steel outer steel secondary containment.
4. Manufacturer's 30 year warranty.
5. Placard, no smoking, combustible decal.
6. Tank label: Provide tank label with name of product to be stored in minimum 4 inch letters and easily readable location when tank is installed.
7. Finish paint coat white epoxy.
8. Mount on 2-inch supports for visual leak inspection.
9. Tanks shall be equipped with audible low level and overfill alarm and high and low level indicator. Provide high and low level switches to meet the requirements of the specifications. Used Oil tank LR-18 shall have alarm interconnected to solenoid valve on compressed air line to the used oil Evacuation Pumps. Compressed air to pumps are to be shut off when used fluid tanks reach alarm level. Coordinate with Plumbing Drawings.
10. Tank shall be equipped with an interstitial monitor that will indicate the presence of a leak in the secondary containment. Provide with two – 2 inch interstitial fittings.
11. Tanks shall be rectangular in design.
12. Secondary containment tank shall provide a minimum of 110% secondary containment.
13. Secondary containment pressure tested in factory to UL142 specification at 3 PSI.
14. Tanks shall be equipped with emergency vents as required by NFPA 30
15. All tanks shall be grounded to the structure as per manufacturer's recommended requirements. Manufacturer shall provide suggested grounding tank details to the contractor as part of the installation requirements.
16. Seismic design anchoring shall be provided to all tanks per manufacturer's design requirements and per all seismic codes having jurisdiction.

D. Dimensions:
1. Overall: 4-foot, 10-inches long x 3-foot, 10-inches wide x 5-foot, 1-inches high.
2. 2 - 2-inch interstitial fittings.

3. 7-gallon overspill box as supplied by Hoover Lube Cube tanks with drain.
4. 2, - 4-inch emergency vents. One on primary space and one on secondary containment.
5. 2 inch gauge
6. 2 inch monitoring point
7. 1 - 2-inch vent with riser pipe.
8. 2-inch fill opening with flip top fill cap.
9. 2 inch spare

E. Utilities:
1. Electrical: 120V/1PH/60Hz service for audible overfill alarm

F. The 500-Gallon Aboveground Tanks shall be the 500-Gallon Lube Cube with secondary containment as manufactured by Containment Solutions or approved equal with the above minimum requirements.

2.22 PORTABLE OIL DRAIN RECEIVER

A. Equipment Item No.'s LD-4 and HD-5.

B. Acceptable Manufacturers:
1. Products of the following manufacturer are specified herein as the standard of quality for the portable oil drain:
a. Graco, Incorporated
3165 Garfield Avenue
Los Angeles, CA 90040
Telephone: (213) 722-4783
Distributor: Peterson Hydraulics
Telephone: (310) 323-3155
2. Approved products of equal quality and utility of other manufacturers shall be accepted.

C. Construction Features:
1. 25 gallon drum with drain valve.
2. Built in wheeled base.
3. Adjustable height funnel assembly.
4. Sight gauge.
5. Filter drain tray.
6. Provide quick disconnect matching the evacuation pump siphon hoses as listed in section 2.05 of this specification to properly drain the container. Contractor to coordinate. Connection shall be a sturdy connection reinforced and not flexible on the container.

D. Portable Oil Drain shall be Oil King Model No. 238-866 as manufactured by Graco, Inc. or approved equal with the above minimum requirements.

2.23 PORTABLE COOLANT/ANTI-FREEZE RECEIVER

A. Equipment Item No.'s LD-5 and HD-6.

B. Acceptable Manufacturers:
1. Products of the following manufacturer are specified herein as the standard of quality for the portable oil drain:
b. Graco, Incorporated
3165 Garfield Avenue
Los Angeles, CA 90040
Telephone: (213) 722-4783
Distributor: Peterson Hydraulics
Telephone: (310) 323-3155
2. Approved products of equal quality and utility of other manufacturers shall be accepted.

C. Construction Features:

1. 25 gallon drum with drain valve.
2. Built in wheeled base.
3. Adjustable height funnel assembly.
5. Sight gauge.
6. Filter drain tray.
7. Provide quick disconnect matching the evacuation pump siphon hoses as listed in section 2.05 of this specification to properly drain the container. Contractor to coordinate. Connection shall be a sturdy connection reinforced and not flexible on the container.

D. Portable Coolant/Anti-freeze Drain shall be Coolant King Model No. 238-866 as manufactured by Graco, Inc. or approved equal with the above minimum requirements.

2.24 ELECTRIC REEL/TROUBLE LIGHT

A. Equipment Item No.'s LD-18, LD-18A, HD-17, HD-17A

B. Acceptable Manufacturers:
1. Products of the following manufacturer are specified herein as the standard of quality for the electric trouble light:
   a. General Manufacturing Inc.
      1100 S. Morgan Street
      Bluffton, IN 46714
      Telephone: (260) 824-3440
   b. Or approved equal.

C. Provide a heavy duty, open electric cable reel with the following attributes:
1. Adjustable guide arm for ceiling, wall or bench mount.
2. Ball stop to set hand down height of the retracting cord.
3. 5.5' power inlet cord with grounded plug.
4. 50' long 12/3 SJTO cord.
5. Outlet strip with a minimum of two outlets. Provide as part of the General Mfg. accessory and not as separate unit
6. UL and C-UL listed.
7. Mounting Accessories.
8. Provide Service light, Stubby II Short Cord Model, No. 1113-0101 on all reels.

D. Utility Requirements:
1. 120V/1PH/60 Hz, 20 Amps.

E. Electric Cable Reel shall be Saf-T-Lite Series 4550-5101 Industrial Power Supply Reel with Stubby II service light Model No. 1113-0101, as manufactured by General Mfg., Inc. or approved equal with the above minimum requirements.

2.25 TOTAL LUBE MANAGEMENT SYSTEM

A. Equipment Item No. LD-19.

B. Provide Graco Matrix fluid dispensing and management system consisting of the following components as required for a complete and operational fluid management system. Quantities of components required for operation is the ultimate responsibility of the Contractor. Provide shop drawings with complete system prior to installation. Computer stations (PC) will be provided by Nevada County.

1. Battery operated dispense metering valves model no. 256282 for Motor Oil, hydraulic fluid, gear oil and model no. 256482 for ATF and Coolant to communicate wirelessly to a PC on site. Metering valves to be coordinated with the reel systems specified in sub-sections of these specifications. Chassis Grease dispensing will not be tracked automatically by Management System.
2. Tank level monitor (TLM) model no. 256285 utilizing ultrasonic level technology and

required transmitters to provide tank fluid levels for the supply and waste tanks wirelessly to the City's PCs.

3. Transceiver model no. 257464 to send and receive signals from dispenser meters and tank level monitors. A total of 3 transceivers are located in the automotive, Heavy truck and in the Lube/Pump Room. Manufacturer and installer to coordinate locations and signal distances to assure that three are sufficient. Provide the correct number for a complete working system as required. Coordinate the transceiver locations with required conduits for proper installation.
4. Graco Matrix premier software model no. 256634 to be provided for two computer stations located at the Equipment Manager's Office (#112) and the Parts Office Counter. The Equipment manager's Office shall be the primary system.
5. USB to RS422 converter model no. 255731
6. Provide all components, wiring and requirements for a full installation included but not limited to Items 1 thru 5 above, USBR connectors, miscellaneous cabling, RS422 wiring, conduit work, Pump Air Control model no. 247436 for tanks, etc. to monitor all fluid reels in the facility.

C. Provide proper training on the use of the hardware and the software to include the ability to print out reports to the specifications of the Nevada County Representative prior to acceptance of the equipment installation.

D. Provide ability to connect to existing or future Inventory Management Software. The County to provide specification requirements for management software.

E. Computer stations (PC) and printers at the two specified locations to be provided by Nevada County.

F. Electrical Requirements:
1. Transceiver locations to be provided with 120VAC/1Ph/60Hz outlet.
2. Contractor to provide conduit to each location for the distribution of the RS422 cable and electrical connection to each transceiver. Final locations to be provided by the manufacturer's shop drawings.

G. Matrix Total Fluid Management System shall be a complete system to manage all reel dispensed fluid and waste fluid collection as manufactured by Graco, Inc. or approved equal with the above minimum requirements.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install equipment in strict accordance with approved shop drawings and manufacturers installation instructions all locations indicated in drawings.

B. Coordinate installation of the fluid reels at the bays and the pumps supplying service located in the Lube Room with the plumbing drawings for process piping and specifications. Provide all connections for proper operation of the fluid distribution system. In addition, contractor to coordinate all equipment installation with compressed air system distribution.

C. Provide isolation valves to every fluid and air reel in the facility servicing the reels covered under these specifications in order to isolate areas for servicing and maintenance. Provide a shut-off valve at the pumps to shut down system in the event of an emergency. In addition, provide isolation valves at strategic locations on the fluid and air loops to allow the isolation of piping sections to minimize loss of service during maintenance or piping repair situation to the entire shop.

D. The Structural engineering drawings shall cover the structural support requirements to fasten the fluid reel bank to the building structure. Coordination for the requirements to supported equipment on this specifications with the Structural Engineer and the Building Manufacturer to be properly coordinate support for the fluid distribution system at locations shown on

drawings.

E. Provide mounting channels and brackets (as required) as recommended by manufacturer for reel bank support. Mounting heights as indicated in the drawings.
   1. Contractor to use mounting brackets as provided by Graco model no. 204741 mounting channel as required for beam mounting installation. Each three-reel bank shall use mounting channel model no. 24A221, each two-reel bank shall use model no. 24A220 and each single-reel bank shall use model no. 24A219 mounting channels. Provide the reel installation using any combination of mounting brackets and channels listed above. Provide as required to work in conjunction with building structural supports. See Item D for mounting coordination.
   2. Mounting channels and plates to be coordinated with the structural support frame for proper mounting of the reel banks. General Contractor responsible for coordinating with installers for proper mounting requirements for the reels.

F. Provide all air line connections to fluid pumps and equipment requiring air distribution with required air filter, lubricator, regulator and valve.

G. Coordinate the installation of the overfill alarm on the supply tanks and waste oil/antifreeze tanks. A required interconnection to a solenoid valve on the compressed air lines supplying the waste oil pumps shall be installed. Compressed air to the waste oil and coolant pumps shall be shut off when the tank is full and/or alarm is activated.

H. Install the Graco Matrix Fluid Management System utilizing all the requirements as stipulated in these specifications and the manufacturer's shop drawings to install a complete working system. Coordinate between disciplines to assure proper installation.

3.02 FIELD QUALITY CONTROL

A. Provide the services of qualified manufacturer's representatives to perform the following as stated in section 11 00 50 of these specifications:
   1. Inspect preparatory work performed by other trades.
   2. Inspect installation.
   3. Coordinate, prior to installation, the mounting requirements of the fluid pumps to the tanks to assure that proper hardware has been provided.
   4. Provide shut-off valves for the pump room, at a convenient visible location for emergency shut-off of fluid lines and at each reel for individual service, as required and per process piping drawings. Place signage for proper identification, signage shall be in white background with red lettering using proper product identification. (e.g. Motor Oil 5W20 – Shut-Off Valve)
   5. Prior to substantial completion of the facility, inspect testing, by the Contractor in the presence of the Nevada County Representative, to ensure proper operation of the equipment.
   6. Instruct personnel in the proper safe operation and maintenance of the equipment.
   7. Perform all scheduled and unscheduled maintenance during warranty period; provide all labor and materials.

B. Testing/Inspection Requirements:
   1. Prior to accepting the equipment, every reel shall be inspected for fluid delivery, nozzle function and reel mechanism. All fluid lines shall be primed and bled prior to inspection of the equipment. Reels shall work with the Matrix System to allow the collection of all data at specified locations.
   2. Contractor to submit a pressure and functional test procedure as part of shop drawing package for approval.
   3. The Matrix Fluid Management System (or equal) and software shall be tested for proper operation and data gathering requirements prior to inspection by Nevada County Representative.
   4. The Contractor shall be responsible for reimbursing Nevada County Fleet Services for all of the fluid utilized for testing the fluid distribution system.

END OF SECTION

SECTION 11 14 80 - VEHICLE EXHAUST REELS/HOSE

PART 1 – GENERAL

1.01 DESCRIPTION

A. This section specifies furnishing, installing and testing exhaust hose reel systems at the location indicated on the Drawings. All exhaust fans and ductwork shall be provided my Mechanical under a separate specification.

B. The provisions of Section 11 00 50 apply to the work of this Section.

C. Related Work Specified elsewhere:
1. General Requirements: Division 1
2. Mechanical: Division 23
3. Electrical: Division 26

1.02 SUBMITTALS

A. Submit catalog cuts, shop drawings, preliminary copies of Product Maintenance Forms, reel locations in relation to the bus bays and manufacturers assembly and installation instructions. For substitutions see requirements in Division 1 – General Requirements of the specifications.

B. Submit exhaust system design calculations. Submit detailed drawings of supports for exhaust removal system equipment based upon manufacturer's recommendations; rigid support system shall prevent stationary exhaust removal equipment from movement in vertical and horizontal directions. Coordinate with structural drawings.

1.03 WARRANTY

A. Following completion, the Contractor shall provide County of Nevada Representative with two (2) years of warranty as stipulated in Section 1 40 00 starting at project acceptance, covering all parts, materials, and labor. All warranty work shall be performed by a local manufacturer's representative at the Project Site location, who has capabilities of responding to all problems within 24 hours. Any shipping and delivery costs associated with the warranty of this equipment shall be the responsibility of the Contractor.

1.04 DELIVERY, STORAGE AND HANDLING

A. Deliver, store, and handle products without damaging them.
1. Receive, unload, check, protect, and store equipment in facilities suitable to keep it clean, dry, and free from damage, vandalism, and pilferage.
2. Pay demurrage charges and claims for damage resulting from unloading operations.
3. Examine equipment for visible and concealed damage. Report any damage to carrier, supplier, and County of Nevada Representative as soon as possible.

B. Protect equipment from loss, deterioration, and damage until work is complete.
1. Protect equipment during storage and prior to start-up.
2. Protect exposed finished surfaces with removable coating for film, cover openings to exclude dirt and fouling materials, and protect unfinished surfaces against rust, corrosion, and other damage.
3. Protect equipment from paint or coating spills and spots.

PART 2 - PRODUCTS

2.01 VEHICLE EXHAUST SYSTEM

A. Acceptable Manufacturers.
1. Products of the following manufacturer are specified herein as the standard of quality for the vehicle exhaust reels.
a. Harvey Industries, Inc.
1340 Home Avenue
Akron, OH 44310
Telephone: (330) 633-0122
Fax: (330) 633-0320
2 Products of equal quality and utility of the following manufacturers shall be accepted:
a. Car-Mon Products, Inc.
1225-T Davis Rd. Elgin, IL 60123
Tel: 847-695-9000
Fax: 847-695-9078
b. Monoxivent
1306 Mill Street
Rock Island, IL 61201
Tel: (309) 794-1000

2.02 VEHICLE EXHAUST REELS

A. Equipment Item: LD-20 (4 inch hose), HD-18 and HD-18A (6 -inch hose)

B. Equipment: All equipment shall be supplied by a single manufacturer, which specializes in fabricating vehicle exhaust removal systems.

C. Main ductwork: Coordinate with Mechanical drawings to furnish and install main ductwork in the sizes and at the locations indicated in the Mechanical Drawings. Ductwork shall be provided to connect the exhaust fan to the exhaust locations as shown in the Mechanical drawings. Provide 1-inch diameter threaded test ports in main ductwork proceeding and following fans to permit testing as specified. See Mechanical Drawings for duct configuration.

D. General: the system shall be a multi reel system connected to a centralized exhaust fan system, motorized hose reel units at each location shown on the drawings. The design of the fan shall be as shown on Mechanical Drawings. Fans shall route ductwork to connect to the individual exhaust fans located on the work bays. All hose diameter and hose temperature rating shall be appropriate for the individual application and location. All required accessories and mounting hardware to provide a complete system shall be supplied. Motor operated hose reels shall be installed at locations shown on the drawings and coordinated with the Mechanical drawings. Contractor to coordinate between disciplines for proper installation of vehicle exhaust system.
1. Fixed Ducts: Provide all fixed ducts as shown on Mechanical Drawings to interconnect the exhaust fans to the connecting tube of the exhaust hose reel.

2. Drum and Frame: the drum and frame for the Exhaust Hose Reel shall be constructed of heavy steel and coated with an acid resistant powder coating for atmospheric protection. The drum shall be sized for a 35-foot hose (working length). The link between the exhaust hose and connecting tube shall be located inside the drum. This connection pipe shall be made of aluminum, for use with hot gases and shall be factory sealed and greased. The reel shall be motorized to deliver and rewind the exhaust hose, activated by a pendant controller. Power shall be 115V/1 phase/60 Hz service. Motor shall be TENV class “B” enclosure. The blower motor shall activate by way of a limit switch mounted on the reel. When the down button is pressed and reel begins to feed the hose, the motor will

activate and when the hose is retracted, the motor will shut off.

3. Exhaust Hose: The hose shall be rubber coated silicone fiberglass with an internal wire helix high temperature fabric with uninterrupted smooth hose for efficient air flow. The hose shall withstand temperatures of 600F continuous and 675F intermittent when used with diesel exhaust temperatures. The hose shall be 35 feet long working length and each hose reel shall be sized for a 35 foot of exhaust hose minimal.
   a. For equipment item HD-18 and HD-18A, hose diameter shall be 6 inches and for item LD-20 shall be 4 inches used in Exhaust Reel Assembly Series RHR-D12X-6NHR for 6 inch application and RHR-D9X-4RNR for the 4 inch application, with the minimum requirements listed in these specifications.
   b. Provide a total of four (4) hose extensions 11 feet long x 6 inch diameter each for extending the 35 foot reel hose on special circumstances due to location of exhaust stack locations on vehicles. The hose shall be similar to those specified above with the easy connect/disconnect coupler connectors. Hose extensions couplers shall be HAC-60 or equal to meet the specified requirements. Hoses shall be stored on hook hangers on shop wall along column grid 13 for easy access, See Detail on Drawing Industrial Equipment Drawings.
   c. Two hose extensions shall be provided with coupler on one end (HAC-60). Two hose extensions shall be provided with galvanized nozzles with clamp similar to Nozzles on 35' hose reel.
   d. Provide two (2) Harvey Diesel Canes adapters for use on high exhaust stack vehicles. The cane shall be supplied with 6 inch diameter hose, diesel stack adapter, positioning pole and 600 degrees F silicone/fiberglass flexible hose.

4. Nozzles: Coordinate with user and provide as part of the system. Nozzles required for exhaust reel (HD-18) hoses shall be metal nozzles type to be able to connect to the County of Nevada's fleet of vehicles (top exhaust) via an exhaust cane Model No. DC-6R and also direct to the exhaust stack. Nozzle to fit the exhaust cane and the truck exhaust stack. Provide as part of the 6 inch diameter reel, two (2) total exhaust canes as stated above, to facilitate in the connection of the truck exhaust stack. For lower exhaust system, provide appropriate nozzles to support the County of Nevada Fleet. Contractor to verify with County of Nevada Representative the various types of exhaust stacks on the larger trucks and/buses to assure proper nozzles are provided for use.
   For the 4 inch hose reels (LD-20) nozzle shall be rubber nozzle type for standard automobiles and light duty trucks with rear bottom exhaust.

5. Controls: A suspended pendant with strain relief mechanism, suspended at a height of 60 inches above finish floor, shall be provided for standard installation on all reels. The pendant control shall have a minimum of two push buttons, operating the coiling and uncoiling of the hose from hose reel.

   a. Starter and push-button pendant shall be shipped loose for field installation.
   b. Connection cable and conduit runs to each designated location to be provided as part of the equipment.
   c. For the reel motor electrical feed, provide a 120V/1Ph service for the up and down operation of the reel.
   d. Coordinate with Mechanical Drawings for all wall mounted push-button control box controller to turn the exhaust Fans on and off. Location shall be coordinated by the Mechanical Drawings. The Control boxes shall have a green/red warning light to let the user know when the fan motor is on/off. Coordinate with mechanical and electrical drawings. This function is to assure that the user shuts-off motor when system is not in use.

E. Central Exhaust Fan Requirements for reels: The system shall be designed to provide a minimal of 940 CFM (6 inch hose) and 430 CFM (4 inch hose) at 2-1/2" static pressure minimal. Coordinate the central fan units with mechanical drawings for proper connection and function for the exhaust reels.

F. Utilities:
1. 120VAC, 1 Phase, ¼ HP
2. 6.25 nominal connection to centralized exhaust ductwork and fans.

F. Vehicle Exhaust System shall be manufactured by Harvey Industries, Inc with above requirements, or approved equal meeting the above minimal requirements.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install equipment in strict accordance with the approved shop drawings and manufacturers installation instructions.

B. Contractor is responsible for coordinating the installation of the equipment. All parts, mounting brackets/channels, utilities, ducts, etc., necessary for a complete installation of the equipment shall be supplied as part of these Contract Specifications without any additional costs to the County of Nevada. See Industrial drawings for reel locations and Mechanical drawings for all exhaust fans and connecting duct requirements and routing.

C. Contractor shall coordinate required locations for all exhaust reels as shown on drawings Q1.10 and Q1.20 with mechanical drawings for ducts alignment and exhaust fan locations on the Mechanical drawings.

D. Coordinate with structural details for structural bracket connections to hang exhaust reels at locations shown on Industrial Equipment Drawings.

E. Coordinate with Structural Details for the provision of hook ladder hangers to hang and store the 6 inch diameter hose extensions at location shown on plans and as per Detail on Industrial Equipment Drawings. Provide a minimal of four hangers per hose for proper support. See Structural drawings for additional information.

F. At minimum, manufacturer to provide all required components to meet Class I, Division 2 for all components within 18 inches above finished floor and components within 18 inches from the ceiling as required by NFPA and Fire codes having jurisdiction. Contractor to verify the final location of exhaust reels and fans to confirm code location requirements.

G. Install all hose reels and hanging brackets per CA Seismic Design Categories as stated per all codes having jurisdiction.

3.02 FIELD QUALITY CONTROL

A. Provide the services of a qualified, certified manufacturer's representative to perform the following:
1. Supervise preparatory work performed by other trades.
2. Supervise installation.
3. Supervise testing, by the Contractor in the presence of the County of Nevada Representative to ensure proper operation of the equipment.

3.03 FIELD TESTING AND CERTIFICATION

A. Perform testing of the equipment and system in accordance with the requirements

specified in Division 1 and Section 11 00 50. Perform and document all testing procedures recommended by the manufacturer.

3.04 TRAINING PROGRAM AND OPERATION AND MAINTENANCE MANUALS

A. Provide a training program and Operation and Maintenance manual in accordance with the requirements as specified in Division 1 and in Section 11 00 50.

END OF SECTION

SECTION 11 51 00 - SHOP WORK STATIONS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
1. The work specified in this section includes furnishing, installing, and testing work table at location shown on the Drawings. All wiring, conduit, piping, ductwork, and controls required to connect these shop work stations to building utilities are part of the overall contract.

B. Related Sections:
1. Division 1 – General Requirements.
2. Section 11 00 50 - Basic Equipment Materials and Methods.
3. Division 23 – Mechanical.
4. Division 26 - Electrical.

C. Provisions of Section 11 00 50 apply to the work of this Section.

1.02 REFERENCES

A. Occupational Safety and Health Administration (CAL OSHA):
1. 9 CFR 1910 Occupational Safety and Health Standards.

B. National Fire Protection Association (NFPA):
1. NFPA 70 National Electrical Code (NEC)

1.03 QUALITY ASSURANCE

A. Comply with the provisions of Division 1, Section 01 00 00 - General Requirements.

B. Use adequate numbers of skilled workers who are completely familiar with the specified requirements and the materials and methods necessary for proper performance of the Work of this Section.

1.04 SUBMITTALS

A. Pursuant to the provisions of Division 1, General Requirements and Section 11 00 50, Basic Equipment Materials and Methods the Contractor shall submit:
1. Material and equipment list itemizing products furnished to satisfy the requirements of this section.
2. Product data including catalog cuts, manufacturer’s assembly and installation data, manufacturer’s certificates of compliance, and samples.
3. Shop drawings.
4. Schedule of work.
5. Operations and maintenance data.
6. List of recommended spare parts and maintenance materials.
7. Evidence of manufacturers and installers experience including names, addresses and phone numbers of reference clients.
8. Calculations and certification specified.
9. Documentation of field tests.

1.05 WARRANTY

A. Following completion, the Contractor shall provide the County of Nevada Representative with two (2) years of warranty as stipulated in Section 1 40 00 starting at project acceptance, covering all parts, materials, and labor. All warranty work shall be performed by a local manufacturer's representative at the Project Site location, who has capabilities of responding to all problems within 24 hours. Any shipping and delivery costs associated with the warranty of this equipment shall be the responsibility of the Contractor

1.06 DELIVERY, STORAGE AND HANDLING

A. Deliver, store, and handle products without damaging them.
   1. Receive, unload, check, protect, and store equipment in facilities suitable to keep it clean, dry, and free from damage, vandalism, and pilferage.
   2. Pay demurrage charges and claims for damage resulting from unloading operations.
   3. Examine equipment for visible and concealed damage. Report any damage to carrier, supplier, and County of Nevada Representative as soon as possible.

B. Protect equipment from loss, deterioration, and damage until work is complete.
   1. Protect equipment during storage and prior to start-up.
   2. Protect exposed finished surfaces with removable coating for film, cover openings to exclude dirt and fouling materials, and protect unfinished surfaces against rust, corrosion, and other damage.
   3. Protect equipment from paint or coating spills and spots.

PART 2 - PRODUCTS

2.01 WORK SURFACE WITH SHELF

A. Equipment Item No. TC-2.

B. Acceptable Manufacturers:
   1. The products of the following manufacturer are specified as the standard of quality for the Heavy Duty Workbench.
      a. Pollard Brothers Mfg. Co.
         5504 Northwest Highway
         Chicago, IL 60630
         Telephone: 773-763-6868
   2. Products of equal quality and utility of the following manufacturers will be accepted.
      a. Grizzley Equipment
         1440 East 36th Street
         Cleveland, OH 44114
         Telephone: (800) 336-4986
      b. Hodge Manufacturing Co.
         55 Fisk Avenue
         Springfield, MA 01107
         Telephone: (800) 336-4986
      c. Approved Equal

C. Construction Features:
   1. Open workbench, all steel construction.
   2. 12 gauge formed worktop
   3. 6 gauge formed back plate.
   4. All welded legs 2 inch by 2 inch by 1/8 inch.
   5. Formed 16 gauge formed stringer.

6. 12 gauge formed lower shelf 120” x 24”

D. Dimensions and Capacities:
1. 120 inches long by 34 inches deep by 34 inches high.
2. Capacity: 12,000 lbs. evenly distributed.

E. Workbench shall be Model 124-1036-32 as manufactured by Pollard Brothers MFG. Co. or approved equal with the above minimum requirements.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install equipment in strict accordance with the approved shop drawings and manufacturer’s installation instructions.
B. Coordinate work with other trades to ensure proper equipment interface with the building structure and equipment required utilities including power connection to workbenches.
C. Proceed with start-up, testing and instruction in accordance with Section 11 00 50.
D. Coordinate with manufacturer and anchor workbenches as required to meet Seismic Design Category per all codes having jurisdiction.

3.02 FIELD QUALITY CONTROL

A. Provide the services of a qualified manufacturer’s representative to perform the following:
1. Supervise preparatory work performed by other trades.
2. Supervise installation.
3. Supervise testing, by the Contractor in the presence of the County of Nevada Representative to ensure proper operation of the equipment.

3.03 FIELD TESTING

A. Perform testing of the equipment and system in accordance with the requirements specified in Division 1. Perform and document all testing procedures recommended by the manufacturer.

3.04 TRAINING PROGRAM AND OPERATION AND MAINTENANCE MANUALS

A. Provide a training program and operation and maintenance manual in accordance with the requirements specified in Division 1 and 11 00 50.

END OF SECTION

SECTION 11 52 00 - SHOP EQUIPMENT

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
1. The work specified in this section includes furnishing, installing, and testing shop equipment at locations shown on the Drawings. All wiring, conduit, piping, ductwork, and controls required to connect these shop work stations to building utilities are also a part of the work of this section.

B. Related Sections:
1. Division 1 – General Requirements
2. Section 01 91 00 - Commissioning
3. Section 11 00 50 - Basic Equipment Materials and Methods.
4. Division 22 - Plumbing
5. Division 23 Mechanical.
6. Division 26 Electrical.

C. Provisions of Section 11 00 50 apply to the work of this Section.

1.02 REFERENCES

A. American Institute of Steel Construction, Inc. (AISC)
1. Manual of Steel Construction.

B. American Welding Society (AWS)
1. D1.1 Structural Welding Code – Steel.

C. Occupational Safety and Health Administration (CAL OSHA)
1. Title 29, Chapter XVII 1910 and 1926 Occupational Safety and Health Standards.

D. National Fire Protection Association (NFPA)
1. NFPA 70 National Electrical Code.
2. NFPA 79 Electrical Standard for Industrial Machinery.
3. NFPA 91 Standards for Exhaust Systems for Air Conveying of Vapors, Gasses, Mists, and Noncombustible Particulate Solids.

E. National Electrical Manufacturers Association (NEMA)
1. NEMA 250 – Enclosures for Electrical Equipment (1,000 Volts maximum).
2. NEMA MG-1 – Motors and Generators.
3. NEMA MG-2 – Safety Standard for Construction and Guide for Selection, Installation, and Use of Electric Motors and Generators.
4. NEMA MG-10 – Energy Management Guide for Selection and Use of Polyphase Motors.

F. American National Standards Institute (ANSI)
1. ANSI B30.1 – Safety Standard For Jacks.
2. ANSI C50.10 – Rotating Electrical Machinery – Synchronous Machines.
3. ANSI A10.14 – Requirements for Harnesses, Lanyards, Lifelines, and Drop Lines for Construction and Industrial Use.

G. Institute of Electrical and Electronics Engineers (IEEE)

1. IEEE 112 – Standard Test Procedures for Polyphase Induction Motors and Generators.

H. Underwriter Laboratories, Inc., (UL)
1. UL 519 Impedance Protected Motors.
2. UL 547 Thermal Protectors for Electric Motors.

I. Steel Structures Painting Council (SSPC)
1. Steel Structures Painting Manual.

1.03 QUALITY ASSURANCE

A. Certify that shop equipment furnished and installed complies with applicable CAL OSHA standards.

B. Comply with the provisions of Division 1 – General Requirements.

C. Provide services of manufacturer's representative to perform services specified in Section 3.02 of these specifications.

D. Use adequate numbers of skilled workers who are completely familiar with the specified requirements and the materials and methods necessary for proper performance of the Work of this Section.

1.04 SUBMITTALS

A. Pursuant to the provisions of Division 1-General Requirements and Section 11 00 50, Equipment General Requirements, submit the following:
1. Material and equipment list itemizing products furnished to satisfy the requirements of this section.
2. Product data including catalog cuts, manufacturer's assembly and installation data, manufacturer's certificates of compliance, and samples.
3. Shop drawings.
4. Schedule of Work.
5. Training program and operations and maintenance manual.
6. List of recommended spare parts and maintenance materials.
7. Evidence of manufacturers and installers experience including names, addresses and phone numbers of reference clients.
8. Documentation of field tests.

1.05 EXPERIENCE

A. Furnish products only from manufacturers who demonstrate that they have a minimum of five years' experience manufacturing items equivalent to those required as the Work of this Section.

1.06 WARRANTY

A. Warranty equipment, parts, and replacement labor for the one-year period specified in General Requirements in Section 11 00 50 with additional requirements listed below.

B. Following completion, the Contractor shall provide the County of Nevada Representative with two (2) years of warranty as stipulated in Section 1 40 00 unless otherwise specified differently in this Section starting at project acceptance, covering all parts, materials, and labor. All warranty work shall be performed by a local manufacturer's representative at the

Project Site location, who has capabilities of responding to all problems within 24 hours. Any shipping and delivery costs associated with the warranty of this equipment shall be the responsibility of the Contractor.

1.07 DELIVERY, STORAGE AND HANDLING

A. Deliver, store, and handle products without damaging them.
1. Receive, unload, check, protect, and store equipment in facilities suitable to keep it clean, dry, and free from damage, vandalism, and pilferage.
2. Pay demurrage charges and claims for damage resulting from unloading operations.
3. Examine equipment for visible and concealed damage. Report any damage to carrier, supplier, and County of Nevada Representative as soon as possible.

B. Protect equipment from loss, deterioration, and damage until work is complete.
1. Protect equipment during storage and prior to start-up.
2. Protect exposed finished surfaces with removable coating for film, cover openings to exclude dirt and fouling materials, and protect unfinished surfaces against rust, corrosion, and other damage.
3. Protect equipment from paint or coating spills and spots.

PART 2 - PRODUCTS

2.01 PORTABLE FUME EXHAUSTER

A. Equipment Item No. WS-16.

B. Acceptable Manufacturer:
1. Products of the following manufacturer are specified herein as the standard of quality for the portable fume exhauster.
a. United Air Specialists, Inc.
4440 Creek Road
Cincinnati, OH 45242
Telephone: (513) 891-0400
2. Products of equal quality and utility of the following manufacturers will be accepted.
a. Plymovent Exhaust Systems.
1966 W. Holt Ave.
Pomona, CA 91768
Telephone: (909) 620-7114
b. Car-Mon Products, Inc.
1225 Davis Road
Elgin, IL 60123-1317
Telephone: (708) 695-9000

C. Construction Features:
1. Type: Portable fume exhauster consisting of fume extractor arm, fan with prefilter, ionizer, and electrostatic filter collection cell.
2. Dimensions:
a. Length: 42 inches.
b. Width: 28 inches.
c. Height: 44 inches.
d. Fume Extractor Arm Diameter: 8 inches.
e. Fume Extractor Arm Length: 10 feet.
3. Air Flow Capacity: 1,000 cfm [nominal].
4. Fan Motor: 1 horsepower, 115 Volts, single phase, 60 Hertz, 7.4 Amps.

5. Prefilter: Reusable, constructed of layered expanded aluminum mesh.
6. Ionizer: Tungsten ionizing wire with ceramic ionizer insulators operating at 12.0 kilovolt nominal voltage.
7. Electrostatic Filter Collection Cell: 20,160 square inches of surface area.
8. Power Pack: Capable of providing 11,000 Volts DC to the ionizer and 6,000 Volts DC to the electrostatic filter collection cell.
9. Removable dust collection drawer.
10. Portability provided by two fixed wheels and two rotatable casters.

D. Portable Fume Exhauster shall be SMOG-HOG Porta-Clean model with optional 1 HP motor as manufactured by United Air Specialists, Inc or approved equal with the above minimum requirements.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install equipment in strict accordance with the approved shop drawings and manufacturer's installation instructions.

B. Contractor has the sole responsibility to coordinate work between the equipment specifications with construction documents, approved manufacturer shop drawings and with other trades to ensure proper equipment interface with the building structure and proper utility is provided to each piece of equipment for proper function.

C. Contractor has ultimate responsibility to coordinate between County of Nevada Representative and his electrical and plumbing sub-contractor for proper utility to the equipment listed above.

D. Coordinate the location of the wheel balancer with the electrical and air feed to the equipment and allow for sufficient power run to the equipment to assure proper connection and flexibility.

E. Proceed with start-up, testing and instruction in accordance with Section 11 00 50 to assure all equipment functions as specified and called for in the Operations and Maintenance manuals.

F. Contractor to install all equipment following Seismic Design Category requirements to adhere to all codes having jurisdiction.

G. Follow Start- and testing procedures in accordance with Section 01 91 00 and Section 11 00 50.

3.02 FIELD QUALITY CONTROL

A. Provide the services of a qualified manufacturer's representative to perform the following:
1. Supervise preparatory work performed by other trades.
2. Supervise installation.
3. Supervise testing, by the Contractor in the presence of County of Nevada Representative to ensure proper operation of the equipment, including but not limited to proper adjustment of all clearances, proper operation of guards, and return to safe condition upon loss of power.

3.03 FIELD TESTING

A. Perform testing of the equipment and system in accordance with the requirements specified in Division 1 – General Requirements and Section 11 00 50. Perform and document all testing procedures recommended by the manufacturer.

3.04 TRAINING PROGRAM AND OPERATION AND MAINTENANCE MANUALS

A. Provide a training program and operation and maintenance manual in accordance with the requirements specified in Division 1 and 11 00 50.

END OF SECTION

SECTION 11 53 50 - CLEANING EQUIPMENT

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
1. The work specified in this section includes furnishing, installing, and testing Hot Water Pressure Washer Equipment at location shown on the Drawings.

B. Related Sections:
1. Drawings, General Provisions, Special Provisions and Division 1 apply to the work of this section.
2. Section 11 00 50 – Basic Equipment Materials and Methods.
3. Division 23 – Mechanical.
4. Division 26 – Electrical.

1.02 REFERENCES

A. American Society for Testing and Materials (ASTM).
1. A 240/240M Heat Resisting Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels.

B. Occupational Safety and Health Administration (CAL OSHA)
1. 29 CFR 1910 Occupational Safety and Health Standards.

C. National Fire Protection Association (NFPA)
1. 70 National Electrical Code (NEC).
2. 79 Electrical Standard for Industrial Machinery.

D. American Society of Mechanical Engineers (ASME)
1. Boiler Pressure Vessel Code (BPVC) Section VIII - Rules For Construction of Pressure Vessels Division 1.

1.03 QUALITY ASSURANCE

A. Certify that cleaning equipment furnished and installed complies with applicable CAL OSHA standards.

B. Comply with the provisions of Division 1, General Requirements.

C. Use adequate numbers of skilled workers who are completely familiar with the specified requirements and the materials and methods necessary for proper performance of the Work of this Section.

D. Provide services of manufacturer's representative to perform services specified in Article 3.02.

1.04 SUBMITTALS

A. Pursuant to the General Provisions and Division 1, Submittals, and Section 11 00 50, Basic Equipment Materials and Methods, submit the following:
1. Material and equipment list itemizing products furnished to satisfy the requirements of this section.

2. Product data including catalog cuts, manufacturer's assembly and installation data, manufacturer's certificates of compliance, and samples.
3. Shop drawings.
4. Schedule of Work.
5. Training Program and Operations and Maintenance Manual.
6. List of recommended spare parts and maintenance materials.
7. Evidence of manufacturers and installers experience including names, addresses and phone numbers of reference clients.
8. Working drawings showing cleaning equipment placement and required clearances.
9. Embedded anchor and mounting device requirements.
10. Documentation of testing methods and procedures.

1.05 DELIVERY, STORAGE AND HANDLING

A. Deliver, store, and handle products without damaging them.
1. Receive, unload, check, protect, and store equipment in facilities suitable to keep it clean, dry, and free from damage, vandalism, and pilferage.
2. Pay demurrage charges and claims for damage resulting from unloading operations.
3. Examine equipment for visible and concealed damage. Report any damage to carrier, supplier, and County of Nevada Representative as soon as possible.

B. Protect equipment from loss, deterioration, and damage until work is complete.
1. Protect equipment during storage and prior to start-up.
2. Protect exposed finished surfaces with removable coating for film, cover openings to exclude dirt and fouling materials, and protect unfinished surfaces against rust, corrosion, and other damage.
3. Protect equipment from paint or **coating** spills and spots.

1.06 EXPERIENCE

A. Furnish products and services only from manufacturers and installers who demonstrate that they have a minimum of five years' experience manufacturing and installing items equivalent to those required as the Work of this Section.

1.07 WARRANTY

A. Following completion, the Contractor shall provide the County of Nevada Representative with two (2) years of warranty as stipulated in Section 1 40 00 starting at project acceptance, covering all parts, materials, and labor. All warranty work shall be performed by a local manufacturer's representative at the Project Site location, who has capabilities of responding to all problems within 24 hours. Any shipping and delivery costs associated with the warranty of this equipment shall be the responsibility of the Contractor.

PART 2 - PRODUCTS

2.01 HIGH PRESSURE WASH REMOTE REEL

A. Equipment Item No. WB-2.

B. Acceptable Manufacturers:
1. Products of the following manufacturer are specified as the standard of quality for the Pressure Washer.
a. Cox Reels

5865 South Ash Avenue
Tempe, AZ 85283
Telephone: 480-820-6396

b. Or approved equal.

C. Features and Construction:

1. Safety controls: Safety features shall be factory tested, shall have UL approval and shall bear the appropriate UL label.
   a. Trigger gun with cool grip, stainless steel, dual lance variable pressure lance.
   b. Pedestal mounted high capacity hose reel with manual feed handle. Provide reel with the following features:
      1) Heavy duty all welded steel A frame construction with rolled edges.
      2) Low profile riser and open drum.
      3) Self-aligning pillow and block bearings.
      4) Steel construction.
      5) Powder coat finish.
      6) Adjustable long wearing break assembly.
      7) External fluid path with machined solid brass 90 degree full flow NTP swivel.
      8) Solid steel direct hand crank with smoothed round handle.
      9) Provide all mounting accessories.
   c. Provide two spray wand holders to be constructed of minimum 2 inch galvanized pipe, open at both ends, with mounting brackets. Holder shall allow for convenient storage of spray wand assembly. See detail on drawing Q3.20

D. Provide all piping from the high pressure washer (WB-1) to the remote reel. See Process Piping drawings for piping requirements.

E. Dimensions and Capacities:
1. Weight: 36 pounds empty
2. Size: 19 ½ inches W x 18 ¾ inches H x 17 5/8 inches L

F. The remote pressure washer reel, shall be model #HP1125-4-100 Series as manufactured by Cox Reels with high pressure hose and wand or approved equal with the above minimum requirements.

2.02 HOT WATER PRESSURE WASHER

A. Equipment Item No. WB-1.

B. Acceptable Manufacturers:
1. Prime manufacturer: Specifications are based on equipment identified herein by manufacturer's name and model to establish acceptable standards of quality, performance, features, and construction for the hot water pressure washer
   a. Landa Cleaning Systems
      West Distributor: Boyd Equipment
      355 East Warner Road, Suite #1
      Chandler, AZ 85225
      Phone: (480) 782-7412
      e-mail: eric.strait@karcherna.com

2. Other manufacturers: Contingent upon compliance with these specifications and documentation requirements set forth in SUBMITTALS, equipment produced by other manufacturers, including the following, may be considered as equal.

a. Hotsy Cleaning Equipment
Distributor: Precission Cleaning Systems
8165 Alpine Avenue
Sacramento, CA 95826
Phone: (916) 731-4489 or (800) 468-7923
Website: www.hotsysacramento.com
b. Approved Equal

C. Construction Features:
1. Heavy duty stationary unit
2. Leak free hot water coil – schedule 80, cold rolled steel pipe
3. Electronic ignition
4. Brass, anti-syphon detergent metering valve for chemical dispensing
5. Detergent metering valve
6. Belt driven pump unit
7. Hinged access cover for maintenance access to pump and valves.
8. Time delay shutdown Model #8.903-489.0
9. Provide system with a wired control box mounted to the wall or column at location of each reel. Control Box shall have the means of turning system on-of, heat control and dispensing chemical as needed. Control box shall not be wireless.
10. Two -Variable pressure wands one located at each reel. Requirements below are for each wand per reel.
a. 42” angled spray wand.
b. One 30 degree nozzle extension for spray wand.
c. One nozzle with 0, 15, 25 and 40 degree tips, for spray wand.
d. Provide two spray wand holders to be constructed of minimum 2 inch galvanized pipe, open at both ends, with mounting brackets. Holder shall allow for convenient storage of spray wand assembly. See detail for mounting locations on Q3.20.
11. Two - 50 foot of 3/8” double steel braid high pressure hose with hose reel, one for each reel. Hose shall be rated for the specified high pressure. Hoses shall be located on remote reels as specified on section 2.01 of these specifications. The hose and reel shall be fed via high pressure lines from the pressure washer. See Plumbing drawings for piping runs.

D. Capacities and Dimensions:
1. Delivery: 3.9 GPM
2. Pressure: 3000 PSI
3. Pump RPM: 775 RPM
4. Weight: 868 lbs.
5. Size: 24” deep x 53” wide

E. Utilities Available:
1. Electrical: 230V/1PH/60Hz – 8.2 HP – 36 Amps
2. Gas: 400,000 BTU
3. Water: City Water

F. Finish: Durable enamel in manufacturer's standard color.

G. Hot Water Pressure Washer shall be Model #VHG4-30024A as manufacturer by Landa Cleaning Systems with the above minimal requirements or approved equal.

2.03 PARTS WASHER

A. Equipment Item No. LD-9

B. Acceptable Manufacturers:
1. Prime manufacturer: Specifications are based on equipment identified herein by manufacturer's name and model to establish acceptable standards of quality, performance, features, and construction for the parts washer
   a. Graymills
      2601 South 25th Avenue
      Broadview, IL, 60155
      Phone: (877) 465-7867
      www.graymills.com

2. Other manufacturers: Contingent upon compliance with these specifications and documentation requirements set forth in SUBMITTALS, equipment produced by other manufacturers, including the following, may be considered as equal.
   a. Safety-Kleen
      2600 North Central Expressway, Suite 400
      Richardson, TX 75080
      Phone: (800) 323-5040
      Website: www.safety-kleen.com
   b. Approved Equal

C. Construction Features:
1. 18 gauge steel tank construction with powder coat finish
2. Filter and sludge collector basket with dual element foam filter
3. Flexible metal flush hose
4. Bottom drain for fluid changeouts.
5. Parts basket
6. Fusible safety link. Close lid automatically in event of fire
7. 400 GPH Superflow pump
8. Removable work shelf

D. Capacities and dimensions:
1. Capacity: 20 Gallons
2. Tank Dimensions: 36” L x 22” W x 38 ½” H
3. Overall height with lid open: 60” H
4. Maximum Liquid Level: 6”

E. Utilities:
1. Electrical: 115V – 1 Ph – 60 Hz – ½ HP

F. Parts Washer shall be Model No. PL-36 as manufactured by Graymills with the above minimal requirements, or approved equal.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install equipment in strict accordance with the approved shop drawings and manufacturer’s installation instructions.

B. Coordinate work with other trades to ensure proper equipment utilities and interface with the building structure and required utilities. These shall include but not limited to electrical, plumbing, and drainage.

C. For reel location and mounting requirements, refer to Industrial drawing no. Q2.00 and Q3.20. Coordinate with structural drawings for structural requirements for mounting the pressure washer reels.

D. Coordinate the installation of the reel, hose and wand with the pressure washer to assure proper function.

E. Provide proper ventilation as required by the manufacturer and suggested shop drawings.

F. Demonstrate that cleaning equipment performs and operates as specified.

G. Adjust parts requiring adjustment in order to operate as specified.

H. Proceed with start-up, testing and instruction in accordance with Section 11 00 50.

I. Coordinate with other trades for proper drainage requirements for the pressure wash equipment. All effluent shall be drained to an oil water separator.

3.02 FIELD QUALITY CONTROL

A. Provide the services of a qualified manufacturer's representative to perform the following:
1. Supervise preparatory work performed by other trades.
2. Supervise installation.
3. Supervise testing, by the Contractor in the presence of the County of Nevada Representative to ensure proper operation of the equipment.

B. Contractor to follow requirements as listed in Division 1 – General Requirements

3.03 FIELD TESTING

A. Perform testing of the equipment and system in accordance with the requirements specified in Division 1 – General Requirements and Section 11 00 50. Perform and document all testing procedures recommended by the manufacturer.

3.04 TRAINING PROGRAM AND OPERATION AND MAINTENANCE MANUALS

A. Provide a training program and operation and maintenance manual in accordance with the requirements specified in Division 1 – General Requirements and Section 11 00 50.

END OF SECTION

SECTION 11 95 00 – PORTABLE FALL ARREST STATION

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
1. The work specified in this section includes furnishing, installing, and testing A Portable Fall Arrest Station at location shown on the Drawings. All requirements to install and test this station to work within bay requirements is also a part of the work of this section.

B. Related Sections:
1. Division 1 – General Requirements.
2. Section 11 00 50 - Basic Equipment Materials and Methods.

C. Provisions of Section 11 00 50 apply to the work of this Section.

1.02 REFERENCES

A. Occupational Safety and Health Administration (CAL OSHA):
1. 9 CFR 1910 Occupational Safety and Health Standards.

1.03 QUALITY ASSURANCE

A. Comply with the provisions of Division 1, Section 01 00 00 - General Requirements.

B. Use adequate numbers of skilled workers who are completely familiar with the specified requirements and the materials and methods necessary for proper performance of the Work of this Section.

1.04 SUBMITTALS

A. Pursuant to the provisions of Division 1, General Requirements and Section 11 00 50, Basic Equipment Materials and Methods the Contractor shall submit:
1. Material and equipment list itemizing products furnished to satisfy the requirements of this section.
2. Product data including catalog cuts, manufacturer’s assembly and installation data, manufacturer’s certificates of compliance, and samples.
3. Shop drawings.
4. Schedule of work.
5. Operations and maintenance data.
6. List of recommended spare parts and maintenance materials.
7. Evidence of manufacturers and installers experience including names, addresses and phone numbers of reference clients.
8. Calculations and certification specified.
9. Documentation of field tests.

1.05 WARRANTY

A. Following completion, the Contractor shall provide the County of Nevada Representative with two (2) years of warranty as stipulated in Section 1 40 00 starting at project acceptance, covering all parts, materials, and labor. All warranty work shall be performed by a local manufacturer's representative at the Project Site location, who has capabilities of responding to all problems within 24 hours. Any shipping and delivery costs associated with the warranty of this equipment shall be the responsibility of the Contractor

1.06 DELIVERY, STORAGE AND HANDLING

A. Deliver, store, and handle products without damaging them.
   1. Receive, unload, check, protect, and store equipment in facilities suitable to keep it clean, dry, and free from damage, vandalism, and pilferage.
   2. Pay demurrage charges and claims for damage resulting from unloading operations.
   3. Examine equipment for visible and concealed damage. Report any damage to carrier, supplier, and County of Nevada Representative as soon as possible.

B. Protect equipment from loss, deterioration, and damage until work is complete.
   1. Protect equipment during storage and prior to start-up.
   2. Protect exposed finished surfaces with removable coating for film, cover openings to exclude dirt and fouling materials, and protect unfinished surfaces against rust, corrosion, and other damage.
   3. Protect equipment from paint or coating spills and spots.

PART 2 - PRODUCTS

2.01 PORTABLE FALL ARREST STATION

A. Equipment Item No. HD-36

B. Acceptable Manufacturers:
   1. The products of the following manufacturer are specified as the standard of quality for the Fall Arrest Work Station.
      a. CAI Safety Systems
         555 Monica Circle
         Corona, CA 92880
         Telephone: 888-246-6999
   2. Products of equal quality, configuration and utility from qualified manufacturers will be accepted.
      a. Approved Equal

C. General Description
   1. Fall Arrest system shall be portable with caster for ease of movement between bays. It shall include a self-retracting lifeline and anchorage connector. The harness and carabiner are not part of the specifications and will be supplied by the Nevada County based on their standard specifications from their safety personnel.
   2. System shall be a portable freestanding fall anchor and ladder system designed for safe fall protection of two people simultaneously attached to system with two sets of anchor points and self-retracting lifeline.
   3. System shall be safety certified after installation to assure it meets all the safety requirements as stipulated by the Nevada County Representative.

D. Construction Features:
   1. Powder coated aluminum construction
   2. Personnel Platform with guardrails
   3. Two fall arrest bars (Davit) for use of multiple SRL on the system
   4. Adjustable portable freestanding ladder access to platform with handrails and cable for adjustment of height.
   5. Multiple platform height adjustment.
   6. Foam protected platform for protection of the vehicle rooftops.
   7. Manual height adjustment via winch assembly
   8. Overhead anchor point post.
   9. Heavy duty leveling jacks

10. 8 inch urethane wheel sets
11. Low Profile kit to fit under vehicle when used.
12. Tow bar for system for ease in movement
13. Tag line feature to access SRL connection
14. Collapse feature when not in use.
15. Meets OSHA 1926.502; ANSI Z359.6 for fall arrest requirements.

E. Capacities and Dimensions
1. Capacity: 310 lbs.
2. Number of Users: Two
3. Platform Adjustment: 10 feet 9 inches to 15 feet 6 inches
4. SRL to be SALA Ultra-Lok or equal self-retracting lifeline with 20 foot of galvanized steel wire rope with swivel snap hook.
5. Weight: 2056 lbs.

F. Finish: Standard OSHA yellow powder coated finish.

G. Portable Fall Arrest system shall me Model No. 8517715 as manufactured by CAI Safety Systems or approved equal with the above minimal requirements.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install equipment in strict accordance with the approved shop drawings and manufacturer's installation instructions.
B. Coordinate work with other trades to ensure proper equipment interface with the building structure and equipment required clearances to bay structure and other components.
C. Proceed with start-up, testings and instruction in accordance with Section 11 00 50.
D. Coordinate with manufacturer and anchor workbenches as required to meet Seismic Design Category per all codes having jurisdiction.

3.02 FIELD QUALITY CONTROL

A. Provide the services of a qualified manufacturer's representative to perform the following:
1. Supervise preparatory work performed by other trades.
2. Supervise installation.
3. Supervise testing, by the Contractor in the presence of the County of Nevada Representative to ensure proper operation of the equipment.

3.03 FIELD TESTING

A. Perform testing of the equipment and system in accordance with the requirements specified in Division 1. Perform and document all testing procedures recommended by the manufacturer.

3.04 TRAINING PROGRAM AND OPERATION AND MAINTENANCE MANUALS
A. Provide a training program and operation and maintenance manual in accordance with the requirements specified in Division 1 and 11 00 50.

END OF SECTION

SECTION 12 24 13 – ROLL DOWN WINDOW SHADES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Manually operated sunscreen roller shades.

B. Electrically operated sunscreen roller shades.

C. Local group and master control system for shade operation with addressable motors.

1.02 RELATED SECTIONS

A. Section 06100 - Rough Carpentry: Wood blocking and grounds for mounting roller shades and accessories.

B. Section 09260 - Gypsum Board Assemblies: Coordination with gypsum board assemblies for installation of shade pockets, closures and related accessories.

C. Section 09510 - Acoustical Ceilings: Coordination with acoustical ceiling systems for installation of shade pockets, closures and related accessories.

D. Division 16 - Electrical: Electric service for motor controls.

1.03 REFERENCES

A. ASTM G 21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.

B. NFPA 70 - National Electrical Code.

C. NFPA 701-99 - Fire Tests for Flame-Resistant Textiles and Films.

1.04 SUBMITTALS

A. Product Data: Manufacturer's data sheets on each product to be used, including:

1. Preparation instructions and recommendations.

2. Styles, material descriptions, dimensions of individual components, profiles, features, finishes and operating instructions.

3. Storage and handling requirements and recommendations.

4. Mounting details and installation methods.

5. Typical wiring diagrams including integration of motor controllers with building management system, audiovisual and lighting control systems as applicable.

B. Shop Drawings: Plans, elevations, sections, product details, installation details, operational clearances, wiring diagrams and relationship to adjacent work.

D. Window Treatment Schedule: For all roller shades. Use same room designations as indicated on the Drawings and include opening sizes and key to typical mounting details.

C. Selection Samples: For each finish product specified, one set of shade cloth options and aluminum finish color samples representing manufacturer's full range of available colors and patterns.

D. Maintenance Data: Methods for maintaining roller shades, precautions regarding cleaning materials and methods, instructions for operating hardware and controls.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Obtain roller shades through one source from a single manufacturer with a minimum of ten years experience in manufacturing products comparable to those specified in this section.

B. Installer Qualifications: Installer trained and certified by the manufacturer with a minimum of three years experience in installing products comparable to those specified in this section.

C. Fire-Test-Response Characteristics: Passes NFPA 701-99 small and large-scale vertical burn. Materials tested shall be identical to products proposed for use.

D. Electrical Components: NFPA Article 100 listed and labeled by either UL or ETL or other testing agency acceptable to authorities having jurisdiction, marked for intended use, and tested as a system. Individual testing of components will not be acceptable in lieu of system testing.

E. Anti-Microbial Characteristics: 'No Growth' per ASTM G 21 results for fungi ATCC9642, ATCC 9644, ATCC9645.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver shades in factory-labeled packages, marked with manufacturer and product name, fire-test-response characteristics, and location of installation using same room designations indicated on Drawings and in the Window Treatment Schedule.

1.07 PROJECT CONDITIONS

A. Environmental Limitations: Install roller shades after finish work including painting is complete and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

1.08 WARRANTY

A. Roller Shade Hardware, Chain and Shadecloth Manufacturer's standard non-depreciating twenty-five year limited warranty.

B. Roller Shade Motors and Motor Control Systems: Manufacturer's standard non-depreciating five-year warranty.

C. Roller Shade Installation: One year from date of Substantial Completion, not including scaffolding, lifts or other means to reach inaccessible areas.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Acceptable Manufacturer: MechoShade Systems, Inc. or approved equal

B. Substitutions: Substitutions shall be submitted in writing and Architect shall have final authority of acceptance.

2.02 APPLICATIONS/SCOPE

A. Roller Shade Schedule:

Provide window coverings at all interior & exterior window locations at windows with a head height of 14’ and below:

1. Shade Type 1: Manual operating, chain drive, sunscreen roller shades in all exterior windows of rooms and spaces shown on the Drawings.

2.03 SHADE CLOTH

A. Visually Transparent Single-Fabric Shadecloth: MechoShade Systems, Inc., ThermoVeil group, single thickness non-raveling 0.030-inch (0.762 mm) thick vinyl fabric, woven from 0.018-inch (0.457 mm) diameter extruded vinyl yarn comprising of 21 percent polyester and 79 percent reinforced vinyl, in colors selected from manufacturer's full range.

1. Dense Basket Weave: "1500 series", 3 percent open, 2 by 2 dense basket-weave pattern

a. Color: Selected from manufacturer's full range of colors.

b. At Exterior Windows

B. Visually Transparent Single-Fabric Shadecloth: MechoShade Systems, Inc., EuroTwill "6000" Series: 0.010 diameter (0.254 mm) non-raveling vinyl/polyester yarn, fabric thickness 0.025 inches (0.635 mm).

1. Extra Dense Twill Weave "6000" series, 2-3 percent open.

a. Color: Selected from manufacturer's full range of colors.

b. At Interior Windows

2.04 SHADE BAND

A. Shade Bands: Construction of shade band includes the fabric, the hem weight, hem-pocket, shade roller tube, and the attachment of the shade band to the roller tube. Sewn hems and open hem pockets are not acceptable.

1. Hem Pockets and Hem Weights: Fabric hem pocket with RF-welded seams (including welded ends) and concealed hem weights. Hem weights shall be of appropriate size and weight for shade band. Hem weight shall be continuous inside a sealed hem pocket. Hem pocket construction and hem weights shall be similar, for all shades within one room.

2. Shade band and Shade Roller Attachment:

a. Use extruded aluminum shade roller tube of a diameter and wall thickness required to support shade fabric without excessive deflection. Roller tubes less than 1.55 inch (39.37 mm) in diameter for manual shades, and less than 2.55 inches (64.77 mm) for motorize shades are not acceptable.

b. Provide for positive mechanical engagement with drive / brake mechanism.

c. Provide for positive mechanical attachment of shade band to roller tube; shade band shall be made removable / replaceable with a "snap-on" snap-off" spline mounting, without having to remove shade roller from shade brackets.

d. Mounting spline shall not require use of adhesives, adhesive tapes, staples, and/or rivets.

e. Any method of attaching shade band to roller tube that requires the use of: adhesive, adhesive tapes, staples, and/or rivets are not acceptable.

2.05 SHADE FABRICATION

A. Fabricate units to completely fill existing openings from head to sill and jamb-to-jamb, unless specifically indicated otherwise.

B. Fabricate shadecloth to hang flat without buckling or distortion. Fabricate with heat-sealed trimmed edges to hang straight without curling or raveling. Fabricate unguided shadecloth to roll true and straight without shifting sideways more than 1/8 inch (3.18 mm) in either direction per 8 feet (2438 mm) of shade height due to warp distortion or weave design. Fabricate hem as follows:

1. Bottom hem weights.

C. Provide battens in standard shades as required to assure proper tracking and uniform rolling of the shadebands. Contractor shall be responsible for assuring the width-to-height (W:H) ratios shall not exceed manufacturer's standards or, in absence of such standards, shall be responsible for establishing appropriate standards to assure proper tracking and rolling of the shadecloth within specified standards. Battens shall be roll-formed stainless steel or tempered steel, as required.

D. For railroaded shadebands, provide seams in railroaded multi-width shadebands as required to meet size requirements and in accordance with seam alignment as acceptable to Architect. Seams shall be properly located. Furnish battens in place of plain seams when the width, height, or weight of the shade exceeds manufacturer's standards. In absence of such standards, assure proper use of seams or battens as required to, and assure the proper tracking of the railroaded multi-width shadebands.

E. Provide battens for railroaded shades when width-to-height (W:H) ratios meet or exceed manufacturer's standards. In absence of manufacturer's standards, be responsible for proper use and placement of battens to assure proper tracking and roll of shadebands.

2.06 COMPONENTS

A. Access and Material Requirements:

1. Provide shade hardware allowing for the removal of shade roller tube from brackets without removing hardware from opening and without requiring end or center supports to be removed.

2. Provide shade hardware that allows for removal and re-mounting of the shade bands without having to remove the shade tube, drive or operating support brackets.

3. Use only Delrin engineered plastics by DuPont for all plastic components of shade hardware. Styrene based plastics, and /or polyester, or reinforced polyester will not be acceptable.

B. Manual Operated Chain Drive Hardware and Brackets:

1. Provide for universal, regular and offset drive capacity, allowing drive chain to fall at front, rear or non-offset for all shade drive end brackets. Universal offset shall be adjustable for future change.

2. Provide hardware capable for installation of a removable fascia, for both regular and/or reverse roll, which shall be installed without exposed fastening devices of any kind.

3. Provide shade hardware system that allows for removable regular and/or reverse roll fascias to be mounted continuously across two or more shade bands without requiring exposed fasteners of any kind.

4. Provide shade hardware system that allows for operation of multiple shade bands (multi-banded shades) by a single chain operator, subject to manufacturer's design criteria. Connectors shall be offset to assure alignment from the first to the last shade band.

5. Provide shade hardware system that allows multi-banded manually operated shades to be capable of smooth operation when the axis is offset a maximum of 6 degrees on each side of the plane perpendicular to the radial line of the curve, for a 12 degrees total offset.

6. Provide positive mechanical engagement of drive mechanism to shade roller tube. Friction fit connectors for drive mechanism connection to shade roller tube are not acceptable

7. Provide shade hardware constructed of minimum 1/8-inch (3.18 mm) thick plated steel or heavier as required to support 150 percent of the full weight of each shade.

2.07 ACCESSORIES

A. Roller Shade Pocket for recessed mounting in acoustical tile, or drywall ceilings as indicated on the Drawings

1. Provide either extruded aluminum and or formed steel shade pocket, sized to accommodate roller shades, with exposed extruded aluminum closure mount, tile support and removable closure panel to provide access to shades.

B. Fascia (for outside mount shades)

1. Continuous removable extruded aluminum fascia that attaches to shade mounting brackets without the use of adhesives, magnetic strips, or exposed fasteners.

2. Fascia shall be able to be installed across two or more shade bands in one piece.

3. Fascia shall fully conceal brackets, shade roller and fabric on the tube.

4. Provide bracket / fascia end caps where mounting conditions expose outside of roller shade brackets.

5. Notching of Fascia for manual chain shall not be acceptable.

a. Color: Selected from manufacturer's full range of colors.

PART 2 EXECUTION

3.01 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.02 INSTALLATION

A. Install roller shades level, plumb, square, and true according to manufacturer's written instructions, and located so shade band is not closer than 2 inches (50 mm) to interior face of glass. Allow proper clearances for window operation hardware.

B. Adjust and balance roller shades to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range.

C. Clean roller shade surfaces after installation, according to manufacturer's written instructions.

D. Engage Installer to train Owner's maintenance personnel to adjust, operate and maintain roller shade systems.

3.04 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

SECTION 12 93 00 – SITE FURNISHINGS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Bike Rack

1.02 MEASUREMENT AND PAYMENT

A. Payment of the various Construction Items described in the Schedule of Values shall be considered full compensation for work of this Section.

1.03 SUBMITTALS

A. Product Data: Submit product data for each specified item.

B. Shop Drawings: Submit manufacturer's installation shop drawings for each specified item.

C. Color Samples: Submit manufacturer's color samples for each color specified. Final color selection shall be based on these samples.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Madrax, 1080 Uniek Drive, Waunakee, WI 53597, (800) 448-7931, www.madrax.com.

2.02 MANUFACTURED PRODUCTS

A. Bike Rack: As specified in the plans.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine site and verify lines, grades, and other work and verify that areas are ready to receive installations.

3.02 INSTALLATION -GENERAL

A. Coordinate with paving and other affected Work.

B. Complete assembly of furnishing, where required.

C. Install in accordance with manufacturer's shop drawings and recommendations.

D. Install square to lines indicated on the Drawings and plumb to vertical.

E. Unless otherwise indicated, install furnishings after landscaping and paving have been completed.

3.03 CLEANING AND PROTECTION

A. Clean work in accordance with manufacturer's recommendations.

B. Protect work against damage until final acceptance. Replace or repair to the satisfaction of the Architect any work that becomes damaged prior to final acceptance.

END OF SECTION

SECTION 13 34 19 - METAL BUILDING SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Structural-steel framing.
    a. Future bridge cranes – include hanger supports complete with lateral bracing for attaching crane runway beams.
    b. Support framing for roof and wall supported equipment such as mechanical, electrical, industrial equipment, etc. as shown on mechanical, electrical, industrial equipment, etc. drawings
2. Metal roof panels.
3. Metal wall panels.
4. Foam-insulation-core metal wall panels.
5. Translucent panels.
6. Metal soffit panels.
7. Thermal insulation.
8. Doors and frames.
9. Windows.
10. Accessories.

B. Related Sections:

1. Section 07 41 00 “Insulated Metal Roof Panels”
2. Section 07 41 13 “Non-Insulated Metal Roof Panels”
3. Section 07 42 12 “Non-Insulated Metal Wall & Soffit Panels”
4. Section 07 42 13 “Insulated Metal Wall Panels”
5. Section 07 62 00 “Sheet Metal Flashing and Trim”
6. Section 08 12 13 “Hollow Metal Doors and Frames”
7. Section 08 33 23 "Overhead Coiling Doors"
8. Section 08 36 10 “ Aluminum-Framed Entrances and Storefronts
9. Section 08 71 00 “Finish Hardware”
10. Section 08 80 00 “Glazing”

1.3 DEFINITIONS

A. Terminology Standard: See MBMA's "Metal Building Systems Manual" for definitions of terms for metal building system construction not otherwise defined in this Section or in referenced standards.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of metal building system component. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for the following:

1. Structural-steel-framing system.
2. Metal roof panels.
3. Metal wall panels.
4. Metal liner panels.
5. Translucent panels.
6. Insulation and vapor retarder facings.
7. Flashing and trim.
8. Doors.
9. Windows.
10. Accessories.

B. Shop Drawings: For the following metal building system components. Include plans, elevations, sections, details, and attachments to other work.

1. Anchor-Bolt Plans: Submit anchor-bolt plans and templates before foundation work begins. Include location, diameter, and projection of anchor bolts required to attach metal building to foundation. Indicate column reactions at each location.
2. Structural-Framing Drawings: Show complete fabrication of primary and secondary framing; include provisions for openings. Indicate welds and bolted connections, distinguishing between shop and field applications. Include transverse cross-sections.

    a. Show provisions for attaching roof curbs and service walkways.

3. Metal Roof and Wall Panel Layout Drawings: Show layouts of metal panels including methods of support. Include details of edge conditions, joints, panel profiles, corners, anchorages, trim, flashings, closures, and special details. Distinguish between factory- and field-assembled work; show locations of exposed fasteners.

    a. Show roof-mounted items including roof hatches, equipment supports, pipe supports and penetrations, lighting fixtures, and items mounted on roof curbs.
    b. Show wall-mounted items including doors, windows, louvers, and lighting fixtures.
    c. Show translucent panels.

4. Accessory Drawings: Include details of the following items, at a scale of not less than 1-1/2 inches per 12 inches. Profiles shall match Architectural drawings:

    a. Flashing and trim.
    b. Gutters.
    c. Downspouts.
    d. Roof ventilators.
    e. Louvers.
    f. Service walkways.

C. Samples for Initial Selection: For units with factory-applied color finish.

D. Samples for Verification: For each type of exposed finish required, prepared on Samples of sizes indicated below:

1. Metal Panels: Nominal 12 inches long by actual panel width. Include fasteners, closures, and other exposed panel accessories.
2. Translucent Panels: Nominal 12 inches long by actual panel width.
3. Flashing and Trim: Nominal 12 inches long. Include fasteners and other exposed accessories.
4. Vapor-Retarder Facings: Nominal 6-inch-square Samples.
5. Windows: Full-size, nominal 12-inch-long frame Samples showing typical profile.
6. Accessories: Nominal 12-inch-long Samples for each type of accessory.

E. Door Schedule: For doors and frames. Use same designations indicated on Drawings. Include details of reinforcement.

1. Door Hardware Schedule: Include details of fabrication and assembly of door hardware. Organize schedule into door hardware sets indicating complete designations of every item required for each door or opening.
2. Keying Schedule: Detail Owner's final keying instructions for locks. Include schematic keying diagram and index each key set to unique door designations.

F. Delegated-Design Submittal: For metal building systems indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified erector and manufacturer.

B. Manufacturer Accreditation: Statement that metal building system and components were designed and produced by a manufacturer accredited according to the International Accreditation Service's AC472.

C. Welding certificates.

D. Metal Building System Certificates: For each type of metal building system, from manufacturer.

1. Letter of Design Certification: Signed and sealed by a qualified professional engineer. Include the following:

a. Name and location of Project.
b. Order number.
c. Name of manufacturer.
d. Name of Contractor.
e. Building dimensions including width, length, height, and roof slope.
f. Indicate compliance with AISC standards for hot-rolled steel and AISI standards for cold-rolled steel, including edition dates of each standard.
g. Governing building code and year of edition.
h. Design Loads: Include dead load, roof live load, collateral loads, roof snow load, deflection, wind loads/speeds and exposure, seismic design category or effective peak velocity-related acceleration/peak acceleration, and auxiliary loads (cranes).
i. Load Combinations: Indicate that loads were applied acting simultaneously with concentrated loads, according to governing building code.
j. Building-Use Category: Indicate category of building use and its effect on load importance factors.

E. Erector Certificates: For each product, from manufacturer.

F. Manufacturer Certificates: For each product, from manufacturer.

G. Material Test Reports: For each of the following products:

1. Structural steel including chemical and physical properties.
2. Bolts, nuts, and washers including mechanical properties and chemical analysis.
3. Tension-control, high-strength, bolt-nut-washer assemblies.
4. Shop primers.

H. Product Test Reports: Based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, for insulation and vapor-retarder facings. Include reports for thermal resistance, fire-test-response characteristics, water-vapor transmission, and water absorption.

I. Source quality-control reports.

J. Field quality-control reports.

K. Surveys: Show final elevations and locations of major members. Indicate discrepancies between actual installation and the Contract Documents. Have surveyor who performed surveys certify their accuracy.

L. Warranties: Sample of special warranties.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For metal panel finishes and door hardware to include in maintenance manuals.

1.7 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer and member of MBMA.

1. Accreditation: According to the International Accreditation Service's AC472.
2. Engineering Responsibility: Preparation of comprehensive engineering analysis and Shop Drawings by a professional engineer who is legally qualified to practice in jurisdiction where Project is located.

B. Erector Qualifications: An experienced erector who specializes in erecting and installing work similar in material, design, and extent to that indicated for this Project and who is acceptable to manufacturer.

C. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.

D. Source Limitations: Obtain metal building system components, including primary and secondary framing and metal panel assemblies, from single source from single manufacturer.

E. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. AWS D1.3, "Structural Welding Code - Sheet Steel."

F. Structural Steel: Comply with AISC 360, "Specification for Structural Steel Buildings," for design requirements and allowable stresses.

G. Cold-Formed Steel: Comply with AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members" for design requirements and allowable stresses.

H. Fire-Resistance Ratings: Where indicated, provide metal panel assemblies identical to those of assemblies tested for fire resistance per ASTM E 119 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.
2. Combustion Characteristics: ASTM E 136.

I. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.

1. Oversize Fire-Rated Door Assemblies: For units exceeding sizes of tested assemblies, provide certification by a qualified testing agency that doors comply with standard construction requirements for tested and labeled fire-rated door assemblies except for size.

J. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Build mockup of typical wall area as shown on Drawings.
2. Build mockups for typical wall metal panel including accessories.

    a. Size: 48 inches long by 48 inches.

3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.

K. Preinstallation Conference: Conduct conference at Project site.

1. Review methods and procedures related to metal building systems including, but not limited to, the following:

    a. Condition of foundations and other preparatory work performed by other trades.
    b. Structural load limitations.
    c. Construction schedule. Verify availability of materials and erector's personnel, equipment, and facilities needed to make progress and avoid delays.
    d. Required tests, inspections, and certifications.
    e. Unfavorable weather and forecasted weather conditions.

2. Review methods and procedures related to metal roof panel assemblies including, but not limited to, the following:

    a. Compliance with requirements for purlin and rafter conditions, including flatness and attachment to structural members.
    b. Structural limitations of purlins and rafters during and after roofing.
    c. Flashings, special roof details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect metal roof panels.

d. Temporary protection requirements for metal roof panel assembly during and after installation.
e. Roof observation and repair after metal roof panel installation.

3. Review methods and procedures related to metal wall panel assemblies including, but not limited to, the following:

a. Compliance with requirements for support conditions, including alignment between and attachment to structural members.
b. Structural limitations of girts and columns during and after wall panel installation.
c. Flashings, special siding details, wall penetrations, openings, and condition of other construction that will affect metal wall panels.
d. Temporary protection requirements for metal wall panel assembly during and after installation.
e. Wall observation and repair after metal wall panel installation.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver components, sheets, panels, and other manufactured items so as not to be damaged or deformed. Package metal panels for protection during transportation and handling.

B. Unload, store, and erect metal panels in a manner to prevent bending, warping, twisting, and surface damage.

C. Stack metal panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal panels to ensure dryness, with positive slope for drainage of water. Do not store metal panels in contact with other materials that might cause staining, denting, or other surface damage.

D. Protect foam-plastic insulation as follows:

1. Do not expose to sunlight, except to extent necessary for period of installation and concealment.
2. Protect against ignition at all times. Do not deliver foam-plastic insulation materials to Project site before installation time.
3. Complete installation and concealment of foam-plastic materials as rapidly as possible in each area of construction.

1.9 PROJECT CONDITIONS

A. Weather Limitations: Proceed with installation only when weather conditions permit metal panels to be installed according to manufacturers' written instructions and warranty requirements.

B. Field Measurements:

1. Established Dimensions for Foundations: Comply with established dimensions on approved anchor-bolt plans, establishing foundation dimensions and proceeding with fabricating structural framing without field measurements. Coordinate anchor-bolt installation to ensure that actual anchorage dimensions correspond to established dimensions.
2. Established Dimensions for Metal Panels: Where field measurements cannot be made without delaying the Work, either establish framing and opening dimensions and proceed with fabricating metal panels without field measurements, or allow for field trimming metal

panels. Coordinate construction to ensure that actual building dimensions, locations of structural members, and openings correspond to established dimensions.

1.10 COORDINATION

A. Coordinate sizes and locations of concrete foundations and casting of anchor-bolt inserts into foundation walls and footings. Concrete, reinforcement, and formwork requirements are specified in Section 03 30 00 "Cast-in-Place Concrete."

B. Coordinate installation of roof curbs equipment supports and roof penetrations, which are specified in Section 07 72 00 "Roof Accessories."

C. Coordinate metal panel assemblies with rain drainage work, flashing, trim, and construction of supports and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.11 WARRANTY

A. Special Warranty on Metal Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal panels that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:

a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Finish Warranty Period: 20 years from date of Substantial Completion.

B. Special Weathertightness Warranty for Standing-Seam Metal Roof Panels: Manufacturer's standard form in which manufacturer agrees to repair or replace standing-seam metal roof panel assemblies that leak or otherwise fail to remain weathertight within specified warranty period.

1. Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following or approved equal:

1. A&S Building Systems, Inc.; Division of NCI Building Systems, L.P.
2. Alliance Steel, Inc.
3. American Buildings Company; Division of Magnatrax Corp.
4. American Steel Building Co., Inc.
5. BC Steel Buildings, Inc.
6. Behlen Mfg. Co.
7. Bigbee Steel Buildings, Inc.
8. Butler Manufacturing Company; a BlueScope Steel company.
9. CBC Steel Buildings; Division of Magnatrax Corp.

10. Ceco Building Systems; Division of NCI Building Systems, L.P.
11. Chief Buildings; Division of Chief Industries, Inc.
12. Elite Structures, Inc.
13. Garco Building Systems; Division of NCI Building Systems, L.P.
14. Gulf States Manufacturers, Inc.; Division of Magnatrax Corp.
15. Inland Buildings; Subsidiary of Behlen Mfg. Co.
16. Kirby Building Systems; Division of Magnatrax Corp.
17. Mesco Building Solutions; Division of NCI Building Systems, L.P.
18. Metallic Building Company; Division of NCI Building Systems, L.P.
19. Metco Metal Supply.
20. Mid-West Steel Building Company; Division of NCI Building Systems, L.P.
21. Nucor Building Systems.
22. Oakland Metal Buildings, Inc.
23. Olympia Steel Building Systems.
24. Package Industries, Inc.
25. Pinnacle Structures, Inc.
26. Robertson Building Systems; an NCI company.
27. Ruffin Building Systems, Inc.
28. Schulte Building Systems, LLP.
29. Spirco Manufacturing.
30. Star Building Systems; an NCI company.
31. Tyler Building Systems, L.P.
32. USA, Inc.
33. VP Buildings; a United Dominion company.
34. Vulcan Steel Structures, Inc.
35. Whirlwind Building Systems.

2.2 METAL BUILDING SYSTEMS

A. Description: Provide a complete, integrated set of metal building system manufacturer's standard mutually dependent components and assemblies that form a metal building system capable of withstanding structural and other loads, thermally induced movement, and exposure to weather without failure or infiltration of water into building interior.

1. Provide metal building system of size and with bay spacings, roof slopes, and spans indicated.

B. Primary-Frame Type:

1. Rigid Modular: Solid-member, structural-framing system without and without interior columns unless shown otherwise.
2. Lean to: Solid member, structural-framing system without interior columns, designed to be partially supported by another structure.

C. End-Wall Framing: Manufacturer's standard, for buildings not required to be expandable, consisting of primary frame, capable of supporting one-half of a bay design load, and end-wall columns and load-bearing end-wall and corner columns and rafters.

D. Secondary-Frame Type: Manufacturer's standard purlins and joists and flush-framed girts.

E. Eave Heights: As indicated by nominal height on Drawings.

F. Bay Spacing: As shown on drawings.

G. Roof Slope: As shown on drawings.

H. Roof System: Manufacturer's standard metal roof panels as shown on drawings with field-installed insulation.

I. Exterior Wall System: Manufacturer's standard foam-insulation-core metal wall panels.

2.3 METAL BUILDING SYSTEM PERFORMANCE

A. Delegated Design: Design metal building system, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Structural Performance: Metal building systems shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated according to procedures in MBMA's "Metal Building Systems Manual."

1. Design Loads: As indicated on Drawings.
2. Deflection Limits: As indicated on Drawings.
3. Drift Limits: As indicated on Drawings.
4. Although ASTM E 1592 in subparagraph below applies to all types of single-sheet metal roof panels, from most manufacturers only the standing-seam metal roof panels can meet requirement below. The test is also used for single-sheet metal wall panels.
5. Metal panel assemblies shall withstand the effects of gravity loads and loads and stresses within limits and under conditions indicated according to ASTM E 1592.

C. Thermal Movements: Allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base engineering calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

D. Air Infiltration for Metal Roof Panels: Air leakage through assembly of not more than 0.06 cfm/sq. ft. of roof area when tested according to ASTM E 1680 at negative test-pressure difference of 1.57 lbf/sq. ft.

E. Air Infiltration for Metal Wall Panels: Air leakage through assembly of not more than 0.06 cfm/sq. ft. of wall area when tested according to ASTM E 283 at static-air-pressure difference of 1.57 lbf/sq. ft.

F. Water Penetration for Metal Roof Panels: No water penetration when tested according to ASTM E 1646 at test-pressure difference of 2.86 lbf/sq. ft.

G. Water Penetration for Metal Wall Panels: No water penetration when tested according to ASTM E 331 at a wind-load design pressure of not less than 2.86 lbf/sq. ft.

H. Wind-Uplift Resistance: Provide metal roof panel assemblies that comply with UL 580 for Class 60.

I. Thermal Performance: Provide insulated metal panel assemblies with the following maximum U-factors and minimum R-values for opaque elements when tested according to ASTM C 1363 or ASTM C 518:

1. Metal Roof Panel Assemblies:

    a. U-Factor: In accordance with Section 07 41 13.
    b. R-Value: In accordance with Section .07 41 13

2. Metal Wall Panel Assemblies:
    a. U-Factor: In accordance with Section.07 42 13
    b. R-Value: In accordance with Section.07 42 13

J. Energy Performance: Provide roof panels that are listed on the DOE's ENERGY STAR Roof Products Qualified Product List for low-slope roof products.

K. Energy Performance: Provide roof panels with initial solar reflectance not less than 0.70 and emissivity not less than 0.75 when tested according to CRRC.

2.4 STRUCTURAL-STEEL FRAMING

A. Primary Framing: Manufacturer's standard primary-framing system, designed to withstand required loads and specified requirements. Primary framing includes transverse and lean-to frames; rafter, rake, and canopy beams; sidewall, intermediate, end-wall, and corner columns; and wind bracing.

1. General: Provide frames with attachment plates, bearing plates, and splice members. Factory drill for field-bolted assembly. Provide frame span and spacing indicated.

    a. Slight variations in span and spacing may be acceptable if necessary to comply with manufacturer's standard, as approved by Architect.
2. Rigid Modular Frames: I-shaped frame sections fabricated from shop-welded, built-up steel plates or structural-steel shapes. Provide interior columns fabricated from shop-welded, built-up steel plates.
3. Frame Configuration: As indicated on drawings.
4. Exterior Column Type: As indicated on drawings.
5. Rafter Type: Uniform depth.

B. End-Wall Framing: Manufacturer's standard primary or truss-frame end-wall framing fabricated for field-bolted assembly to comply with the following:

1. End-Wall and Corner Columns: I-shaped sections fabricated from structural-steel shapes; shop-welded, built-up steel plates; or C-shaped, cold-formed, structural-steel sheet.
2. End-Wall Rafters: C-shaped, cold-formed, structural-steel sheet; or I-shaped sections fabricated from shop-welded, built-up steel plates or structural-steel shapes.

C. Secondary Framing: Manufacturer's standard secondary framing, including purlins, girts, eave struts, flange bracing, base members, gable angles, clips, headers, jambs, and other miscellaneous structural members. Unless otherwise indicated, fabricate framing from either cold-formed, structural-steel sheet or roll-formed, metallic-coated steel sheet, prepainted with coil coating, to comply with the following:

1. Purlins: C- or Z-shaped sections; fabricated from built-up steel plates, steel sheet, or structural-steel shapes; minimum 2-1/2-inch-wide flanges.

    a. Depth: 8” min.

2. Girts: C- or Z-shaped sections; fabricated from built-up steel plates, steel sheet, or structural-steel shapes. Form ends of Z-sections with stiffening lips angled 40 to 50 degrees from flange, with minimum 2-1/2-inch-wide flanges.

    a. Depth: 8” or 10”.

3. Eave Struts: Unequal-flange, C-shaped sections; fabricated from built-up steel plates, steel sheet, or structural-steel shapes; to provide adequate backup for metal panels.
4. Flange Bracing: Minimum 2-by-2-by-1/8-inch structural-steel angles or 1-inch-diameter, cold-formed structural tubing to stiffen primary-frame flanges.
5. Sag Bracing: Minimum 1-by-1-by-1/8-inch structural-steel angles.
6. Base or Sill Angles: Minimum 3-by-2-inch zinc-coated (galvanized) steel sheet.
7. Purlin and Girt Clips: Manufacturer's standard clips fabricated from steel sheet. Provide galvanized clips where clips are connected to galvanized framing members.
8. Secondary End-Wall Framing: Manufacturer's standard sections fabricated from structural-steel sheet.
9. Framing for Openings: Channel shapes; fabricated from cold-formed, structural-steel sheet or structural-steel shapes. Frame head and jamb of door openings and head, jamb, and sill of other openings.
10. Miscellaneous Structural Members: Manufacturer's standard sections fabricated from cold-formed, structural-steel sheet; built-up steel plates; or zinc-coated (galvanized) steel sheet; designed to withstand required loads.

D. Canopy Framing: Manufacturer's standard structural-framing system, designed to withstand required loads; fabricated from shop-welded, built-up steel plates or structural-steel shapes. Provide frames with attachment plates and splice members, factory drilled for field-bolted assembly.

    1. Type: Straight-beam, eave type Purlin-extension type Tapered-beam, below-eave type as indicated.

E. Bracing: Provide adjustable wind bracing as follows:

    1. Rods: ASTM A 36/A 36M; ASTM A 572/A 572M, Grade 50; or ASTM A 529/A 529M, Grade 50; minimum 1/2-inch-diameter steel; threaded full length or threaded a minimum of 6 inches at each end.
    2. Cable: ASTM A 475, 1/4-inch-diameter, extra-high-strength grade, Class B, zinc-coated, seven-strand steel; with threaded end anchors.
    3. Angles: Fabricated from structural-steel shapes to match primary framing, of size required to withstand design loads.
    4. Rigid Portal Frames: Fabricated from shop-welded, built-up steel plates or structural-steel shapes to match primary framing; of size required to withstand design loads.
    5. Fixed-Base Columns: Fabricated from shop-welded, built-up steel plates or structural-steel shapes to match primary framing; of size required to withstand design loads.
    6. Diaphragm Action of Metal Panels: Design metal building to resist wind forces through diaphragm action of metal panels.
    7. Bracing: Provide wind bracing using any method specified above, at manufacturer's option.

F. Bolts: Provide plain-finish bolts for structural-framing components that are primed or finish painted. Provide hot-dip galvanized bolts for structural-framing components that are galvanized.

G. Materials:

    1. W-Shapes: ASTM A 992/A 992M; ASTM A 572/A 572M, Grade 50 or 55; or ASTM A 529/A 529M, Grade 50 or 55.

2. Channels, Angles, M-Shapes, and S-Shapes: ASTM A 36/A 36M; ASTM A 572/A 572M, Grade 50 or 55; or ASTM A 529/A 529M, Grade 50 or 55.
3. Plate and Bar: ASTM A 36/A 36M; ASTM A 572/A 572M, Grade 50 or 55; or ASTM A 529/A 529M, Grade 50 or 55.
4. Steel Pipe: ASTM A 53/A 53M, Type E or S, Grade B.
5. Cold-Formed Hollow Structural Sections: ASTM A 500, Grade B or C, structural tubing.
6. Structural-Steel Sheet: Hot-rolled, ASTM A 1011/A 1011M, Structural Steel (SS), Grades 30 through 55, or High-Strength Low-Alloy Steel (HSLAS), Grades 45 through 70; or cold-rolled, ASTM A 1008/A 1008M, Structural Steel (SS), Grades 25 through 80, or High-Strength Low-Alloy Steel (HSLAS), Grades 45 through 70.
7. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grades 33 through 80 or High-Strength Low-Alloy Steel (HSLAS), Grades 50 through 80; with G60 coating designation; mill phosphatized.
8. Metallic-Coated Steel Sheet Prepainted with Coil Coating: Steel sheet, metallic coated by the hot-dip process and prepainted by the coil-coating process to comply with ASTM A 755/A 755M.

    a. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grades 33 through 80 or High-Strength Low-Alloy Steel (HSLAS), Grades 50 through 80; with G90 coating designation.
    b. Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A 792/A 792M, Structural Steel (SS), Grade 50 or 80; with Class AZ50 coating.
9. Non-High-Strength Bolts, Nuts, and Washers: ASTM A 307, Grade A, carbon-steel, hex-head bolts; ASTM A 563 carbon-steel hex nuts; and ASTM F 844 plain (flat) steel washers.

    a. Finish: Plain.

10. High-Strength Bolts, Nuts, and Washers: ASTM A 325, Type 1, heavy-hex steel structural bolts; ASTM A 563 heavy-hex carbon-steel nuts; and ASTM F 436 hardened carbon-steel washers.

    a. Finish: Plain.

11. High-Strength Bolts, Nuts, and Washers: ASTM A 325, Type 1, heavy-hex steel structural bolts or tension-control, bolt-nut-washer assemblies with spline ends; ASTM A 563 heavy-hex carbon-steel nuts; and ASTM F 436 hardened carbon-steel washers, plain.
12. Tension-Control, High-Strength Bolt-Nut-Washer Assemblies: ASTM F 1852, Type 1, heavy-hex-head steel structural bolts with spline ends.

    a. Finish: Plain.

13. Unheaded Anchor Rods: ASTM F 1554, Grade 36 or ASTM A 572/A 572M, Grade 50.

    a. Configuration: Straight.
    b. Nuts: ASTM A 563hex carbon steel.
    c. Plate Washers: ASTM A 36/A 36M carbon steel.
    d. Washers: ASTM F 436 hardened carbon steel.
    e. Finish: Plain.

14. Headed Anchor Rods: ASTM F 1554, Grade 36.

    a. Configuration: Straight.
    b. Nuts: ASTM A 563hex carbon steel.
    c. Plate Washers: ASTM A 36/A 36M carbon steel.
    d. Washers: ASTM F 436 hardened carbon steel.

e. Finish: Plain.

15. Threaded Rods: ASTM A 193/A 193M, ASTM A 572/A 572M, Grade 50, ASTM A 36/A 36M.

a. Nuts: ASTM A 563hex carbon steel.
b. Washers: ASTM A 36/A 36M carbon steel.
c. Finish: Plain.

H. Finish: Factory primed. Apply specified primer immediately after cleaning and pretreating.

1. Apply primer to primary and secondary framing to a minimum dry film thickness of 1 mil.

a. Prime secondary framing formed from uncoated steel sheet to a minimum dry film thickness of 0.5 mil on each side.

2. Prime galvanized members with specified primer after phosphoric acid pretreatment.
3. Primer: SSPC-Paint 15, Type I, red oxide.

2.5 METAL ROOF PANELS

A. As indicated in drawings and specified in:
1. Section 07 41 00 – Insulated Metal Roof Panels
2. Section 07 41 13 – Non-Insulated Metal Roof Panels

2.6 FOAM-INSULATION-CORE METAL WALL PANELS

A. As indicated in drawings and specified in:
1. Section 07 42 13 – Insulated Metal Wall Panels

2.7 NON-INSULATED METAL WALL PANELS

A. As indicated in drawings and specified in:
1. Section 07 42 12 – Non-Insulated Metal Wall & Soffit Panels

2.8 METAL SOFFIT PANELS

A. As indicated in drawings and specified in:
1. Section 07 42 12 – Non-Insulated Metal Wall & Soffit Panels

2.9 THERMAL INSULATION

A. As indicated in drawings and specified in:
1. Section 07 21 00 – Building Insulation
2. Section 07 22 00 – Foam Board Insulation

2.10 DOORS AND FRAMES

A. As indicated in drawings and specified in:

1. Section 08 12 13 – Hollow Metal Doors and Frames
2. Section 08 12 50 – Interior Aluminum Frames

2.11 WINDOWS

A. As indicated in drawings and specified in:
   1. Section 08 36 10 - Aluminum-Framed Entrances and Storefronts

B. Glazing: As indicated in drawings and specified in Section 08 80 00 - Glazing

2.12 ACCESSORIES

A. General: Provide accessories as standard with metal building system manufacturer and as specified. Fabricate and finish accessories at the factory to greatest extent possible, by manufacturer's standard procedures and processes. Comply with indicated profiles and with dimensional and structural requirements.

   1. Form exposed sheet metal accessories that are without excessive oil-canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.

B. Roof Panel Accessories: Provide components required for a complete metal roof panel assembly including copings, fasciae, corner units, ridge closures, clips, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal roof panels unless otherwise indicated.

   1. Closures: Provide closures at eaves and ridges, fabricated of same material as metal roof panels.
   2. Clips: Manufacturer's standard, formed from steel sheet, designed to withstand negative-load requirements.
   3. Cleats: Manufacturer's standard, mechanically seamed cleats formed from steel sheet.
   4. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.
   5. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch-thick, flexible closure strips; cut or premolded to match metal roof panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.

C. Wall Panel Accessories: Provide components required for a complete metal wall panel assembly including copings, fasciae, mullions, sills, corner units, clips, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal wall panels unless otherwise indicated.

   1. Closures: Provide closures at eaves and rakes, fabricated of same material as metal wall panels.
   2. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.
   3. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch-thick, flexible closure strips; cut or premolded to match metal wall panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.

D. Flashing and Trim: Formed from 0.022-inch nominal-thickness, metallic-coated steel sheet or aluminum-zinc alloy-coated steel sheet prepainted with coil coating; finished to match adjacent metal panels.

1. Provide flashing and trim as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, eaves, rakes, corners, bases, framed openings, ridges, fasciae, and fillers.
2. Opening Trim: Formed from 0.022-inch nominal-thickness, metallic-coated steel sheet or aluminum-zinc alloy-coated steel sheet prepainted with coil coating to match building finish color. Trim head and jamb of door openings, and head, jamb, and sill of other openings.

E. Gutters: Formed from 0.022-inch nominal-thickness, metallic-coated steel sheet or aluminum-zinc alloy-coated steel sheet prepainted with coil coating; finished to match roof fascia and rake trim. Match profile of gable trim, complete with end pieces, outlet tubes, and other special pieces as required. Fabricate in minimum 96-inch-long sections, sized according to SMACNA's "Architectural Sheet Metal Manual."

1. Gutter Supports: Fabricated from same material and finish as gutters.
2. Strainers: Bronze, copper, or aluminum wire ball type at outlets.

F. Downspouts: Formed from 0.022-inch nominal-thickness, zinc-coated (galvanized) steel sheet or aluminum-zinc alloy-coated steel sheet prepainted with coil coating; finished to match metal wall panels. Fabricate in minimum 10-foot-long sections, complete with formed elbows and offsets.

1. Mounting Straps: Fabricated from same material and finish as gutters.

G. Roof Ventilators: Gravity type, complete with hardware, flashing, closures, and fittings.

1. Circular-Revolving Type: Minimum 20-inch diameter throat opening; fabricated from 0.028-inch nominal-thickness, metallic-coated steel sheet or aluminum-zinc alloy-coated steel sheet prepainted with coil coating; finished to match metal roof panels; with matching base and rain cap.

    a. Type: Directional revolving.
    b. Bird Screening: Galvanized steel, 1/2-inch-square mesh, 0.041-inch wire; or aluminum, 1/2-inch-square mesh, 0.063-inch wire.
    c. Dampers: Spring-loaded, butterfly type; pull-chain operation; with pull chain of length required to reach within 36 inches of floor.
    d. Reinforce and brace units, with joints properly formed and edges beaded to be watertight under normal positive-pressure conditions.
    e. Mount ventilators on square-to-round bases for ridge or on-slope mounting, designed to match roof pitch and roll formed to match metal roof panel profile.

2. Continuous or Sectional-Ridge Type: Factory-engineered and -fabricated, continuous unit; fabricated from 0.022-inch nominal-thickness, metallic-coated steel sheet or aluminum-zinc alloy-coated steel sheet prepainted with coil coating; finished to match metal roof panels. Fabricated in minimum 10-foot-long sections. Provide throat size and total length indicated, complete with side baffles, ventilator assembly, end caps, splice plates, and reinforcing diaphragms.

    a. Bird Screening: Galvanized steel, 1/2-inch-square mesh, 0.041-inch wire; or aluminum, 1/2-inch-square mesh, 0.063-inch wire.
    b. Dampers: Manually operated, spring-loaded, vertically rising type; chain and worm gear operator; with pull chain of length required to reach within 36 inches of floor.
    c. Throat Size: 12 inches

H. Louvers: Size and design indicated; self-framing and self-flashing. Fabricate welded frames from minimum 0.052-inch nominal-thickness, metallic-coated steel sheet; finished to match metal wall panels. Form blades from 0.040-inch nominal-thickness, metallic-coated steel sheet; folded or beaded at edges, set at an angle that excludes driving rains, and secured to frames by riveting or welding. Fabricate louvers with equal blade spacing to produce uniform appearance.

1. Blades: Fixed.
2. Blades: Adjustable type, with weather-stripped edges, and manually operated by hand crank or pull chain.
3. Free Area: Not less than 48-inch-wide by 48-inch-high louver.
4. Bird Screening: Galvanized steel, 1/2-inch-square mesh, 0.041-inch wire; with rewirable frames, removable and secured with clips; fabricated of same kind and form of metal and with same finish as louvers.

    a. Mounting: Exterior face of louvers.

5. Vertical Mullions: Provide mullions at spacings recommended by manufacturer, or 72 inches o.c., whichever is less.

I. Roof Curbs: Fabricated from minimum 0.052-inch nominal-thickness, metallic-coated steel sheet or aluminum-zinc alloy-coated steel sheet prepainted with coil coating; finished to match metal roof panels; with welded top box and bottom skirt, and integral full-length cricket; capable of withstanding loads of size and height indicated.

1. Curb Subframing: Fabricated from 0.064-inch nominal-thickness, angle-, C-, or Z-shaped metallic-coated steel sheet.
2. Insulation: 1-inch-thick, rigid type.

J. Service Walkways: Fabricated from 0.052-inch nominal-thickness, metallic-coated steel plank grating; with slip-resistant pattern; 36-inch overall width. Support walkways on framing system anchored to metal roof panels without penetrating panels; with predrilled holes and clamps or hooks for anchoring.

K. Pipe Flashing: Premolded, EPDM pipe collar with flexible aluminum ring bonded to base.

L. Materials:

1. Fasteners: Self-tapping screws, bolts, nuts, self-locking rivets and bolts, end-welded studs, and other suitable fasteners designed to withstand design loads. Provide fasteners with heads matching color of materials being fastened by means of plastic caps or factory-applied coating.
    a. Fasteners for Flashing and Trim: Blind fasteners or self-drilling screws with hex washer head.
    b. Blind Fasteners: High-strength aluminum or stainless-steel rivets.

2. Corrosion-Resistant Coating: Cold-applied asphalt mastic, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.
3. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.
4. Metal Panel Sealants:

a. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene-compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape of manufacturer's standard size.
b. Joint Sealant: ASTM C 920; one-part elastomeric polyurethane or polysulfide; of type, grade, class, and use classifications required to seal joints in metal panels and remain weathertight; and as recommended by metal building system manufacturer.

2.13 SOURCE QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to evaluate product.

B. Special Inspector: Owner will engage a qualified special inspector to perform the following tests and inspections and to submit reports. Special inspector will verify that manufacturer maintains detailed fabrication and quality-control procedures and will review the completeness and adequacy of those procedures to perform the Work.

1. Special inspections will not be required if fabrication is performed by manufacturer registered and approved by authorities having jurisdiction to perform such Work without special inspection.

a. After fabrication, submit copy of certificate of compliance to authorities having jurisdiction, certifying that Work was performed according to Contract requirements.

C. Testing: Test and inspect shop connections for metal buildings according to the following:

1. Bolted Connections: Shop-bolted connections shall be tested and inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
2. Welded Connections: In addition to visual inspection, shop-welded connections shall be tested and inspected according to AWS D1.1/D1.1M and the following inspection procedures, at inspector's option:

a. Liquid Penetrant Inspection: ASTM E 165.
b. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
c. Ultrasonic Inspection: ASTM E 164.
d. Radiographic Inspection: ASTM E 94.

D. Product will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

2.14 FABRICATION

A. General: Design components and field connections required for erection to permit easy assembly.

1. Mark each piece and part of the assembly to correspond with previously prepared erection drawings, diagrams, and instruction manuals.
2. Fabricate structural framing to produce clean, smooth cuts and bends. Punch holes of proper size, shape, and location. Members shall be free of cracks, tears, and ruptures.

B. Tolerances: Comply with MBMA's "Metal Building Systems Manual" for fabrication and erection tolerances.

C. Primary Framing: Shop fabricate framing components to indicated size and section, with baseplates, bearing plates, stiffeners, and other items required for erection welded into place. Cut, form, punch, drill, and weld framing for bolted field assembly.

1. Make shop connections by welding or by using high-strength bolts.
2. Join flanges to webs of built-up members by a continuous, submerged arc-welding process.
3. Brace compression flange of primary framing with steel angles or cold-formed structural tubing between frame web and purlin web or girt web, so flange compressive strength is within allowable limits for any combination of loadings.
4. Weld clips to frames for attaching secondary framing.
5. Shop Priming: Prepare surfaces for shop priming according to SSPC-SP 2. Shop prime primary framing with specified primer after fabrication.

D. Secondary Framing: Shop fabricate framing components to indicated size and section by roll-forming or break-forming, with baseplates, bearing plates, stiffeners, and other plates required for erection welded into place. Cut, form, punch, drill, and weld secondary framing for bolted field connections to primary framing.

1. Make shop connections by welding or by using non-high-strength bolts.
2. Shop Priming: Prepare uncoated surfaces for shop priming according to SSPC-SP 2. Shop prime uncoated secondary framing with specified primer after fabrication.

E. Metal Panels: Fabricate and finish metal panels at the factory to greatest extent possible, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements. Comply with indicated profiles and with dimensional and structural requirements.

1. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of metal panel.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with erector present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Before erection proceeds, survey elevations and locations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments to receive structural framing, with erector present, for compliance with requirements and metal building system manufacturer's tolerances.

1. Engage land surveyor to perform surveying.

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

3.2 PREPARATION

A. Clean and prepare surfaces to be painted according to manufacturer's written instructions for each particular substrate condition.

B. Provide temporary shores, guys, braces, and other supports during erection to keep structural framing secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural framing, connections, and bracing are in place unless otherwise indicated.

3.3 ERECTION OF STRUCTURAL FRAMING

A. Erect metal building system according to manufacturer's written erection instructions and erection drawings.

B. Do not field cut, drill, or alter structural members without written approval from metal building system manufacturer's professional engineer.

C. Set structural framing accurately in locations and to elevations indicated, according to AISC specifications referenced in this Section. Maintain structural stability of frame during erection.

D. Base and Bearing Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.

1. Set plates for structural members on wedges, shims, or setting nuts as required.
2. Tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
3. Promptly pack grout solidly between bearing surfaces and plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.

E. Align and adjust structural framing before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact with framing. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.

1. Level and plumb individual members of structure.
2. Make allowances for difference between temperature at time of erection and mean temperature when structure will be completed and in service.

F. Primary Framing and End Walls: Erect framing level, plumb, rigid, secure, and true to line.

1. Make field connections using high-strength bolts installed according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for bolt type and joint type specified.

    a. Joint Type: Snug tightened or pretensioned.

G. Secondary Framing: Erect framing level, plumb, rigid, secure, and true to line. Field bolt secondary framing to clips attached to primary framing.

1. Provide rake or gable purlins with tight-fitting closure channels and fasciae.
2. Locate and space wall girts to suit openings such as doors and windows.
3. Locate canopy framing as indicated.
4. Provide supplemental framing at entire perimeter of openings, including doors, windows, louvers, ventilators, and other penetrations of roof and walls

3.4 METAL PANEL INSTALLATION, GENERAL

A. Examination: Examine primary and secondary framing to verify that structural-panel support members and anchorages have been installed within alignment tolerances required by manufacturer.

1. Examine roughing-in for components and systems penetrating metal panels, to verify actual locations of penetrations relative to seams before metal panel installation.

B. General: Anchor metal panels and other components of the Work securely in place, with provisions for thermal and structural movement.

1. Field cut metal panels as required for doors, windows, and other openings. Cut openings as small as possible, neatly to size required, and without damage to adjacent metal panel finishes.

a. Field cutting of metal panels by torch is not permitted unless approved in writing by manufacturer.

2. Install metal panels perpendicular to structural supports unless otherwise indicated.
3. Flash and seal metal panels with weather closures at perimeter of openings and similar elements. Fasten with self-tapping screws.
4. Locate and space fastenings in uniform vertical and horizontal alignment.
5. Locate metal panel splices over, but not attached to, structural supports with end laps in alignment.
6. Lap metal flashing over metal panels to allow moisture to run over and off the material.

C. Lap-Seam Metal Panels: Install screw fasteners using power tools with controlled torque adjusted to compress EPDM washers tightly without damage to washers, screw threads, or metal panels. Install screws in predrilled holes.

1. Arrange and nest side-lap joints so prevailing winds blow over, not into, lapped joints. Lap ribbed or fluted sheets one full rib corrugation. Apply metal panels and associated items for neat and weathertight enclosure. Avoid "panel creep" or application not true to line.

D. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with corrosion-resistant coating, by applying rubberized-asphalt underlayment to each contact surface, or by other permanent separation as recommended by metal roof panel manufacturer.

E. Joint Sealers: Install gaskets, joint fillers, and sealants where indicated and where required for weatherproof performance of metal panel assemblies. Provide types of gaskets, fillers, and sealants indicated; or, if not indicated, provide types recommended by metal panel manufacturer.

1. Seal metal panel end laps with double beads of tape or sealant the full width of panel. Seal side joints where recommended by metal panel manufacturer.
2. Prepare joints and apply sealants to comply with requirements in Section 07 92 00 "Joint Sealants."

3.5 METAL ROOF PANEL INSTALLATION

A. General: Provide metal roof panels of full length from eave to ridge unless otherwise indicated or restricted by shipping limitations.

1. Install ridge caps as metal roof panel work proceeds.
2. Flash and seal metal roof panels with weather closures at eaves and rakes. Fasten with self-tapping screws.

B. Standing-Seam Metal Roof Panels: Fasten metal roof panels to supports with concealed clips at each standing-seam joint, at location and spacing and with fasteners recommended by manufacturer.

1. Install clips to supports with self-drilling or self-tapping fasteners.
2. Install pressure plates at locations indicated in manufacturer's written installation instructions.
3. Snap Joint: Nest standing seams and fasten together by interlocking and completely engaging factory-applied sealant.
4. Seamed Joint: Crimp standing seams with manufacturer-approved motorized seamer tool so that clip, metal roof panel, and factory-applied sealant are completely engaged.
5. Rigidly fasten eave end of metal roof panels and allow ridge end free movement due to thermal expansion and contraction. Predrill panels for fasteners.
6. Provide metal closures at peaks, rake edges, rake walls and each side of ridge and hip caps.

C. Lap-Seam Metal Roof Panels: Fasten metal roof panels to supports with exposed fasteners at each lapped joint, at location and spacing recommended by manufacturer.

1. Provide metal-backed sealing washers under heads of exposed fasteners bearing on weather side of metal roof panels.
2. Provide sealant tape at lapped joints of metal roof panels and between panels and protruding equipment, vents, and accessories.
3. Apply a continuous ribbon of sealant tape to weather-side surface of fastenings on end laps and on side laps of nesting-type metal panels, on side laps of ribbed or fluted metal panels, and elsewhere as needed to make metal panels weatherproof to driving rains.
4. At metal panel splices, nest panels with minimum 6-inch end lap, sealed with butyl-rubber sealant and fastened together by interlocking clamping plates.

D. Metal Fascia Panels: Align bottom of metal panels and fasten with blind rivets, bolts, or self-drilling or self-tapping screws. Flash and seal metal panels with weather closures where fasciae meet soffits, along lower panel edges, and at perimeter of all openings.

E. Metal Roof Panel Installation Tolerances: Shim and align metal roof panels within installed tolerance of 1/4 inch in 20 feet on slope and location lines as indicated and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

3.6 METAL WALL PANEL INSTALLATION

A. General: Install metal wall panels in orientation, sizes, and locations indicated on Drawings. Install panels perpendicular to girts, extending full height of building, unless otherwise indicated. Anchor metal wall panels and other components of the Work securely in place, with provisions for thermal and structural movement.

1. Unless otherwise indicated, begin metal panel installation at corners with center of rib lined up with line of framing.
2. Shim or otherwise plumb substrates receiving metal wall panels.
3. When two rows of metal panels are required, lap panels 4 inches minimum.
4. When building height requires two rows of metal panels at gable ends, align lap of gable panels over metal wall panels at eave height.

5. Rigidly fasten base end of metal wall panels and allow eave end free movement due to thermal expansion and contraction. Predrill panels.
6. Flash and seal metal wall panels with weather closures at eaves, rakes, and at perimeter of all openings. Fasten with self-tapping screws.
7. Install screw fasteners in predrilled holes.
8. Install flashing and trim as metal wall panel work proceeds.
9. Apply elastomeric sealant continuously between metal base channel (sill angle) and concrete, and elsewhere as indicated; or, if not indicated, as necessary for waterproofing.
10. Align bottom of metal wall panels and fasten with blind rivets, bolts, or self-drilling or self-tapping screws.
11. Provide weatherproof escutcheons for pipe and conduit penetrating exterior walls.

B. Metal Wall Panels: Install metal wall panels on exterior side of girts. Attach metal wall panels to supports with fasteners as recommended by manufacturer.

C. Insulated Metal Wall Panels: Install insulated metal wall panels on exterior side of girts. Attach panels to supports at each panel joint using concealed clip and fasteners at maximum 42 inches o.c., spaced not more than manufacturer's recommendation. Fully engage tongue and groove of adjacent insulated metal wall panels.

1. Install clips to supports with self-tapping fasteners.
2. Apply continuous ribbon of sealant to panel joint on concealed side of insulated metal wall panels as vapor seal; apply sealant to panel joint on exposed side of panels as weather seal.

D. Installation Tolerances: Shim and align metal wall panels within installed tolerance of 1/4 inch in 20 feet, nonaccumulative, on level, plumb, and on location lines as indicated, and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

3.7 TRANSLUCENT PANEL INSTALLATION

A. Translucent Panels: Attach translucent panels to structural framing with fasteners according to manufacturer's written instructions. Install panels perpendicular to supports unless otherwise indicated. Anchor translucent panels securely in place, with provisions for thermal and structural movement.

1. Provide end laps of not less than 6 inches and side laps of not less than 1-1/2-inch corrugations for metal roof panels.
2. Provide end laps of not less than 4 inches and side laps of not less than 1-1/2-inch corrugations for metal wall panels.
3. Align horizontal laps with adjacent metal panels.
4. Seal intermediate end laps and side laps of translucent panels with translucent mastic.

3.8 METAL SOFFIT PANEL INSTALLATION

A. Provide metal soffit panels the full width of soffits. Install panels perpendicular to support framing.

B. Flash and seal metal soffit panels with weather closures where panels meet walls and at perimeter of all openings.

3.9 THERMAL INSULATION INSTALLATION

A. General: Install insulation concurrently with metal panel installation, in thickness indicated to cover entire surface, according to manufacturer's written instructions.

1. Set vapor-retarder-faced units with vapor retarder toward warm side of construction unless otherwise indicated. Do not obstruct ventilation spaces except for firestopping.
2. Tape joints and ruptures in vapor retarder, and seal each continuous area of insulation to the surrounding construction to ensure airtight installation.
3. Install factory-laminated, vapor-retarder-faced blankets straight and true in one-piece lengths, with both sets of facing tabs sealed, to provide a complete vapor retarder.
4. Install blankets straight and true in one-piece lengths. Install vapor retarder over insulation, with both sets of facing tabs sealed, to provide a complete vapor retarder.
5. Install blankets to fill voids between conditioned and unconditioned spaces.

B. Blanket Roof Insulation: Comply with the following installation method:

1. Over-Framing Installation: Extend insulation and vapor retarder over and perpendicular to top flange of secondary framing. Hold in place by metal roof panels fastened to secondary framing.
2. Between-Purlin Installation: Extend insulation and vapor retarder between purlins. Carry vapor-retarder-facing tabs up and over purlin, overlapping adjoining facing of next insulation course and maintaining continuity of retarder. Hold in place with bands and crossbands below insulation.
3. Over-Purlin-with-Spacer-Block Installation: Extend insulation and vapor retarder over and perpendicular to top flange of secondary framing. Install layer of filler insulation over first layer to fill space formed by metal roof panel standoffs. Hold in place by panels fastened to standoffs.

    a. Thermal Spacer Blocks: Where metal roof panels attach directly to purlins, install thermal spacer blocks.

4. Two-Layers-between-Purlin-with-Spacer-Block Installation: Extend insulation and vapor retarder between purlins. Carry vapor-retarder-facing tabs up and over purlin, overlapping adjoining facing of next insulation course and maintaining continuity of retarder. Install layer of filler insulation over first layer to fill space between purlins formed by thermal spacer blocks. Hold in place with bands and crossbands below insulation.

    a. Thermal Spacer Blocks: Where metal roof panels attach directly to purlins, install thermal spacer blocks.

5. Retainer Strips: Install retainer strips at each longitudinal insulation joint, straight and taut, nesting with secondary framing to hold insulation in place.

C. Blanket Wall Insulation: Extend insulation and vapor retarder over and perpendicular to top flange of secondary framing. Hold in place by metal wall panels fastened to secondary framing.

1. Retainer Strips: Install retainer strips at each longitudinal insulation joint, straight and taut, nesting with secondary framing to hold insulation in place.
2. Sound-Absorption Insulation: Where sound-absorption requirement is indicated for metal liner panels, cover insulation with polyethylene film and provide inserts of wire mesh to form acoustical spacer grid.

D. Board Wall Insulation: Extend board insulation in thickness indicated to cover entire wall. Hold in place by metal wall panels fastened to secondary framing. Comply with manufacturers' written instructions.

1. Retainer Strips: Install retainer strips at each longitudinal insulation joint, straight and taut, nesting with secondary framing to hold insulation in place.

3.10 DOOR AND FRAME INSTALLATION

A. General: Install doors and frames plumb, rigid, properly aligned, and securely fastened in place according to manufacturers' written instructions. Coordinate installation with wall flashings and other components. Seal perimeter of each door frame with elastomeric sealant used for metal wall panels.

B. Personnel Doors and Frames: Install doors and frames according to SDI A250.8. Fit non-fire-rated doors accurately in their respective frames, with the following clearances:

1. Between Doors and Frames at Jambs and Head: 1/8 inch.
2. Between Edges of Pairs of Doors: 1/8 inch.
3. At Door Sills with Threshold: 3/8 inch.
4. At Door Sills without Threshold: 3/4 inch.
5. At fire-rated openings, install frames according to, and doors with clearances specified in, NFPA 80.

C. Sliding Service Doors: Bolt support angles to opening head members through factory-punched holes. Bolt door tracks to support angles at maximum 24 inches o.c. Set doors and operating equipment with necessary hardware, jamb and head mold stops, continuous hood flashing, anchors, inserts, hangers, and equipment supports.

D. Field Glazing: Comply with installation requirements in Section 08 80 00 "Glazing."

E. Retain paragraph below if hardware is not specified.

F. Door Hardware: Mount units at heights indicated in DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."

1. Install surface-mounted items after finishes have been completed on substrates involved.
2. Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.
3. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.
4. Set thresholds for exterior doors in full bed of butyl-rubber sealant complying with requirements specified in Section 07 92 00 "Joint Sealants."

3.11 WINDOW INSTALLATION

A. General: Install windows plumb, rigid, properly aligned, without warp or rack of frames or sash, and securely fasten in place according to manufacturer's written instructions. Coordinate installation with wall flashings and other components. Seal perimeter of each window frame with elastomeric sealant used for metal wall panels.

1. Separate dissimilar materials from sources of corrosion or electrolytic action at points of contact with other materials by complying with requirements specified in AAMA/WDMA/CSA 101/I.S.2/A440.

B. Set sill members in bed of sealant or with gaskets, as indicated, for weathertight construction.

C. Install windows and components to drain condensation, water penetrating joints, and moisture migrating within windows to the exterior.

D. Mount screens directly to frames with tapped screw clips.

E. Field Glazing: Comply with installation requirements in Section 08 80 00 "Glazing."

3.12 ACCESSORY INSTALLATION

A. General: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.

1. Install components required for a complete metal roof panel assembly, including trim, copings, ridge closures, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.
2. Install components for a complete metal wall panel assembly, including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.
3. Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with corrosion-resistant coating, by applying rubberized-asphalt underlayment to each contact surface, or by other permanent separation as recommended by manufacturer.

B. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.

1. Install exposed flashing and trim that is without excessive oil-canning, buckling, and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof and weather-resistant performance.
2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped or bayonet-type expansion provisions cannot be used or would not be sufficiently weather resistant and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).

C. Gutters: Join sections with riveted-and-soldered or lapped-and-sealed joints. Attach gutters to eave with gutter hangers spaced as required for gutter size, but not more than 36 inches o.c. using manufacturer's standard fasteners. Provide end closures and seal watertight with sealant. Provide for thermal expansion.

D. Downspouts: Join sections with 1-1/2-inch telescoping joints. Provide fasteners designed to hold downspouts securely 1 inch away from walls; locate fasteners at top and bottom and at approximately 60 inches o.c. in between.

1. Provide elbows at base of downspouts to direct water away from building.

2. Tie downspouts to underground drainage system indicated.

E. Circular Roof Ventilators: Set ventilators complete with necessary hardware, anchors, dampers, weather guards, rain caps, and equipment supports. Mount ventilators on flat level base. Install preformed filler strips at base to seal ventilator to metal roof panels.

F. Continuous Roof Ventilators: Set ventilators complete with necessary hardware, anchors, dampers, weather guards, rain caps, and equipment supports. Join sections with splice plates and end-cap skirt assemblies where required to achieve indicated length. Install preformed filler strips at base to seal ventilator to metal roof panels.

G. Louvers: Locate and place louver units level, plumb, and at indicated alignment with adjacent work.

1. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weathertight connection.
2. Provide perimeter reveals and openings of uniform width for sealants and joint fillers.
3. Protect galvanized- and nonferrous-metal surfaces from corrosion or galvanic action by applying a heavy coating of corrosion-resistant paint on surfaces that will be in contact with concrete, masonry, or dissimilar metals.
4. Install concealed gaskets, flashings, joint fillers, and insulation as louver installation progresses, where weathertight louver joints are required. Comply with Section 07 92 00 "Joint Sealants" for sealants applied during louver installation.

H. Roof Curbs: Install curbs at locations indicated on Drawings. Install watertight flashing around bases where they meet metal roof panels.

I. Pipe Flashing: Form watertight flashing around pipe penetration and metal roof panels. Fasten and seal to panel as recommended by manufacturer.

3.13 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:

1. Inspection of fabricators.
2. Steel construction.

B. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

C. Tests and Inspections:

1. High-Strength, Field-Bolted Connections: Connections shall be tested and inspected during installation according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
2. Welded Connections: In addition to visual inspection, field-welded connections shall be tested and inspected according to AWS D1.1/D1.1M and the following inspection procedures, at inspector's option:

a. Liquid Penetrant Inspection: ASTM E 165.
b. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
c. Ultrasonic Inspection: ASTM E 164.
d. Radiographic Inspection: ASTM E 94.

D. Product will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

3.14 ADJUSTING

A. Doors: After completing installation, test and adjust doors to operate easily, free of warp, twist, or distortion.

B. Door Hardware: Adjust and check each operating item of door hardware and each door to ensure proper operation and function of every unit. Replace units that cannot be adjusted to operate as intended.

C. Windows: Adjust operating sashes and ventilators, screens, hardware, and accessories for a tight fit at contact points and at weather stripping to ensure smooth operation and weathertight closure. Lubricate hardware and moving parts.

D. Roof Ventilators and Adjustable Louvers: After completing installation, including work by other trades, lubricate, test, and adjust units to operate easily and be free of warp, twist, or distortion as needed to provide fully functioning units.

1. Adjust louver blades to be weathertight when in closed position.

3.15 CLEANING AND PROTECTION

A. Repair damaged galvanized coatings on galvanized items with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

B. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.

C. Touchup Painting: After erection, promptly clean, prepare, and prime or reprime field connections, rust spots, and abraded surfaces of prime-painted structural framing, bearing plates, and accessories.

1. Clean and prepare surfaces by SSPC-SP 2, "Hand Tool Cleaning," or by SSPC-SP 3, "Power Tool Cleaning."
2. Apply a compatible primer of same type as shop primer used on adjacent surfaces.

D. Touchup Painting: Cleaning and touchup painting are specified in Section 09 91 13 "Exterior Painting" and Section 09 91 23 "Interior Painting."

E. Metal Panels: Remove temporary protective coverings and strippable films, if any, as metal panels are installed. On completion of metal panel installation, clean finished surfaces as recommended by metal panel manufacturer. Maintain in a clean condition during construction.

1. Replace metal panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

F. Doors and Frames: Immediately after installation, sand rusted or damaged areas of prime coat until smooth and apply touchup of compatible air-drying primer.

1. Immediately before final inspection, remove protective wrappings from doors and frames.

G. Windows: Clean metal surfaces immediately after installing windows. Avoid damaging protective coatings and finishes. Remove excess sealants, glazing materials, dirt, and other substances. Clean factory-glazed glass immediately after installing windows.

H. Louvers: Clean exposed surfaces that are not protected by temporary covering, to remove fingerprints and soil during construction period. Do not let soil accumulate until final cleaning.

1. Restore louvers damaged during installation and construction period so no evidence remains of corrective work. If results of restoration are unsuccessful, as determined by Architect, remove damaged units and replace with new units.

a. Touch up minor abrasions in finishes with air-dried coating that matches color and gloss of, and is compatible with, factory-applied finish coating.

END OF SECTION

SECTION 14 45 00 - VEHICLE LIFTS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
1. This Section specifies furnishing, installing and testing a two-post automotive frame lift. Provide necessary labor, services, and incidental required for complete equipment installations.

B. Related Sections:
1. Division 3 - Concrete.
2. Section 09 90 00 – Painting and Coatings
3. Section 11 00 50 – Basic Equipment Materials and Methods.
4. Division 23 - Mechanical.
5. Division 26 - Electrical.

1.02 REFERENCES

A. Automotive Lift Institute (ALI).
1. ALI ALCTV, Standard for Automotive Lifts - Safety Requirements for Construction, Testing and Validation.

B. National Electrical Manufacturers Association (NEMA).

C. Underwriter Laboratories, Inc. (UL).

D. National Electrical Code (NEC).

E. Institute for Electrical and Electronics Engineers, Inc. (IEEE).

F. American National Standards Institute (ANSI).

G. American Bearing Manufacturers Association (ABMA).

1.03 QUALITY ASSURANCE/QUALITY CONTROL

A. The manufacturer shall guarantee the lifts' compliance with all applicable provisions set forth by ALI ALCTV “Standard for Automotive Lifts – Safety Requirements for Construction, Testing and Validation“.

B. The manufacturer shall certify that the vehicle lift installer has satisfactory past experience in the installation of equipment of the type specified herein. Manufacturer's certification shall include the following items:
1. A letter certifying that the proposed vehicle lift installer has submitted satisfactory evidence that the installing firm has had successful past experience in the installation of similar equipment in the past 2 years.
2. Provide a list of a minimum of three locations where similar equipment installed by the proposed vehicle lift installer is in service, including the duration of service.
3. Provide the name of a person contacted by the manufacturer at each installation location referred to above, who is familiar with the operation and maintenance of the vehicle lift equipment. Include a brief synopsis of conversation regarding lift operation and maintenance.

C. Construction Conditions and Coordination:
   1. Before submitting bid, review the Contract Documents and become thoroughly familiar with the conditions affecting the work. Contractor and his supplier and installer shall coordinate the shop drawing requirements with the County of Nevada Representative prior to shop drawing submittal and installation to assure that the vehicle fleet requirements are addressed. Wheel base range shall be verified and coordinated with the user and the Engineer prior to ordering vertical rise lift. No additional compensation will be granted due to extra work made necessary by his failure to investigate such conditions.
   2. Prior to initiating work specified in this Section examine all work prepared by other trades to receive the work of this Section and report any defect affecting installation to the County of Nevada Representative for correction. Commencement of work will be construed as complete acceptance of preparatory work by other trades. All concrete work will be coordinated with approved shop drawings dimensions and embeds. Coordinate with Manufacturer's approved shop drawings for minimal concrete thickness for the lift loadings.
   3. Plan installation of new work and connections to any existing work if applicable to insure minimum interference with other Work of the Contract.
   4. The Work shall be carried out in accordance with actual field requirements and approved shop drawings and shall not depend on the extent of details shown on plans.
   5. Verify the critical building dimensions associated with the equipment prior to final fabrication and installation of the equipment.
   6. Coordinate the fabrication and installation of the equipment with the other Work of the Contract and schedule so that there will be no delay in the proper installation and completion of any part or part of each respective work task wherein it may be interrelated with that of this Contract so that generally all construction work can proceed in its natural sequence without unnecessary delay.
   7. Examine all Contract Drawings relating to this Project, and verify all governing conditions at the site and become fully informed as to the extent and character of the work required and its relation to other work in this Project. No consideration will be granted for any alleged misunderstanding of the materials to be furnished for work to be done.

1.04 SUBMITTALS

A. Submit shop drawings, catalog cuts and all manufacturer's data covering all equipment covered in this section. If submitting catalog cuts, assure that the models specified or submitted are highlighted or underlined. No generic information will be accepted. Submit the following for review and approval:
   1. Shop drawings.
   2. Product data.
   3. Installation Instructions.
   4. Operations and maintenance manuals.

B. Shop Drawings: Shop drawings shall consist of the following as applicable:
   1. Layout drawings showing equipment layout, elevations, conduit runs, utility layout and hook-ups, and all required dimensions. <u>These drawings must be specific to the project</u> and not generic drawings and must show detailed dimensions for the Contractor to follow.
   2. Detail drawings.
   3. Foundation and structural support drawings including pit details, embeds, anchor bolt plan, conduit and sleeve requirements and elevation.
   4. Utility connection plan.
   5. Electrical control diagram.

6. Electrical equipment layout, with all motors, limit switches, solenoid valves, disconnects, control panels, etc. located and labeled.
7. Piping systems including pipe routing, sizing, valving, etc. fully noted and scheduled.

C. Product Data: Manufacturer's literature including catalog cuts, pamphlets, descriptive literature, equipment specifications, performance and test data, and brochures which adequately describe the piece of equipment or product. Provide sufficient product and preventive maintenance information to properly address each equipment item and all major components installed to the maximum extent possible during the equipment submittal and approval phase of the project.

D. Installation Instructions: Manufacturer's recommended installation instructions and manufacturer's installation drawings specific to the project and not generic information.

E. Operations and Maintenance Data:
1. In accordance with Division 1 and Section 11 00 50.

1.05 TRAINING PROGRAM
1. In accordance with Division 1 and Section 11 00 50.

1.06 GENERAL DESIGN AND FABRICATION REQUIREMENTS

A. Equipment shall be designed, fabricated, installed and adjusted to secure the best commercially available results with respect to smooth, quiet, convenient and efficient operation, durability, economy of maintenance and operation, and the highest standards of safety.

B. It is not the intent of these Specifications to detail the design and fabrication of the various parts of the equipment, but is expected that the type, material, design, workmanship and fabrication of each part shall be fully adequate for the service required, durable, properly coordinated with all other parts, in accordance with the best commercial standards and of the highest commercial efficiency. The components of electric circuits shall be of ample and proper size, design and material to avoid injurious heating and arcing, and all other objectionable effects which may reduce the efficiency of operation and economy of maintenance and upkeep below the best commercially available results. Minimum requirements are given herein for the certain parts of equipment. Equivalent requirements approved by the County of Nevada Representative shall apply to such parts as are of special design, construction or material and to which the specified requirements are not directly applicable. These minimum requirements as a whole shall also be considered as establishing proportionate general minimum standards for all parts of the equipment.

C. The County of Nevada Representative may permit variations from the requirements of these Specifications to permit the use of the manufacturer' standard equipment, provided that in his opinion such standard equipment is in every way adequate for the intended use and meets the full intent of these Specifications. All proposed variations shall be called to the attention of the County of Nevada Representative in writing and shall be made only if approved in writing.

D. Certain design limitations and tests are herein specified as a partial check on the adequacy of design, fabrication, and materials. These requirements do not cover all features necessary to insure satisfactory and approved operation of the equipment. Conformity with these requirements shall, in no way, supersede the general requirements as to satisfactory and efficient operation of the equipment.

1.07 SHOP PAINTING

A. Equipment shall be given one shop prime coat of approved rust-inhibitive paint containing at least 50 percent rust-inhibitive pigments and manufacturer's standard finish coat system. Shop drawings shall indicate brand and type of paints. Coordinate with requirements as set forth on Section 09 90 00 – Painting and Coatings.

1.08 ELECTRICAL REQUIREMENTS

A. Power supply for equipment shall be 480 volts, 3-phase, 60 hertz unless otherwise specified.

B. Provide transformers for equipment as required to step down the specified supply voltage to provide lower voltage for controls and accessories and to provide voltage compatible with equipment as required.

C. Wiring shall be provided for complete installation of all equipment and accessories and shall be adequate for proper operation of equipment. Provide a disconnect switch for each equipment item requiring electric power; disconnect switch shall meet requirements of the respective equipment item manufacturer. Permanently label each disconnect switch to identify corresponding equipment item; labeling method shall be subject to approval of the County of Nevada Representative. Power wiring to line side of disconnect switch will be provided through work outside this contract. Contractor/supplier shall make connection to secondary side of disconnect switch and provide all wiring and conduit from this point, including wiring to controllers and starters. Provide 480-volt equipment with electric fusible disconnecting means, sized and fused as required for each equipment item. All disconnect switches shall be fused with 200,000-amp limiter fuses. Provide 120-volt equipment with electric thermal overload disconnect means sized as required for each equipment item. Wire and cable for light, power and signal circuits shall conform to those specified in the NEC. In no case shall maximum current carried exceed that specified by National Electrical Code for type of conductor used. Provide conduit where required; all wiring and conduit shall be in accordance with the requirements of NEC. Wiring and conduit for power shall be provided to all equipment from power connection sources within the building. See building drawings for power connection sources provided.

D. Motors:
1. Motors shall be high efficiency motors each bearing the UL label and constructed to standard of NEMA, IEEE, ANSI, and ABMA.
2. Motors shall be suitable for operation on the electrical service indicated.
3. There shall be no open motors provided. Motors shall be totally enclosed or drip-proof.
4. Provide motors with epoxy encapsulated insulation for severe usage in a corrosive atmosphere.
5. Motors rated one horsepower or greater shall have a full-load power factor of 85 percent or higher. Motors rated 25 horsepower and over shall be designed for reduced voltage starting. All motors shall be of the highest energy efficiency design available for the application.
6. 60 hertz unless otherwise specified.

E. Provide transformers for equipment as required to step down the specified supply voltage to provide lower voltage for controls and accessories and to provide voltage compatible with equipment as required.
1. Electrical enclosures to be NEMA 12 for indoor units and NEMA 4 for outdoor units unless otherwise noted on the Contract Drawings.
2. Starters shall be complete with two sets of auxiliary contacts; one set normally open; one set normally closed.

3. For motors 25 HP or greater, provide solid state type reduced voltage starters.

F. Control devices necessary for proper operation shall be provided and shall be located to permit efficient operation of the equipment, and where possible shall be grouped in a factory-fabricated approved control panel.

G. Switches, lights and control functions shall be identified with legend plates. The plates shall be constructed of polyvinylchloride material of laminated multiple constructions, and rout engraved with appropriate legends. The size of letters, colors and legend shall be submitted for approval. The legend plates shall be mounted on the equipment in an approved manner. No decals will be accepted.

1.09 GASKETS AND FASTENERS

A. Provide new gaskets wherever gasketed mating equipment items or pipe connections have been dismantled. Gaskets shall be in accordance with manufacturer's recommendations.

B. Replace all assembly bolts, studs, nuts and fasteners of any kind which are bent, flattened, corroded, or have their threads, heads or slots damaged.

C. Furnish all bolts, studs, nuts and other fasteners for make-up of all connections to equipment and replace any of these items damaged in storage, shipment or moving.

1.10 EQUIPMENT

A. Equipment, machinery and materials shall be as specified in this section.

B. Equipment shall be factory-finished with manufacturer's standard primer and finish coats of paint.

C. All piping, valves, fittings, conduits and wiring required for the equipment installation shall be in accordance with the applicable portions of the overall construction contract, except where specified by the Equipment Specification. Coordinate with approved shop drawings for locations of any under slab conduits and sleeves required for the proper installation of the lift systems.

1.11 HOLES, OPENINGS AND INSERTS

A. Provide holes and openings in floors, walls, ceilings and roofs as required.

B. Core drill holes in existing concrete and masonry work using dustless method. Install concrete inserts and flashings as required. Grout in holes in walls, floor and roof slabs after installation of equipment, and leave them in a completely neat and sealed condition.

C. General Contractor to coordinate with Manufacturer’s approved Shop Drawings for final locations for all the under-slab conduit and pipe sleeves between the Control Console and the lift pits for a proper flush mount installation. Contractor is responsible for providing all the required under slab piping and conduit as part of the contract document requirements.

D. Repair holes in non-masonry surfaces to match existing materials. Seal with appropriate matching materials.

E. Touch-up paints and coatings to match existing adjacent surfaces.

1.12 SETTING AND ALIGNING EQUIPMENT

A. Equipment shall be set and aligned in accordance with manufacturer's recommendations, approved shop drawings and applicable standards of trade practice.

B. Equipment shall be set true and level. Demonstrate adequate leveling of installed equipment and flush with the finished floor. Any trip hazard due to unleveled installation shall be corrected by the Contractor at their own expense.

C. Re-tighten bolted connections after installation.

1.13 CLEANING AND PROTECTION

A. Clean fabricated assemblies and equipment items thoroughly before and after operating and testing.

B. Protect equipment from damage, deterioration, paint or coating spills or spots, corrosion, or harm from any source.

C. Clean depressed slab for flush mount install thoroughly prior to installation of lift platforms.

1.14 CONCRETE FOUNDATIONS

A. Provide concrete foundations for equipment as indicated on the Contract Documents and approved Shop Drawings. All dimensions pertaining to the forming and fabrication of the pit and pit components shall be per approved shop drawings.

B. Concrete and reinforcement shall conform to manufacturer’s suggested installation or all required governing codes.

C. Provide anchor bolts as required for equipment to be mounted. Follow installation requirements as listed in the manufacturers approved shop drawings.

D. Provide grouting as necessary to stabilize equipment bases to concrete foundations.

1.15 MOTORS AND DRIVES

A. Motors and drives shall be checked carefully for correct rotation and alignment before placing equipment into operation.

B. Couplings shall be disconnected and realigned before placing into service or testing.

C. Belt drives shall be adjusted and worn belts replaced in sets. Speed adjustment shall be subject to approval of the County of Nevada Representative.

1.16 INSPECTION

A. Work will be inspected by the County of Nevada Representative periodically during the course of construction.

B. Provide for inspections by all other trades having jurisdiction over the work performed during the progress of the work.

C. At time of final inspection, furnish certificates of final approval by all those having jurisdiction as applicable.

1.17 FIELD PAINTING

A. Field painting equipment, including touch-up painting, if any, is included under this Section of Specifications. Normally, equipment shall be factory-finished as previously specified. Refer to Section 09 90 00 – Painting and Coatings.

B. Where factory finishes are provided on equipment and no additional field painting is specified, all marred or damaged surfaces shall be touched up or refinished so as to leave a smooth, uniform finish matching the factory finish.

1.18 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle products without damaging them.
1. Receive, unload, check, protect, and store equipment in facilities suitable to keep it clean, dry, and free from damage, vandalism, and pilferage.
2. Pay demurrage charges and claims for damage resulting from unloading operations.
3. Examine equipment for visible and concealed damage. Report any damage to carrier, supplier, and the County of Nevada Representative as soon as possible.

B. Protect equipment from loss, deterioration, and damage until work is complete.
1. Protect installed equipment prior to start-up and Final Acceptance.
2. Protect exposed finished surfaces with removable coating or film, cover openings to exclude dirt and fouling materials, and protect unfinished surfaces against rust, corrosion, and other damage.
3. Protect equipment from paint or coating spills and spots.

1.19 WARRANTY

A. Manufacturer shall warrant all equipment including parts and labor for a period of two (2) years from date of acceptance as stipulated in Section 01 40 00.

B. Contractor shall provide written documentation from the manufacturer that warranty service will be available at the delivery location(s) by a dealership franchised by the manufacturer. Service shall be provided within 24 hours after notification from the County of Nevada Representative.

C. Parts shall be available from a dealership franchised by the manufacturer. The dealership shall normally stock all consumables and parts that could reasonably be expected to fail during normal use of the lift.

PART 2 - PRODUCTS

2.01 TWO POST LIFT - 10,000 LBS.

A. Equipment Item Number LD-1B.

B. Acceptable manufacturers:
1. Products of the following manufacturer are the standard of quality for the platform vehicle lifts:
a. Manufacturer: Forward Lift, a subsidiary of Rotary Lift
Distributor: Air and Lube Systems, Inc.
Jon Bonawitz
8530 Fruitridge Road
Sacramento, CA 95826

(916) 257-1708

2. Products of equal quality of the following manufacturer will be accepted as approved equal.
   a. Manufacturer: Mohawk Lifts
      Steven Perlstein
      P.O. Box 110
      Amsterdam, NY 12010
      Telephone: (518) 842-1431 Ext. #24
   b. Approved Equal

C. Description:
1. The automotive two post vehicle lifts shall be a heavy-duty floor mounted lift, electric type lift.
2. The lift will serve the automotive bays for the County of Nevada Fleet Services fleet.

D. Design Features

1. 10,000 lbs. capacity
2. Heavy duty hydraulic cylinders in each column full stroke with concealed cylinder rod inside carriage.
3. Overhead cable equalization.
4. Single point lock release.
5. Adapters: Models #T110564, #FJ6219, and adapter extensions #FJ880BK
6. Adapter Height: 4-5/8 inches to 7-5/8 inches. From finished floor to clear small sedans. Coordinate with County of Nevada for the lowest clearance required for the lowest light duty vehicle fleet.
7. Stackable Adapters: Provide as part of unit to raise the height as required for variety of vehicles.
8. Spring operated arm restrain, disengaging at floor level.
9. Padded overhead height limit switch bar.
10. Durable powder coat finish.
11. Provide adapter storage rack kit for all lifts Model #FJ6100BK.
12. Provide special truck adapters to satisfy all light truck vehicles being served on automotive bays to include larger crew trucks. Confirm with Nevada County on largest vehicle to be serviced.
13. Air/electric work station with air regulator and oiler Model #FA5911BK.

E. Construction Features:
1. Total Capacity of lift: 10,000 lbs.
2. Rise: 72 5/8”.
3. Minimal Lifting height: 5-3/8”.
4. Drive through: 102 ½”.
5. Overall height: 11 feet 8 ½”.
6. Cylinder height at full rise: 11’ 10 ¾”
7. Clearance at overhead shut-off switch height: 11 feet 2 ¾”.
8. Overall floor width: 11 feet 5 ½ “.
9. Width inside columns: 114 ½”.
10. Rise speed: 45 seconds to full height.
11. Reach (Front Arm Min.): 27 ½”
12. Reach (Front Arm Max.): 59”
13. Reach (Rear Arm Min.): 27 ½”
14. Reach (Rear Arm Max.): 59”
15. Maximum load per arm: 2,500 lbs.
16. ALI Certified.

F. Utilities
   1. Electrical: 230/1PH/60Hz – 2 HP motor, 16 Amps.

G. For relocated two-post 10,000 lbs. (EQ # LD-1A) and 15,000 lbs. (EQ # LD-2). capacity lifts, follow the manufacturer's recommended installation procedures for proper functions.

H. Two Post Lift - 10,000 lbs. shall be Model No. SP010-TA as manufactured by Rotary Lift with the above minimum requirements.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.

C. Test soil to determine corrosive characteristics. Provide necessary features to protect in-ground equipment with a cathodic protection system if needed.

3.02 INSTALLATION

A. Install vehicle lifts in strict accordance with the approved shop drawings and manufacturer's installation instructions. All concrete and utilities shall be coordinated by the Contractor and Manufacturer's representative prior to concrete work and installation.

B. Electrical Interface:
   1. Electric services for equipment are specified as work of Division 26 – Electrical, and are terminated near the piece of equipment in a shut-off means. As part of the work of this Contract, extend these services to the equipment and make the associated connections as recommended by the equipment manufacturer.

C. Mechanical Interface:
   1. Piped services for equipment are specified as work of Division 23 – Mechanical, and are terminated near the piece of equipment in a shut-off means. As part of the work of this Contract, extend these piped services to the equipment and make the associated connections.
   2. Provide hoses, fittings, valves, connections, pipe, conduit etc. of a type and size as recommended by the equipment manufacturer that will properly interface with the piped services provided under Division 23 - Mechanical.

D. Structural Interface:
   1. All dimensions and details for the lifts shown on the structural drawings and the equipment drawings are for reference only. Final dimensions and location shall be coordinated with the manufacturer's approved shop drawings for final requirements. Equipment shall not be purchased or delivered to the site until shop drawings have been approved.

E. Proceed with start-up, testing and instructions.

F. The following utilities will be provided as work of other sections:
   1. 230 VAC service
   2. Compressed Air, 120 psig maximum with filter, lubricator and regulator.

3. Contractor shall be responsible for all utilities required for the proper installation of the lift systems.

G. Contractor shall be responsible for coordinating with the manufacturer regarding the scheduling, delivery and preparations necessary to install the specified equipment.

H. Contractor shall coordinate with the manufacturer to ensure floor slabs and recesses are adequate to mount and support equipment.

I. No preparation work will be allowed by the Contractor until manufacturer's shop drawings have been approved for the proper equipment. Contractor shall verify all dimensions and requirements with manufacturer's shop drawings prior to beginning any concrete work.

3.03 FIELD QUALITY CONTROL

A. Provide the services of a qualified manufacturer's representative to perform the following:
1. Supervise preparatory work performed by other trades.
2. Supervise installation.
3. Prior to substantial completion of the facility, supervise testing, by the Contractor in the presence of the County of Nevada Representative to ensure proper operation of the equipment.

3.04 TRAINING

A. The contractor shall provide training in accordance with the requirements of Division 1 and Section 11 00 50 and this section.

B. Operations and Maintenance Manuals shall be approved and accepted prior to the training and will be provided as required for reference materials during class presentations.

END OF SECTION

SECTION 14 91 00 – 2T MONORAIL HOIST AND TROLLEY

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
1. Furnishing an Underhung Monorail systems complete with electrification, track, hoist, trolley and components, at the locations shown on the Drawings. Include all wiring, conduit, piping, switching and controls required to connect the equipment to the building utilities, and to interconnect the various system components as part of the work of this section.

B. Related Sections:
1. Division 1 – General Requirements
2. Section 11 00 50 - Basic Equipment Materials and Methods.
3. Division 5 - Metals
4. Division 26 - Electrical

1.02 REFERENCES

A. American National Standards Institute (ANSI).
1. ANSI/ASTM B30.17-2006 Specifications for overhead crane systems.
2. ANSI B30.10, Hooks
3. ANSI B30.16, Overhead Hoists.

B. American Welding Society (AWS).
1. AWS D14.1, Specifications for Welding Industrial and Mill Cranes.

C. Hoist Manufacturer's Institute (HMI).
1. HMI 100, Standard Specifications for Electric Wire Rope Hoists.

D. Occupational Safety and Health Administration (OSHA):
1. 29 CFR 1910 Subpart 179 Overhead and Gantry Cranes.

1.03 SUBMITTALS

A. Pursuant to the provisions of the General Provisions, Division 1 – General Requirements, and Section 110050, Basic Equipment Materials and Methods, the contractor shall submit:
1. Material and Equipment List;
2. Product Data including catalog cuts;
3. Shop Drawings;
4. Training Program and Operations and Maintenance Manuals;
5. Spares/Maintenance Materials;
6. Certificates specified in Article 1.06;
7. Results of tests specified in Article 3.03;

1.04 QUALITY ASSURANCE

A. Qualifications:
1. Submit load test certificate for each electric wire rope hoist, which indicates actual breaking strength of the wire rope on the manufacturer's minimum wire rope breaking strength.

1.05 VERIFICATION OF DIMENSIONS

A. Contractor is responsible for coordination and proper relation of all work to the building structure and to the work of all trades. The Contractor shall verify all dimensions of the building that relate to fabrication of the underhung overhead crane and notify the Nevada County Representative of any discrepancy.

1.06 CERTIFICATIONS

A. Submit load test certificate for each electric wire rope hoist, which indicates actual breaking strength of the wire rope or the manufacturer's minimum wire rope breaking strength.

B. Crane Hook Certification: Provide a certification in writing of satisfactory nondestructive test hook (including hook, hook shank, and retaining nut), and certifications that hook has satisfactorily completed proof test in accordance with ANSI B30.10.

1.07 WARRANTY

A. Manufacturer shall warrant all equipment including parts and labor for a period of two (2) years from date of acceptance as stipulated in Section 1 40 00.

B. Contractor shall provide written documentation from the manufacturer that warranty service will be available at the delivery location(s) by a dealership franchised by the manufacturer. Service shall be provided within 24 hours after notification from the Nevada County Representative.

C. Parts shall be available from a dealership franchised by the manufacturer. The dealership shall normally stock all consumables and parts that could reasonably be expected to fail during normal use of the overhead crane.

PART 2 PRODUCTS

2.01 2 TON MONORAIL HOIST AND TROLLEY

A. Equipment Item No. SD-1

B. Acceptable Manufacturers:
   1. Products of the following manufacturers are specified herein as the standard of quality for the 2 Ton underhung monorail hoist and trolley.
      a. Coffing Hoists
         P.O. Box 779
         Wadesboro, NC 28170
         Telephone: (800) 477-5003

   2. Products of equal quality and utility will be accepted:
      a. Approved Equal

C. Monorail Hoist System Design Criteria:
   1. Underhung, monorail hoist
   2. Capacity: 2 Ton capacity
   3. Motorized Hoist Trolley.
   4. 2 Ton Electric two speed Hoist.
   5. Trolley and Hoist pendant control.

6. Monorail Beam: Refer for requirements as set forth in the manufacturer approved shop drawings and structural contract drawings.
   a. Recommended minimal flange width range: 3 to 8 inches
   b. Recommended minimal beam height: 6 to 18 inches
7. Manufacturer to provide hoist stops on both ends of the monorail to secure limits of service for the hoist. Hoist stops shall meet all requirements as stipulated under ANSI/ASTM B30.17-2006 Specifications for underhung crane systems and other agencies having jurisdiction.

D. Monorail Beam:
   1. Monorail beam by project Structural discipline per Hoist and Trolley Manufacturer's recommendations.
   2. Monorail supports by project Structural discipline.

E. Special Feature requirements:
   1. Monorail length of travel: 39 feet. Contractor to verify with structural drawings and also field verify prior to ordering rail beam.
   2. Lift/Hook Height: 16'-0" minimal lift.
   3. 2 Ton Wire Rope Hoist with 2/1 Reeving.
   4. Festoon Electrification.

F. Hoist Design Criteria:
   1. Capacity: 2 ton capacity.
   2. Speed: Two speed with 3:1 ratio
   3. Hoist Motor: Finned aluminum housing and Class F insulation
   4. Multiple disc motor brake
   5. Mechanical overload protection
   6. Hook: The hook shall be of rolled steel or forged steel supported on a ball or roller thrust bearing, washer type bearings are not acceptable. The hook shall be able to rotate freely on this bearing. The load block shall be clearly and permanently marked with the rated hoist capacity. The hook shall be designed for minimum of 150 percent of the hoist rated capacity. The hook shall be provided with swivel locks. Sheaves shall be steel with close fitting steel guards to prevent the ropes from becoming fouled or leaving the sheaves when the load block is lying on the floor with the ropes loose. Provide spring latch.

G. Motorized Trolley:
   1. Speed: Two speed motorized trolley with 3 to 1 speed ratio.
   2. Wrap around side plates
   3. Machined cast iron wheels with sealed lubricated ball bearings
   4. Four-wheel design.

H. System Capacities:
   1. Hoist: 2-ton, two speeds.
   2. Trolley: 2-ton, two speeds
   3. Trolley Weight: 210 lbs.
   4. Monorail Runway length: 39'-0"
   5. Beam Design: by project Structural discipline and approved shop drawings.

I. Hoist and Trolley Requirements:
   1. Power Supply:
      a. 230V, 1 phase, 60 hertz, 1 HP
      b. 115V, single phase, 60 hertz for controls.

J. Push Button Wireless Remote Control:

1. Control of hoist, and trolley motions shall be by means of a wireless, push-button remote control station meeting NEMA 12 specifications. Hoist buttons shall be minimum 2 step momentary contact type, buttons for trolley and hoist shall be proportional to allow infinitely adjustable speed control.
2. Button Controls to include:
   a. POWER - OFF
   b. POWER – ON
   c. Hoist-Up
   d. Hoist-Down
   g. Trolley – East
   h. Trolley – West

3. Provide storage housing with key lock to house and store remote control when not in use. Housing shall be clear plastic with locking mechanism. Provide with 6 sets of keys. Mount on wall 48 inches from FF.

K. Options/Accessories:
1. Hoist Sling
   a. Adjustable 4 leg chain sling with clevis sling hooks
   b. Size: 3/8 inch x 5 foot
   c. Quality grade 100
   d. Built in shorteners on connecting links
   e. Stainless steel construction
   f. Working load limits
      1) 60 degree hitch: 22,000lbs
      2) 45 degree hitch: 18,700 lbs.
      3) 30 degree hitch: 13,200 lbs
   g. Weight: 50 lbs.
2. Adjustable sling shall be Part # 38G100QOSA-5 as supplied by US Cargo Control (Telephone: 866-878-9355) or approved equal with above minimal requirements.

L. Compliance:
1. The equipment shall comply with the most current and applicable local, state, and national codes and standards. The equipment shall also comply with the following:
   a. CFR 1910.179: Overhead and Gantry Cranes, as enforced by OSHA.
   b. MHIA/CMAA: CMAA Specification No. 74 Single Girder Cranes, most recent edition.
   c. ANSI B30.2.0-1967: American National Standard Safety Code for Overhead and Gantry Cranes.
2. NFPA 70 NEC: National Electric Code, most recent edition
3. Other codes having jurisdiction for the monorail system.

M. Two-Ton monorail hoist and trolley shall be Model # JLCMT-4008 as specified above as manufactured by Coffing Hoists or approved equal. or approved equal with the above minimal requirements.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install Monorail System in strict accordance with the approved shop drawings and manufacturer's installation instructions.

B. Coordinate monorail system installation with work of Divisions 5, Section 11 00 50, Division 14 – Conveying Systems and Division 26 - Electrical.

C. The monorail system requirements and installation shall be based on approved manufacturer shop drawing and coordinated with the structural, industrial and electrical drawings for proper installation. All components and installation shall be the responsibility of the manufacturer and contractor for the proper operation of the monorail system.

D. Provide all required testing and certification requirements prior to final inspection to assure monorail passes all certifications upon completion of project. See Sections 3.01/F and 3.03/A in these specifications for testing and certification requirements.

E. Electrical Interface:
   1. Power supply for equipment is designed as 230 volts, 3-phase, 60 hertz.
   2. Provide transformers for equipment as required stepping down the specified supply voltage to provide lower voltage for controls and accessories and to provide voltage compatible with equipment as required.
   3. Provide wiring and conduit for a complete installation and proper operation of all equipment and accessories. Provide electrical service devices (disconnect switches) complying with the requirements of Division 26 - Electrical. Install these electrical service devices, perform wiring (including conduit installation) and make connections between these electrical service devices and equipment specified. Size wiring and conduits for the loads and voltages indicated. Wiring and conduits types shall be in accordance with the requirements of the National Electrical Code of the individual equipment location except where more stringent requirements are specified in Division 26. In no case shall maximum current carried exceed that specified by the National Electrical Code for type of conductor used.
   4. Provide disconnect switches (fused and non-fused as required), motor starters and start-stop control stations for all equipment subject to the following conditions:
      a. Provide above stated electrical devices consistent with both National Electrical Code and equipment design requirements, as well as the electrical power circuit design for each piece of equipment.
      b. Provide the type of electrical device based on the requirements of the preceding paragraph and the electrical characteristics of the project electrical design.
      c. Sizing of the above stated electrical devices is the responsibility of the Contractor based on the information supplied by equipment manufacturer.
   5. Provide control devices necessary for proper operation and locate to permit efficient operation of the equipment, and where possible group in a factory-fabricated control panel meeting NEMA requirements.
   6. Identify switches, lights and control functions with legend plates. Construct the plates of polyvinyl-chloride material of laminated multiple construction, and rout engraved with appropriate legends. Submit the size of letters, colors and legend for review. Mount legend plates on the equipment. No decals shall be accepted.

F. Proceed with start-up, testing and instructions in accordance with Division 1, Testing and certification shall be performed by a Certified Inspector in the State of California and must perform all required tests including as follows:
   1. No-Load Test:
      a. Hoist: Raise each load hook into the hoist limit switch at operating speed. Lower and raise each hook through all controller points.
      b. Trolley: Move trolley the full distance of the beam and observe proper brake operations.

   2. Full Rated Load Test:
      a. Hoist:
         (1) Static Test: Raise test load approximately one foot and hold for ten minutes. Observe lowering that may occur which shall indicate malfunction of hoisting components or brakes.

(2) Dynamic Test: Hoist and lower test load through all controller points. Lower the test load to the ground until hoist lines are slack. Wait five minutes, hoist and lower test load again through controller points.

(3) Hoist Load Brake: Raise test load approximately five feet. With the hoist controller in the neutral position, release (by hand) the holding brake. The load brake should hold the test load. Again with the holding brake in the released position start the test load down (first point) and return the controller to off position as the test load lowers. The load brake should prevent the test load from accelerating.

(4) During either the static or dynamic test, visually observe hoist brakes to ensure correct operation including the proper time delay.

(5) Loss of Power Test: This test is designed to test the reaction of the hoisting unit in the event of power of power failure during a lift. Hoist the test load to convenient distance above the surface. Lower test load and with the controller in the lowering position disconnect the main power source and return the controller to the neutral position. The test load should stop lowering when the controller is placed in the neutral position.

b. Trolley Motion: Move trolley with test load (if space is available) the full distance of the bridge rails using extreme caution and observe any binding of bridge trucks and for proper operation.

3.02 FIELD QUALITY CONTROL

A. Provide the services of a qualified, certified manufacturer's representative to perform the following:
1. Supervise preparatory work performed by other trades.
2. Supervise installation.
3. Supervise testing, by the Contractor in the presence of the Nevada County Representative to ensure proper operation of the equipment.

3.03 FIELD TESTING AND CERTIFICATION

A. Perform testing of the equipment and system in accordance with the requirements specified in Division 1 and Section 11 00 50. Perform and document all testing procedures recommended by the manufacturer and OSHA standards, ANSI B30.10 and ANSI B30.11. Testing to be performed and certified by a qualified Independent Inspection and Testing Agency per Division 1, Section 11 00 50 and Section 3.01/F of these specification requirements.
1. Test hoist and trolley for operation and load test not less than 100 percent and not more than 125 percent of the rated load.

3.04 TRAINING PROGRAM AND OPERATION AND MAINTENANCE MANUALS

A. Provide a training program and operation and maintenance manual in accordance with the requirements specified in Division 1 and Section 11 00 50.

END OF SECTION

SECTION 21 00 50 - BASIC FIRE SPRINKLER MATERIALS AND METHODS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Electric motors.

B. Motor starters.

C. Valve Boxes.

D. Access doors.

E. Expansion loops.

F. Insulation.

1.02 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. This Section is part of each Division 21 Section.

1.03 ADDITIONAL REQUIREMENTS

A. Furnish and install incidental work not shown or specified necessary to provide a complete and workable system.

B. Make temporary connections required to maintain services during the course of the Contract without additional cost to Owner. Notify Owner seven days in advance before interrupting services.

1.04 REFERENCED STANDARDS

A. Where material or equipment is specified to conform to referenced standards, it shall be assumed that the most recent edition of the standard in effect at time of bid shall be used.
   1. ANSI - American National Standards Institute.
   2. ASTM - American Society for Testing and Materials.
   3. CCR - California Code of Regulations.
      a. Title 8 - Division of Industrial Safety, Subchapter 7; General Industry Safety Orders, Articles 31 through 36.
   4. NCPWB - National Certified Pipe Welding Bureau.
   5. CEC - California Electrical Code.
   6. NEMA - National Electrical Manufacturers' Association.
   7. NFPA - National Fire Protection Association, as amended by the CBC.
   8. OSHA - Occupational Safety and Health Act.
   9. UL - Underwriters' Laboratories, Inc.

1.05 DRAWINGS

A. Examine Contract Documents prior to bidding of Work and report discrepancies in writing to Architect.

B. Drawings showing location of equipment and materials are diagrammatic and job conditions will not always permit installation in location shown. The fire protection Drawings show general arrangement of equipment and materials, etc., and shall be followed as closely as existing conditions, actual building construction, and work of other trades permit.
   1. Architectural and structural Drawings are part of the Work. These Drawings furnish Contractor with information relating to design and construction of the Project. Architectural Drawings take precedence over fire protection Drawings.
   2. Because of the small scale of fire protection Drawings, not all offsets, fittings, and accessories required are shown. Investigate structural and finish conditions affecting the Work and arrange Work accordingly. Provide offsets, fittings, and accessories required to meet conditions. Inform Architect immediately when job conditions do not permit installation of equipment and materials in locations shown. Obtain Architects' approval prior to relocation of equipment and materials.
   3. Relocate equipment and materials installed without prior approval of Architect. Remove and relocate equipment and materials at Contactors' expense upon Architects' direction.
   4. Minor changes in locations of equipment, piping, ducts, etc., from locations shown shall be made when directed by the Architect at no additional cost to the Owner providing such change is ordered before such items of work, or work directly connected to same are installed and providing no additional material is required.

C. Execute work mentioned in Specifications and not shown on Drawings, or vice versa, the same as if specifically mentioned or shown in both.

1.06 REQUIREMENTS OF REGULATORY AGENCIES

A. The publications listed below form part of this Specification. Comply with provisions of these publications except as otherwise shown or specified.
   1. California Building Code, 2016.
   2. California Electrical Code, 2016.
   3. California Energy Code, 2016.
   4. California Fire Code, 2016.
   5. California Green Building Standards Code, 2016.
   6. California Mechanical Code, 2016.
   7. California Plumbing Code, 2016.
   8. California Code of Regulations, Title 24.
   9. California Health and Safety Code.
   10. CAL-OSHA.
   11. California State Fire Marshal, Title 19 CCR.
   12. National Fire Protection Association.
   13. Occupational Safety and Health Administration.
   14. Other applicable state laws.

B. Nothing in Drawings or Specifications shall be construed to permit work not conforming to these codes, or to requirements of authorities having jurisdiction. It is not the intent of Drawings or Specifications to repeat requirements of codes except where necessary for clarity.

C. Comply with State of California 2016 2013 Energy Code for systems, equipment, and construction.

1.07 FEES AND PERMITS

A. Obtain and pay for permits and service required in installation of the Work. Arrange for required inspections and secure approvals from authorities having jurisdiction. Comply with the requirements of Division 1.

B. Arrange for utility connections and pay charges incurred, including excess service charges.

C. Obtain permits to operate compressed air tanks required to be furnished as part of this Work. Pay costs, and perform tests required to obtain permits. Post permits framed under glass in a conspicuous place on or near tanks, or as required by authorities having jurisdiction.

1.08 UTILITY CONNECTIONS

A. Bear the cost of construction related to utility services, from point of connection to utility services shown on Contract Documents. This includes piping, excavation, backfill, meters, boxes, check valves, backflow prevention devices, general service valves, concrete work, and the like, whether or not Work is performed by Contractor, local water/sanitation district, public utility, other governmental agencies or agencies' assigns.

1.09 FRAMING, CUTTING AND PATCHING

A. Special framing, recesses, chases and backing for Work of this Section, unless otherwise specified, are covered under other Specification Sections.

B. Contractor is responsible for placement of pipe sleeves, hangers, inserts, supports, and location of openings for the Work.

1.10 SUBMITTALS

A. Provide submittal of materials proposed for use as part of this Project. Product names in Specifications and on Drawings are used as standards of quality. Furnish standard items on specified equipment at no extra cost to the Contract regardless of disposition of submittal data. Other materials or methods shall not be used unless approved in writing by Architect. Architect's review will be required even though "or equal" or synonymous terms are used. Refer to Division 01 for complete instructions.
   1. Partial or incomplete submittals will not be reviewed.
   2. Quantities are Contractor's responsibility and will not be reviewed.
   3. Provide materials of same brand or manufacturer for each class of equipment or material.
   4. Identify each item by manufacturer, brand, trade name, number, size, rating, or other data necessary to properly identify and review materials and equipment. Words "as specified" are not sufficient identification.
   5. Identify each submittal item by reference to items' Specification Section number and paragraph, by Drawing and detail number, and by unit tag number.
   6. Organize submittals in same sequence as in Specification Sections.
   7. Show physical arrangement, construction details, finishes, materials used in fabrications, provisions for piping entrance, access requirements for installation and maintenance, physical size, mechanical characteristics, foundation and support details, and weight.
      a. Submit shop drawings, performance curves, and other pertinent data, showing size and capacity of proposed materials.
      b. Specifically indicate, by drawn detail or note, that equipment complies with each specifically stated requirement of Contract Documents.
      c. Drawings shall be drawn to scale and dimensioned (except schematic diagrams). Drawings may be prepared by vendor but must be submitted as instruments of Contractor, thoroughly checked and signed by Contractor before submission to Architect for review.
      d. Catalog cuts and published material may be included with supplemental scaled drawings.

B. Review of submittals will be only for general conformance with design concept and general compliance with information given in Contract Documents. Review will not include quantities, dimensions, weights or gauges, fabrication processes, construction methods, coordination with work of other trades, or construction safety precautions, which are sole responsibility of Contractor. Review of a component of an assembly does not indicate acceptance of an assembly.

Deviations from Contract Documents not clearly identified by Contractor are Contractor's responsibility and will not be reviewed by Architect.

C. Within reasonable time after award of contract and in ample time to avoid delay of construction, submit to Architect shop drawings or submittals on all items of equipment and materials provided. Provide submittal in at least seven copies and in complete package.
   1. Shop drawings and submittals shall include Specification Section, Paragraph number, and Contract Drawing unit symbol or detail number for reference. Organize submittals into booklets for each Specification section and submit in loose-leaf binders with index. Deviations from Contract Documents shall be clearly identified and appear at the beginning of submittal package, and shall be referenced to applicable Contract Documents requirements.

D. Provide layouts for fire protection systems, for inclusion in coordinated layout specified in Section 23 80 00. Comply with requirements for layouts specified in Section 23 80 00.

E. Provide coordination drawings for fire protection systems in accordance with the requirements of Specification Section 21 10 00.

F. Furnish to Project Inspector complete installation instructions on material and equipment before starting installation.

G. Product Data for California Green Building Standards Code Compliance: For adhesives and sealants, including primers, documentation of compliance including printed statement of VOC content and chemical components.

H. Sustainable Design Submittals:
   1. Product Data: For adhesives and sealants, documentation of compliance including printed statement of VOC content and chemical components.
   2. Laboratory Test Reports: For adhesives and sealants, indicating compliance with requirements for low-emitting materials.

I. Pipe, pipe or plumbing fittings, fixtures, solder and flux installed in a system providing water for human consumption shall comply with lead free requirements of the California Health and Safety Code Section 11 68 75. Provide submittal information for products third-party certified by an approved laboratory as complying with California Health and Safety Code Section 11 68 75.

J. Delegated-Design Submittal: For seismic supports, anchorages, and restraints indicated to comply with performance requirements and design criteria.
   1. Calculations performed for use in selection of seismic supports, anchorages, and seismic restraints shall utilize criteria indicated in Structural Contract Documents.
   2. Supports, anchorage and restraints for piping and equipment shall be an OSHPD pre-approved system such as Tolco, Afcon, ISAT, Badger, Mason, or equal. Pipes and equipment shall be seismically restrained in accordance with requirements of current edition of California Building Code and NFPA 13. System shall have current OPA number and shall meet additional requirements of authority having jurisdiction. Provide supporting documentation required by the reviewing authority and the Architect and Engineer. Provide layout drawings showing piping, ductwork and restraint locations.
      a. Bracing of Piping and Equipment: Specifically state how bracing attachment to structure is accomplished. Provide shop drawings indicating seismic restraints, including details of anchorage to building. In-line equipment must be braced independently of piping, and in conformance with applicable building codes. Provide calculations to show that pre-approval numbers have been correctly applied in accordance with general information notes of pre-approval documentation.
   3. In lieu of the above or for non-standard installations not covered in the above pre-approved systems, Contractor shall provide layout drawings showing piping, equipment, and restraint

locations, and detailing supports, attachments and restraints, and furnish supporting calculations and legible details sealed by a California registered structural engineer, in accordance with California Building Code and NFPA 13.

4. Additional Requirements: In addition to the above, conform to State and local requirements.

1.11 SUBSTITUTIONS

A. Refer to Division 01 for complete instructions. Requirements given below are in addition to or are intended to amplify Division 1 requirements. In case of conflict between requirements given in this Section and those of Division 01, Division 01 requirements shall apply.

B. It is the responsibility of Contractor to assume costs incurred because of additional work and or changes required to incorporate proposed substitute into the Project. Refer to Division 01 for complete instructions.

C. Substitutions will be interpreted to be manufacturers other than those specifically listed in Contract Documents by brand name, model, or catalog number.

D. Only one request for substitution will be considered for each item of equipment or material.

E. Substitution requests shall include the following:
1. Reason for substitution request.
2. Complete submittal information as described herein; see “Submittals.”
3. Coordinated scale layout drawings depicting position of substituted equipment in relation to other work, with required clearances for operation, maintenance and replacement.
4. List optional features required for substituted equipment to meet functional requirements of the system as indicated in Contract Documents.
5. Explanation of impact on connected utilities.
6. Explanation of impact on structural supports.

F. Installation of reviewed substitution is Contractors’ responsibility. Any mechanical, electrical, structural, or other changes required for installation of substituted equipment or material must be made by Contractor without additional cost to Owner. Review by Architect of substituted equipment or material, will not waive these requirements.

G. Contractor may be required to compensate Architect for costs related to substituted equipment or material.

1.12 OPERATION AND MAINTENANCE MANUAL

A. Instruct Owner's authorized representatives in operation, adjustment, and maintenance of mechanical equipment and systems. Provide three copies of certificate signed by Owner's representatives confirming that instruction is completed.

B. Furnish three complete sets of Operating and Maintenance Manual bound in hardboard binder, and one compact disc containing complete Operating and Maintenance Manual in searchable PDF format. Provide Table of Contents. Provide index tabs for each piece of equipment in binder and disc. Start compiling data upon approval of submittals.
1. Sets shall incorporate the following:
   a. Service telephone number, address and contact person for each category of equipment or system.
   b. Complete operating instructions for each item of fire sprinkler system.
      1) Original manual of NFPA-25 for fire sprinkler system.
   c. Copies of guarantees/warrantees for each item of equipment or systems.

d. Test data as specified.
e. Typewritten maintenance instructions for each item of equipment listing lubricants to be used, frequency of lubrication, inspections required, adjustment, etc.
f. Manufacturers' bulletins with parts numbers, instructions, etc., for each item of equipment.
g. A complete list or schedule of scheduled valves giving the number of the valve, location and the rooms or area controlled by the valve. Identify each valve with a permanently attached metal tag stamped with number to match schedule. Post list in frame under plastic on wall in mechanical room or where directed by Architect.
h. Check test and start reports for each piece of fire protection equipment provided as part of the Work.
i. Commissioning and Preliminary Operation Tests required as part of the Work.

C. Post service telephone numbers and addresses in an appropriate place designated by Architect.

1.13 SITE CONDITIONS

A. Information on Drawings relative to existing conditions is approximate. Deviations from Drawings necessary during progress of construction to conform to actual conditions shall be approved by Architect and shall be made without additional cost to Owner. The Contractor shall be held responsible for damage caused to existing services. Promptly notify Architect if services are found which are not shown on Drawings.

1.14 WARRANTY

A. Refer to Division 01 for warranty requirements, including effective date of warranty. Refer to specific items of equipment specified herein for warranty duration if different from that specified in Division 01.

B. Repair or replace defective work, material, or part that appears within warranty period, including damage caused by leaks.

C. On failure to comply with warranty requirements within a reasonable length of time after notification is given, Architect/Owner shall have repairs made at Contractor's expense.

1.15 RECORD DRAWINGS

A. Refer to Division 01, Record Documents, for requirements governing Work specified herein.

B. Upon completion of the Work and as precedent to final payment, deliver to Architect the following:
1. Originals of drawings showing the Work exactly as installed.
2. One complete set of reproducible drawings showing the Work exactly as installed.
3. One compact disc with complete set of drawings in PDF format showing the Work exactly as installed.
4. Provide Contractor’s signature, verifying accuracy of record drawings.

C. Obtain signature of Project Inspector for record drawings.

1.16 DELIVERY AND STORAGE

A. Protect equipment and materials delivered to Project site from weather, humidity and temperature variations, dirt, dust and other contaminants.

1.17 COORDINATION

A. General:
   1. Coordinate Work in this Section with trades covered in other Specification Sections to provide a complete and operable installation of highest quality workmanship.

B. Electrical Coordination:
   1. Refer to the Electrical Drawings and Specifications, Division 26, for service voltage and power feed wiring for equipment specified in this Section. Contractor has full responsibility for the following items of work:
      a. Review the Electrical Drawings and Division 26 Specifications to verify that electrical services provided are adequate and compatible with equipment requirements.
      b. If additional electrical services are required above that indicated on Electrical Drawings and in Division 26, such as more control interlock conductors, larger feeder, or separate 120 volt control power source, include cost to furnish and install additional electrical services as part of bid.
      c. Prior to proceeding with installation of additional electrical work, submit detailed drawings indicating exact scope of additional electrical work.

C. Mechanical Coordination:
   1. Arrange for pipe spaces, chases, slots and openings in building structure during progress of construction, to accommodate mechanical system installation.
   2. Coordinate installation of supporting devices. Set sleeves in poured-in-place concrete and other structural components during progress of construction.
   3. Coordinate requirements for access panels and doors for mechanical items requiring access where concealed behind finished surfaces. Access panels and doors are specified in Division 08 Section “Access Doors and Frames.”

PART 2 - PRODUCTS

2.01 GENERAL

A. Materials or equipment of the same type shall be of the same brand wherever possible. All materials shall be new and in first class condition.

B. All sizes, capacities, and efficiency ratings shown are minimum.

C. Refer to Section 21 10 00 for specific system piping materials.

2.02 MATERIALS

A. No material installed as part of this Work shall contain asbestos.

B. California Green Building Code Compliance:
   1. Fire protection equipment shall not contain CFCs.
   2. Fire protection equipment shall not contain Halons.

2.03 ELECTRIC MOTORS

A. U.S. Motors, Century Electric, General Electric, Lincoln, Gould or equal. Minimum efficiencies shall be as defined by IEEE 112 Test Method B and NEMA MG1. Provide NEMA 3R enclosure where exposed to outdoors.

2.04 MOTOR STARTERS

A. Square D, Allen Bradley, or equal, in NEMA Type 1 enclosure, unless otherwise specified or required. Minimum starter size shall be Size 1. Provide NEMA 3R enclosure where exposed to outdoors.

B. Where three phase motors are provided for two-speed operation, provide two speed motor starters.
   1. All three-phase starters shall have the following:
      a. Provide magnetic motor starters for equipment provided under the fire protection Work. Starters shall be non-combination type. Provide part winding or reduced voltage start motors where shown or as hereinafter specified. Minimum size starter shall be Size 1.
      b. Cover mounted hand-off-automatic switch. Starters installed exposed in occupied spaces shall have key operated HOA switch.
      c. Three ambient compensated thermal overload.
      d. Fused control transformer (for 120 or 24 volt service).
      e. Pilot lights, integral with starters. Starters located outdoors shall be installed in NEMA IIIR enclosures.

2.05 VALVE BOXES

A. General:
   1. Where several valves or other equipment are grouped together, provide larger boxes of rectangular “vault” type adequately sized for condition and similar in construction to those specified above.
   2. Provide valve box extensions as required to set bottom of valve box tight up to top of piping in which valve is installed.
   3. Provide a tee handle wrench for each size, Alhambra Foundry Co. #A-3008, or equal.

B. Valve Boxes in Traffic Areas: Provide Christy No. G5 traffic valve box, Brooks, or equal, 10-3/8 inches inside diameter with extensions to suit conditions, with cast iron or steel locking cover. Provide Owner with set of special wrenches or tools as required for operation of valves.

C. Valve Boxes in Non-Traffic Areas: Provide Christy No. F22, Brooks, or equal, 8 inches inside diameter by 30 inches long, with cast iron or steel locking cover. Provide Owner with set of special wrenches or tools as required for operation of valves. Cut bottom of plastic body for operation of valves.

D. Valve Box (Rectangular Vault Type): Precast concrete or cast iron with cast iron or steel locking type covers lettered to suit service – Brooks No. 3-TL, Christy No. B3, Fraser No. 3, Alhambra A-3004 or A-3005, Alhambra E-2202, or E-2702, or equal, with extension to suit conditions.

2.06 ACCESS DOORS

A. Where floors, walls, or ceilings must be penetrated for access to fire protection equipment or devices, provide access doors, 14 inch by 14 inch minimum size in usable opening. Where entrance of a serviceman may be required, provide 20 inch by 30 inch minimum usable opening. Locate access doors/panels for non-obstructed and easy reach.
   1. Access doors less than 7'-0" above floors and exposed to public access shall have keyed locks.

B. Access doors shall match those supplied in Division 08, except as noted in this Section.

C. Provide stainless steel access doors for use in toilet rooms, shower rooms, kitchens and other damp areas. Provide steel access doors with prime coat of baked-on paint for other areas.

D. Do not locate access doors in highly visible public areas such as lobbies, waiting areas, and primary entrance areas. Coordinate with Architect when access is required in these areas.

E. Where specific information or details relating to access panels different from the above is shown or given on Drawings or other Divisions of work, that information shall supersede this specification.

F. Manufacturers: Subject to compliance with requirements, available manufacturers offering products which may be incorporated into the Work include Milcor, Karp, Nystrom, or Cesco, equal to the following:
   1. Milcor:
      a. Style K (plaster).
      b. Style DW (gypsum board).
      c. Style M (masonry).
      d. Style "Fire Rated" where required.

2.07 EXPANSION LOOPS

A. Manufactured assembly consisting of inlet and outlet elbow fittings, two sections of flexible metal hose and braid, and 180-degree return bend or center section of flexible hose. Flexible hose shall consist of corrugated metal inner hose and braided outer sheath. Provide UL listed assembly selected for 4 inches of movement.

B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:
   1. Metraflex Inc., Fireloop series.
   2. Unisource Manufacturing, Inc., V series.

2.08 EQUIPMENT IDENTIFICATION

A. Identify each piece of equipment with a permanently attached engraved bakelite plate, 1/2 inch high white letters on black background.

B. Text of Signs: Provide identification of equipment unit number, and room or area served. Coordinate name of area served with final room names and numbers for the facility. In addition, provide lettering to distinguish between multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations.

2.09 PIPE IDENTIFICATION

A. Identify each piping system and indicate the direction of flow by means of Seton, Inc., Marking Services Inc., Reef Industries, Inc., or equal, pre-tensioned, coiled semi-rigid plastic pipe labels formed to circumference of pipe, requiring no fasteners or adhesive for attachment to pipe.

B. The legends and flow arrows shall conform to ASME A13.1.

2.10 INSULATION WORK

A. General:
   1. Adhesives shall comply with testing and product requirements of South Coast Air Quality Management District, Rule 1168.
   2. The term "piping" used herein includes pipe, valves and fittings.

a. Apply insulating cement to fittings, valves and strainers and trowel smooth to equal the thickness of adjacent covering. Cover with jacket to match piping. Extend covering on valves up to bonnet. Leave strainer cleanout plugs accessible.
b. Provide pre-formed PVC valve and fitting covers.
c. Provide Calcium Silicate rigid insulation and sheet metal sleeve, 18 inch minimum length at each pipe hanger. Seal ends of insulation to make vapor tight with jacket.

3. Test insulation, jackets, and lap-seal adhesives as a composite product and confirm flame spread of not more than 25 and a smoke developed rating of not more than 50 when tested in accordance with UL723, ASTM E84, or NFPA 255.
4. Clean thoroughly, test and have approved, piping and equipment before installing insulation and/or covering.
5. Repair damage to existing pipe insulation whether or not caused during Work of the Contract, to match existing adjacent insulation for thickness and finish, but conforming to flame spread and smoke ratings specified above.

B. Insulation of Piping:
1. Insulate fire protection piping where exposed to weather for freeze protection with 1 inch thick fiberglass, minimum 3-1/2 pounds per cubic foot density, with ASJ-SSL jacket for sizes up to and including 2 inches. For larger sizes, provide 1-1/2 inches thick fiberglass, minimum 3-1/2 pounds per cubic foot density, with ASJ-SSL jacket.
2. Where insulated piping is exposed to the weather apply aluminum jacket secured with 1/2 inch aluminum bands on 12 inch centers. Cover fittings with glass cloth, two coats of Foster Sealfas 30-36, and Zeston 2000, or equal, PVC fitting covers. Insulation shall be vapor tight before applying metal jacket or PVC covers.
a. Pipes 10 inches diameter and smaller: Minimum .016 inch thick jacket.
b. Pipes 12 inches diameter and larger: Minimum .020 inch thick jacket.

PART 3 - EXECUTION

3.01 ELECTRICAL REQUIREMENTS

A. Provide adequate working space around electrical equipment in compliance with the California Electrical Code. Coordinate the fire protection Work with the electrical Work to comply.

B. Furnish necessary control diagrams and instructions for controls. Before permitting operation of equipment which is furnished, installed, or modified under this Section, Contractor shall review associated electrical work, including overload protection devices, and assume complete responsibility for correctness of electrical connections and protective devices. Motors and control equipment shall conform to the Standards of the National Electrical Manufacturers' Association. Equipment and connections exposed to weather shall be installed in NEMA IIIR enclosures with factory wired strip heaters in each starter enclosure and temperature control panel where required to inhibit condensation.

C. All line voltage and low voltage wiring and conduit associated with fire protection system are included in this Section. Wiring and conduit shall comply with Division 26.

D. Electric Motors:
1. Motors shall be rated for continuous operation at 115% of nameplate amperage but shall be selected to operate at less than nameplate amperage throughout entire operating cycle. Motors found to exceed nameplate amperage shall be promptly replaced at no cost to Owner. Horsepower shown is minimum and shall be increased as necessary to comply with above requirements. Furnish motors with splash-proof or weatherproof housings, where required or recommended by motor manufacturer. Match the nameplate voltage rating with electrical service supplied. Check electrical Drawings. Provide transformer for each motor not wound specifically for system voltage.

E. Motor Starters:
1. Provide magnetic motor starters for equipment provided under the fire protection Work. Starters shall be non-combination type. Provide part-winding or reduced voltage start motors on motors 50 – HP and larger, or where shown or as hereinafter specified. Minimum size starter shall be Size 1. Three-phase starters shall have the following:
   a. Cover-mounted hand-off-automatic switch. Starters installed exposed in occupied spaces shall have key operated HOA switch.
   b. Three ambient compensated thermal overload.
   c. Fused control transformer (for 120 or 24 volt service).
   d. Pilot lights, integral with the starters. Starters located outdoors shall be in NEMA IIIR enclosures.
2. Starters for single-phase motors shall have thermal overloads, Westinghouse Type MSTOLSLIP, Square D, or equal, toggle-operated with pilot light, NEMA I enclosure for starters located indoors, NEMA IIIR enclosure for starters located outdoors.
3. Provide OSHA label indicating that the device starts automatically.

3.02 PIPING SYSTEM REQUIREMENTS

A. Drawing plans, schematic and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.

3.03 PRIMING AND PAINTING

A. Perform all priming and painting on the equipment and materials as specified herein.

B. Priming:
1. Exposed ferrous metals, including piping, which are not galvanized or factory-finished shall be primed. Black steel pipe exposed to weather shall be painted one coat of Rust-Oleum #1069 primer for black steel piping or Rust-Oleum #5260, Kelly Moore, or equal, primer for galvanized piping.
2. Metal surfaces of items to be jacketed or insulated except piping shall be given two coats of primer unless furnished with equivalent factory finish. Items to be primed shall be properly cleaned by effective means free of rust, dirt, scale, grease and other deleterious matter and then primed with the highest grade zinc rich primer. After erection or installation, primed surfaces shall be properly cleaned of foreign or deleterious matter that might impair proper bonding of subsequent paint coatings. Abrasion or other damage to shop or field prime coat shall be properly repaired and touched up with same material used for original priming.
3. Where equipment is provided with nameplate data, the nameplate shall be masked off prior to painting. When painting is completed, remove masking material.

C. See Painting Section for detailed requirements.

3.04 INSTALLATION OF PIPING SYSTEMS

A. At time of final connection, and prior to opening valve to allow pressurization of water piping from existing systems, on site or off site, perform a pressure test to indicate static pressure of existing systems. If pressure on fire protection piping is greater than 175 psi, inform Architect immediately. Do not allow piping systems to be pressurized without written consent of the Architect.

B. General:
1. Piping shall be concealed unless shown or otherwise directed. Allow sufficient space for ceiling panel removal.

2. Installation of piping shall be made with appropriate fittings. Bending of piping will not be accepted.
3. Install piping to permit application of insulation where required and to allow valve servicing.
4. Where piping or conduit is left exposed within a room, the piping or conduit shall be run true to vertical, horizontal, or intended planes. Where possible, uniform margins are to be maintained between parallel lines and/or adjacent wall, floor, or ceiling surfaces.
5. Horizontal runs of pipes and/or electrical conduit suspended from ceilings shall provide for maximum headroom clearance. The clearance shall not be less than 6'-6" without written approval from Architect.
6. Close ends of pipe immediately after installation. Leave closure in place until removal is necessary for completion of installation.
7. Each piping system shall be thoroughly flushed and proved clean before connection to equipment.
8. Install exposed polished or enameled connections with special care showing no tool marks or threads at fittings.
9. Install horizontal valves with valve stem above horizontal.
10. Use reducing fittings; bushings shall not be allowed. Use eccentric reducing fittings wherever necessary to provide free drainage of lines and passage of air.
11. Verify final equipment locations for roughing-in.
12. Service Markers: Mark location of each plugged or capped pipe with 4 inch round by 30 inch long concrete marker, set flush with finished grade. Provide 2-1/2 inch diameter engraved brass plate as part of service marker.
13. Where piping is installed in walls within one inch of face of stud, provide 16 gauge sheet metal shield plate on face of stud. The shield plate shall extend minimum 1-1/2 inches beyond outside diameter of pipe.

C. Expansion Loops:
1. Install expansion loops where piping crosses building expansion or seismic joints, between buildings, between buildings and canopies, and as indicated on Drawings.
2. Install expansion loops of sizes matching sizes of connected piping.
3. Install grooved-joint expansion joints to grooved-end steel piping.
4. Materials of construction and end fitting type shall be consistent with pipe material and type of gas or liquid conveyed by piping system in which expansion loop is installed.

D. Sleeves:
1. Install AMI Products, Adjus-to-Crete, Pipeline Seal and Insulator, or equal, pipe sleeves of sufficient size to allow for free motion of pipe, 24 gauge galvanized steel. The space between pipe and sleeves through floor slabs on ground, through outside walls above or below grade, through roof, and other locations, as directed, shall be caulked with oakum and mastic and made watertight. The space between pipe and sleeve and between sleeve and slab or wall shall be sealed watertight.
2. At Contractor's option, Link-Seal, Metraflex Metraseal, or equal, casing seals may be used in lieu of caulking. Wrap pipes through slabs on grade with 1 inch thick fiberglass insulation to completely isolate pipe from concrete.

E. Floor, Wall, and Ceiling Plates:
1. Fit pipes, with or without insulation, passing through walls, floors, or ceilings, and hanger rods penetrating finished ceilings with chrome-plated or stainless escutcheon plates.

F. Firestopping:
1. Pack annular space between pipe sleeves and pipe through floors and walls with UL listed fire stop, and seal at ends. Pipe penetrations shall be UL listed, Hilti, 3M Pro-Set, or equal.
   a. Install fire caulking behind fire protection services installed within fire rated walls, to maintain continuous rating of wall construction.
2. Provide SpecSeal Systems UL fire rated sleeve/coupling penetrators, or equal, for each pipe penetration or fixture opening passing through floors, walls, partitions or floor/ceiling

assemblies. Penetrators shall comply with UL Fire Resistance Directory (Latest Edition), and with Chapter 7, CBC requirements.

3. Sleeve penetrators shall have built in anchor ring for waterproofing and anchoring into concrete pours or use special fit cored hole penetrator for cored holes.
4. Copper and steel piping shall have SpecSeal plugs, or equal on both sides of penetrator to reduce noise and to provide waterproofing.
5. All above systems to be installed in strict accordance with manufacturer's instructions.
6. Alternate firestopping systems are acceptable if approved as equal. Contractor is responsible for determining suitability of alternate products for their intended use, and shall assume all risks and liabilities in connection with the use of alternate products.

G. Flashing:
1. Flashing for penetrations of metal or membrane roof for fire protection items shall be coordinated with roofing manufacturer and roofing installer for specific roofing type utilized. The work of this section shall include furnishing, layout, sizing, and coordination of penetrations required for fire protection work.
   a. Furnish and install flashing and counterflashing in strict conformance with requirements of the roofing manufacturer. Submit shop drawing details for review prior to installation.
   b. Furnish and install counterflashing above each flashing required. Elmdor/Stoneman Model 1540, or equal.
2. For other types of roofing systems, furnish and install around each pipe, where pipe passes through roof, a flashing and counterflashing. Flashing shall be made of four pound seamless sheet lead with 6 inch minimum skirt and steel reinforced boot. Counterflashing shall be cast iron. Elmdor/Stoneman Model 1100-4, or equal.

H. Hangers and Supports:
1. General: Support equipment and piping so that it is firmly held in place by approved iron hangers and supports and special hangers as required. Hangers and supports shall be UL listed for fire protection service. Components shall support weight of equipment, pipe, fluid, and pipe insulation based on spacing between supports with minimum factor of safety of five based on ultimate strength of material used. Do not exceed manufacturer's load rating. Pipe attachments or hangers, shall be of same size as pipe or tubing on which used, or nearest size available. Architect shall approve hanger material before installation. Do not support piping with plumbers' tape, wire rope, wood, or other makeshift devices. Where building structural members do not match piping support spacing, provide “trapeze” (bridging) support members attached to building structural members by methods approved by structural Engineer.
   a. Materials, design, and type numbers per Manufacturers' Standardization Society (MSS), Standard Practice (SP)-58.
2. Hanger components shall be provided by one manufacturer. B-Line, Grinnell, Tolco, Afcon, Loos & Co., Uni-Strut, or equal.
3. Hanger and Supports:
   a. Vertical Piping: Tolco Fig. 6, or equal, clamps attached to pipe above each floor to rest on floor. Provide intermediate support for vertical piping greater than 25 feet in length.
   b. Individually Suspended Piping: Tolco Fig. 200 or Fig. 1 Clevis, complete with threaded rod, or equal.

Pipe Size	Rod Size
4" and Smaller	3/8"
5" to 6"	5/8"

c. Trapeze Suspension: Sch-10 or Sch-40 steel pipe trapeze member in accordance with NFPA 13- published load ratings.
d. Pipe Clamps and Straps: B-Line B2000 or B2400, Tolco, Fig. 200 or Fig. 1, or equal. Where used for seismic support systems, provide B-line B2400, Tolco fig. 69 series retainer pipe straps, or equal.
e. Concrete Inserts: B-line B221 continuous insert or B2500 spot insert, or equal. Do not use actuated fasteners for support of overhead piping unless approved by Architect.
f. Steel Connectors: Tolco Fig. 65 beam clamps with Fig. 69 retainer straps, or equal.
g. Deck Connectors: Afcon Fig. 610 steel ceiling plate, or equal, where approved by structural Engineer.

4. Support to Structure:
   a. Steel Structure: Provide and install additional steel bracing as required to suit structure. Provide through bolts with length to suit requirements of structural components. Burning or welding on structural member may only be done if approved by Architect.
5. Pipe hanger and support spacing: Locate hangers and supports at each change of direction, within one foot of elbow, and spaced per NFPA 13, and per pipe manufacturer's listing, except as noted below.
6. Provide support for piping through roof, arranged to anchor piping solidly in place at the roof penetration.
7. Provide rigid insulation and a 12 inch long, 18 gauge galvanized sheet iron shield between the covering and the hanger whenever hangers are installed on the outside of the pipe covering.
8. Insulate copper piping from ferrous materials and hangers with two layers of 3 inch wide, 10 mil polyvinyl tape wrapped around pipe.
9. Provide a support or hanger close to each change of direction of pipe either horizontal or vertical and as near as possible to concentrated loads.
10. Suspend rods from concrete inserts with removable nuts where suspended from concrete decks. Power actuated inserts will not be allowed.

3.05 UNIONS AND FLANGES

A. Install Watts, Epco, Nibco, or equal, dielectric unions or flanges at points of connection between copper or brass piping or material and steel pipe or material. Bushings or couplings shall not be used.

B. Install unions in piping NPS 2” and smaller and flanges in piping NPS 2-1/2” and larger whether shown or not at each connection to equipment and tanks, and at connections to automatic valves.

C. Locate unions for easy removal of equipment, tanks, or valves.

3.06 ACCESS DOOR

A. Furnish and install access doors wherever required whether shown or not for easy maintenance of fire protection systems. Access doors shall provide for complete removal and replacement of equipment.

3.07 CONCRETE WORK

A. Concrete work required for Work of this Section shall be included under another section of the Specification, unless otherwise noted, including reinforced concrete bases for pumps, tanks, compressors unless the work is specifically indicated on Drawings to be furnished under this Section.

B. Thrust blocks, underground anchors, and pads for cleanouts, valve access boxes and washer boxes are included under this Section of the Specifications. Concrete shall be 3000 psi test minimum. Refer to Division 03 for concrete types.

3.08 PIPE IDENTIFICATION

A. Provide temporary identification of each pipe installed, at time of installation. Temporary identification shall be removed and replaced with permanent identification as part of the Work.

B. Apply legend and flow arrow at valve locations; at points where piping enters or leaves a wall, partition, cluster of piping or similar obstruction, at each change of direction, and at approximately 20'-0" intervals on pipe runs. Variations or changes in locations and spacing may be made with approval of Architect. There shall be at least one marking in each room. Markings shall be located for maximum visibility from expected personnel approach.
   1. Apply legend and flow arrow at approximately 10’-0” intervals in science classrooms and science prep rooms.

C. Wherever two or more pipes run parallel, markings shall be supplied in the same relative location on each.

D. Apply markings after painting and cleaning of piping and insulation is completed.

3.09 EXPANSION ANCHORS IN HARDENED CONCRETE:

A. Refer to Structural Drawings.

B. Qualification Tests: The specific anchor shall have a current ICC-ES report and have been evaluated in cracked concrete in accordance with Acceptance Criteria AC193. The design shear and withdrawal load shall not be more than 80% of allowable load listed in the current ICC-ES report and manufacturer’s recommendations for the specific anchor.

C. Installation: The anchors must be installed in accordance with the requirements given in ICC Research Committee Recommendations for the specific anchor.

D. Testing: Fifty percent of anchors shall be load-tested on each job to twice the allowable capacity in tension, except that if the design load is less than 75 pounds; only one anchor in ten need be tested. If any anchor fails, all anchors must be tested. The load test shall be performed in the presence of the project inspector.

E. The load may be applied by any method that will effectively measure tension in the anchor, such as direct pull with a hydraulic jack, a torque wrench calibrated using the specific anchor, or calibrated spring-loading devices. Anchors in which torque is used to expand the anchor without applying tension to the bolt may not be verified with a torque wrench.

3.10 TESTS AND ADJUSTMENTS

A. Test installations in accordance with the following requirements and all applicable codes:
   1. Project Inspector should witness tests of piping systems.
   2. Notify Architect at least seven days in advance of tests.
   3. Notify local fire department of time and date of fire systems testing.
   4. Piping shall be tested at completion of roughing-in, or at other times as directed by Architect.
   5. Furnish necessary materials, test pumps, gases, instruments and labor required for testing.
   6. Isolate from system equipment that may be damaged by test pressure.

B. Test Schedule: No loss in pressure or visible leaks shall show after four hours at pressures indicated:

System Tested	Test Pressure PSI	Test With
Fire Sprinkler Piping	200	Water
Compressed Air	200	Air & Non-corrosive Leak Test Fluid
Dry Standpipes	300	Water
Wet Standpipes	200	Water

1. Piping, including underground piping, connected to fire sprinkler system shall be tested and certified in accordance with NFPA requirements, except where requirements listed in this Section exceed requirements of NFPA.
2. Non-corrosive leak test fluid shall be suitable for use with piping material specified, and with type of gas conveyed by piping system.

C. Should material or work fail in any of these tests, it shall be immediately removed and replaced with new material, and portion of work replaced shall again be tested by Contractor at his own expense.

D. Lubricate each item of equipment, including motors, before operation.

3.11 TRACER WIRES

A. Provide tracer wire for non-metallic water pipe in ground outside of buildings. Use AWG #12 tracer wire with blue colored low density high molecular weight polyethylene insulation, and lay continuously on pipe so that it is not broken or stressed by backfilling operations. Secure wire to the piping with tape at 18 inch intervals. Solder all joints.

B. Terminals: Precast concrete box and cast iron locking traffic cover, Brooks 3TL, or equal; cover marked with name of service; 6 inches of loose gravel below box. Plastic terminal board with brass bolts; identify line direction with plastic tags. Test for continuity between terminals, after backfilling, in presence of Inspector.

C. Alternate: (use of this alternate material requires approval of authority having jurisdiction): Use electronically detectable plastic tape with metallic core, Terra Tape D, manufactured by Reef Industries, Inc., Seton, Inc., Marking Services, Inc., or equal; tape 2 inches wide, continuously imprinted "CAUTION WATER LINE BELOW". Install, with printed side up, directly over pipe, 18 inches below finish grade. Backfill material shall be as previously specified for the particular condition where pipe is installed, but avoid use of crushed rock or of earth with particles larger than l/2 inch within the top 12 inches of backfill. Take precautions to insure that tape is not damaged or misplaced during backfill operations. Terminal boxes not required.

3.12 CHECK, TEST AND START REQUIREMENTS

A. An authorized representative of the equipment manufacturer shall perform check, test and start of each piece of fire protection equipment. The representative may be an employee of the equipment manufacturer, or a manufacturer-certified contractor. Submit written certification from the manufacturer stating that the representative is qualified to perform the check test and start of the equipment.

1. As part of the submittal process, provide a copy of each manufacturer's printed startup form to be used.
2. Some items of specified equipment may require that check, test and start of equipment must be performed by the manufacturer, using manufacturer's employees. See specific equipment Articles in these Specifications for this requirement.
3. Provide all personnel, test instruments, and equipment to properly perform the check, test and start work.
4. When work has been completed, provide copies of reports for review, prior to final observation of work.

B. Provide copies of the completed check, test and start report of each item of equipment, bound with the Operation and Maintenance Manual.

C. Upon completion of the work, provide a schedule of planned maintenance for each piece of equipment. Indicate frequency of service, recommended spare parts and methods for adjustment and alignment of all equipment components. Provide a copy of the schedule with each operating and maintenance manual. Provide a copy of certification from the Owner's representative indicating that they have been properly instructed in maintenance requirements for the equipment installed.

3.13 COMMISSIONING AND PRELIMINARY OPERATIONAL TESTS

A. Prior to observation to determine final acceptance, put fire protection systems into service and check that work required has been done, including but not limited to the following condensed check list. Provide indexed report to tabulating the results of tests.
1. Equipment has been started, checked, lubricated and adjusted in accordance with manufacturer's recommendations.
2. Correct rotation of motors and ratings of overload heaters are verified.
3. All manufacturers' certificates of start-up specified have been delivered to Owner.
4. All equipment has been cleaned, and damaged painted finishes touched up.
5. Missing or damaged parts have been replaced.
6. Flushing of piping systems has been completed and water treatment equipment, where specified, is completed.
7. Equipment labels, pipe marker labels, ceiling markers and valve tags are installed.
8. Valve tag schedules, corrected control diagrams, sequence of operation lists and start-stop instructions have been posted.
9. Maintenance manuals have been delivered and Owner training has been completed.

B. Review of Contractor's Tests:
1. Tests made by Contractor or manufacturers' representatives are subject to observation and review by Owner. Provide timely notice prior to start of each test, in order to allow for observation of testing. Upon completion of tests, provide letter to confirm that testing has been successful.

C. Test Logs:
1. Maintain test logs listing the tests on mechanical systems showing dates, items tested, inspectors' names, remarks on success or failure of tests.

END OF SECTION

SECTION 21 10 00 - FIRE SPRINKLER SYSTEMS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Sprinkler heads.

B. Pipe and Fittings.

C. Valves.

D. Reduced pressure backflow preventer.

E. Double check valve backflow preventer.

F. Water flow alarm switch.

G. Fire Department connection.

H. Post indicator valve.

1.02 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. Section 21 00 50 Basic Fire Sprinkler Materials and Methods.

1.03 REFERENCES

A. It is the intent of these Specifications to provide for complete and operating fire protection automatic sprinkler system in full compliance with the following standards:
   1. National Fire Protection Association (NFPA) Standard No. 13, 2016, as amended by the CBC.
   2. CBC Chapter 9 (as amended).
   3. NFPA No. 20, 2016.
   4. NFPA No. 24, 2016 (as amended).
   5. NFPA No. 25, 2013 (California Edition).
   6. NFPA No. 25, 2011 (California Edition).

B. The work shall also be in accordance with all local or state requirements that apply.

1.04 DESCRIPTION OF WORK

A. Work of this section includes, but is not necessarily limited to, the following:

B. Furnish all labor, design drawings, calculations, materials, tools, and equipment to install the wet pipe automatic fire sprinkler system as described in this Specification Section. System shall be hydraulically calculated and designed for the building occupancy classification as determined by NFPA 13.
   1. This work includes, but is not limited to the following:

a. Complete automatic fire risers, including valves, fire department connections, flow switches, pressure switch and service mains as indicated.
b. Complete interior wet type automatic fire protection spray type sprinkler distribution system, including overhead service and branch mains, lateral supply piping, supports, hangers, seismic bracing, and heads
c. Required tests and inspections.
d. Provide electrical work required to complete the system. Contractor shall be responsible for providing complete and operable systems, including electrical wiring. Install wiring in conduit, in accordance with Division 26.
e. Protected areas shall include areas above and below the finished ceilings, exterior exposure, canopies, stairways, rooms, areaways, entry, etc, and other areas requiring sprinklers. Thoroughly examine architectural and other drawings as required to satisfy this requirement.
f. Tags, identification labels and instruction manuals for proper operation and maintenance.

C. Provide fire sprinklers to protect combustible building overhangs greater than 4 feet wide, as required by local authority.

D. Determine the static and residual pressure for the site as required for accurate determination of system requirements. Base system calculations on the lowest expected static and residual pressure for the area.
1. Test data for static and residual pressure shall be obtained from water district or local fire department; test shall be made within the last six months prior to start of work.
2. Provide calculations based on 10 percent minimum safety factor. For hydraulically calculated fire sprinkler systems the maximum velocity in the building and the fire main piping shall not exceed 15 feet per second.

1.05 DRAWINGS

A. Contractor shall thoroughly examine architectural, structural, and other Drawings provided as part of this Contract.

B. Number of sprinkler heads indicated on Contract Drawings shall not be reduced. Provide additional heads required for coordination and to obtain approvals. Coordinate suitable head locations and spacing with Architect.

1.06 QUALITY ASSURANCE

A. Manufacturers: Firms regularly engaged in manufacture of fire protection products, of types, materials, and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.

B. Installer: A firm with at least five years of successful installation experience on projects with fire sprinkler piping systems similar to that required for this Project.
1. A State of California Fire Protection Contractor’s license (C-16) is required.

C. Design Criteria: Provide complete fire protection systems as indicated and as required by authority having jurisdiction.
1. When there is conflict between requirements of authority having jurisdiction or requirements of other standards agencies and these Drawings and Specifications, requirements of authority having jurisdiction and recommendations of standards agencies shall govern.
2. Design and install entire system in accord with applicable codes, standards, and regulations.

3. The automatic sprinkler system shall conform to requirements of the 2007 edition of the National Fire Protection Association, Standard No. 13, as amended by the CBC. Contractor shall hydraulically calculate sprinkler system in accordance with NFPA 13.
4. Drawings are diagrammatic only to indicate rooms/areas of sprinkler protection and piping clearances when appropriate. Rerouting of pipe and addition, deletion or relocation of heads may be necessary. Submit proposed layout for approval prior to start of installation.
5. FM Compliance: Comply with Factory Mutual “Approval Guide.”
6. Supply equipment and accessories in accordance with requirements of all applicable national, state and local codes.
7. Items of a given type shall be the products of the same manufacturer.
8. Scheduled equipment performance is minimum capacity required.
9. Scheduled electrical capacity shall be considered as maximum available.

1.07 COORDINATION

A. Coordinate Work in this Section with trades covered in other Sections of Specifications to provide a complete and operable installation of highest quality workmanship.

B. Coordinate location of fire protection piping, mains and branches, to avoid interference with work by other trades. Plumbing drainage piping and ductwork shall have right-of-way over fire protection piping. Wherever conflicts exist, fire protection piping shall be offset or rerouted at no additional cost to Owner. Provide locations of piping for use in Coordinated Layout called for in Specification Section 23 80 00.

C. Piping shall be concealed, except where so indicated or where absolutely necessary to be exposed. Exposed piping shall be placed as approved by Architect prior to installation. Heads shall be fully coordinated with architectural reflected ceiling plan and placed in center of ceiling tiles.

D. On-site measurement of pipe will be required. Offsets, pipe, fittings, drains, etc., required to meet job conditions shall be furnished and installed at no extra cost to Owner.

E. Additional heads required by NFPA 13 regulations shall be provided at no extra cost, if required as a result of Contractors’ coordination. Location of heads and mains shall not be changed unless approved by Architect.

F. Coordinate layout and installation of sprinklers with other construction penetrating ceilings, including light fixtures, HVAC equipment, and partition assemblies.

G. The Architect shall decide any differences or disputes concerning coordination, interference or extent of work, and his decision shall be final.

1.08 SUBMITTALS

A. Samples: Provide one sample of each sprinkler head type.

B. Shop Drawings: Submit in accordance with Division 01, and as follows:
1. Prepare Drawings, calculations, and product data of fire protection systems indicating pipe sized, pipe locations, fittings, shutoffs, equipment, etc. Note, in bold type, any piping which will project beyond finished surfaces of normally occupied rooms, exterior of the building or other locations which will expose the system to view.
2. Manufacturer's data on each item of material or equipment used.
3. Layout drawings and flow calculations approved by agencies having jurisdiction.

4. Drawings and calculations shall be stamped and signed by a State of California licensed professional engineer prior to submission to the Architect. Engineer shall be qualified for this work.

C. Test Reports: As indicated in paragraph “Tests”.
1. Sprinkler pressure test.
2. Standpipe pressure test.
3. Alarm system test.
4. Underground piping test.

D. Operation and Maintenance Manual:
1. Operation and Maintenance Manual in accordance with Section 21 00 50. Include an original manual of NFPA 25, California edition, in Operation and Maintenance Manual for fire sprinkler system.
2. Guarantees in accordance with Division 01.

E. Deferred Approval Documents: Do not proceed with fabrication or installation of fire sprinkler system until deferred approval documents have been approved by regulatory agencies.
1. General: Provide detailed drawings, specifications, and calculations prepared by a State of California licensed professional engineer.
2. Architect Review: Make additions, changes and corrections as directed by Architect and resubmit.
3. Agency Review: Architect will submit documents to Agency or Authority Having Jurisdiction. Make additions, changes and corrections required by Agency / Authority at no cost to Owner and resubmit to Architect.
4. Agency Approval: Architect will submit documents to Agency / Authority for final approval.

1.09 APPLICABLE PUBLICATIONS

A. The following publications form a part of this specification:
1. ANSI - American National Standards Institute.
2. ASME - American Society of Mechanical Engineers.
3. UL - Underwriters' Laboratories, Inc. Fire Resistance Directory.
4. CBC - California Building Code.
5. NFPA National Fire Protection Standards as amended by the CBC.
6. CFC - California Fire Code.
7. CPC - California Plumbing Code.

1.10 SUPERVISION

A. Keep a competent superintendent on the job that shall coordinate the activities of the crafts and maintain the progress of the work to the satisfaction of the Architect.

1.11 SITE CONDITIONS

A. Verify all dimensions at the building site and check existing conditions before beginning work. Make changes that are necessary to coordinate the work with other trades, after review by the Architect.

1.12 REGULATIONS

A. All work shall be installed in strict conformity with California Building Code (CBC), California Plumbing Code (CPC), and California Electric Codes (CEC), Industrial Safety Orders, California Mechanical Code (CMC), California Fire Code (CFC), and other laws and regulations of authorities having jurisdiction.

1.13 FEES AND PERMITS

A. Take out permits and pay fees and charges required in connection with the Work.

1.14 TEMPORARY CONNECTIONS

A. Temporary connections required to maintain services during the course of the Contract shall be made without additional cost to Owner. The normal function of the building must not be interrupted; notify Owner minimum seven days in advance before interrupting any service.

PART 2 - PRODUCTS

2.01 GENERAL

A. The equipment to be furnished under this Specification shall be standard product of manufacturer. Where two or more units of the same class of equipment are required, these units shall be products of a single manufacturer; however, component parts of system need not be products of the same manufacturer.

2.02 MATERIALS AND EQUIPMENT

A. Unless otherwise shown on Drawings, specified, or directed by Architect, materials and equipment used in installation of sprinkler systems shall be listed as approved by FM or UL for fire protection systems, and shall be the latest design of the manufacturer.

2.03 SPRINKLER HEADS

A. Provide spray pattern type sprinkler heads, of ordinary degree temperature rating, except that sprinkler heads for installation in vicinity of heating equipment, and in other areas noted on Drawings, shall have temperature ratings required for such locations by NFPA 13.

B. Sprinkler heads shall be upright, pendent, or sidewall, as required.
   1. Heads in ceilings of occupied spaces with recessed lights shall be chrome plated, semi-recessed pendent type, with white escutcheon.
   2. Sprinkler heads in rooms with surface mounted lights shall be chrome plated pendant style, with two-piece white escutcheon.
   3. Provide head guards in equipment rooms and storage rooms and all other locations where subject to damage.
   4. Upright heads in areas with no ceilings shall be rough bronze finish.
   5. Provide quick response type heads in light and ordinary hazard occupancies.
   6. Side wall heads may be used (except in extended coverage type) to cover special areas where overhead piping and heads are impractical or a considered visual problem by the Architect or Owner. Side wall heads shall be chrome finish.
   7. Outdoor heads, if required shall be dry or freeze resistant.
   8. Adjustable drop nipples are not acceptable.

C. Recessed sprinkler heads shall have chrome finish and adjustable chrome finish escutcheons; exposed pendent heads in finished ceilings shall have chrome finish and white ceiling escutcheons. Concealed (flush) heads shall be all brass, with white cover plate.
   1. Provide oversized escutcheons where required to meet the requirements of ASCE 7.

D. Spare Heads: Furnish spare heads equal to one percent of total number of heads installed under Contract, but not less than twelve. Spare head types furnished shall be representative of types and temperature ratings of heads installed, and in proportion to number of each type and temperature rating of heads installed. Furnish not less than two sprinkler head wrenches, with at

least one wrench for each type of sprinkler head installed. Place spare heads and wrenches in wall mounted box manufactured for this purpose.

2.04 PIPE AND FITTINGS

A. For Installation Aboveground: 150 PSI, Schedule 40 black steel, ASTM A-135 or A-53 with UL approved ductile or cast iron screwed fittings.
1. Schedule 10 black steel pipe, ASTM A 135 or ASTM A 795, with grooved fittings and associated couplings may be used for pipe sizes 2 inches through 5 inches. Provide NFPA 13-specified wall thickness for pipe sizes 6 inches through 10 inches. Threading of piping will not be accepted.

B. For Installation Underground to 12 inches Above Ground:
1. Pipe and fittings shall be approved for fire protection use.
2. Underground Piping Outside Building: PVC Pipe: AWWA C900 or UL 1285, Class 200, with bell end with gasket, and with spigot end. PVC Fittings: AWWA C900 or UL 1285, Class 200, with bell-and-spigot or double-bell ends. Include elastomeric gasket in each bell.

a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

1) Diamond Plastics Corporation.
2) J.M. Eagle, Inc.

3. Underground Piping Below Building Footing and Slab: One-piece, 304 stainless steel 90-degree fitting, with AWWA C900 gasketed bell-and-spigot inlet connection with lugs on inlet end, and AWWA C606 groove on outlet end, for connection to in-building riser using AWWA C606 grooved couplers and gaskets.

a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

1) Ames Fire and Waterworks, a Watts Water Technologies Company.
2) Wilkins, a Zurn Company.

C. Standpipes: Schedule 40 galvanized steel with 300 psi galvanized fittings.

D. Mechanical tees, saddle fittings, bushings and mechanical sprinkler head fittings shall not be used.

2.05 ENCASEMENT FOR PIPING

A. Standard: ASTM A 674 or AWWA C105.

B. Material: Linear low-density PE film of 0.008-inch minimum thickness.

C. Form: Tube.

D. Color: Natural.
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

a. Northtown Pipe Protection Products; Polywrap.

2.06 VALVES

A. Angle, Check, and Globe Valves: Fed. Spec WW-V-51; Class A, type as suitable for application.
   1. Select check valves for installation in vertical lines recommended by manufacturer as suitable for vertical installation. Install in vertical lines only where flow is upward.

B. Gate Valves:
   1. Sizes 1-1/2 inches or less: Fed. Spec WW-V-54, Class A.
   2. Sizes above 1-1/2 inches: Fed. Spec WW-V-58, Class A, designation OS or OF, as required. Provide OS&Y type, 175 pound rated working pressure.
   3. Furnish and deliver to Owner one wrench of each size required for operating underground valves.

C. Drain Valves: angle, or globe. Fed. Spec WW-V-51; Class A, type as suitable for application.
   1. UL listed and FM approved combination test and drain fittings may be used.

D. Zone Control Valves: UL listed, outside screw and yoke or butterfly. Valves shall be sealed open with approved seal. Provide weatherproof actuator housing, with two single pole, double throw switches.
   1. Supervisory Switch: Fit the control valves on the fire sprinkler risers with supervisory switch, with single pole double throw switch actuator installed to change switch position when valve is being closed.

2.07 REDUCED PRESSURE PRINCIPLE BACKFLOW PREVENTER

A. Provide reduced-pressure principle backflow preventer assembly, including shutoff valves on inlet and outlet, and strainer on inlet, equal to Febco 860 or 880, as required. Backflow preventer shall include test cocks, and pressure differential relief valve located between two positive seating check valves. Construct in accordance with ASSE Standard 1013.

B. Provide minimum 13 gage one or two piece expanded metal backflow preventer enclosure, sized to suit size of backflow preventer. Furnish with mounting hardware and provision for locking enclosure in closed position. Install on concrete pad, in accordance with manufacturer's installation instructions.
   1. Manufacturer: Subject to compliance with requirements and local fire and water authorities having jurisdiction, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

      a. LeMeur Welding and Manufacturing: BF series.
      b. Backflow Protection Co.: Ultimate Tuff Cage.

C. Provide padlock and chain to lock valves in open position, and give key to Project Inspector.
   1. Padlocks shall be as specified under Section 08 70 00.
   2. Chain shall be of carbon steel, 3/8 inch wire diameter, fully welded links and weight of 140 pounds per 100 linear feet. Chain shall be hot galvanized.

D. Provide capped connections at each test cock. Install in accordance with requirements of authorities having jurisdiction.

E. Provide water flow alarm switch at each main valve. Arrange to provide alarm if valves are closed.

F. For units installed within buildings, provide drain, connected to unit, to collect spillage from atmospheric vent. Run drain to nearest floor sink or drain.

G. Manufacturer: Subject to compliance with requirements and local fire and water authorities having jurisdiction, available manufacturers offering products that may be incorporated into the Work include the following, or equal:
   1. Ames Fire and Waterworks: a division of Watts Water Technologies, Inc.
   2. Febco: a division of Watts Water Technologies, Inc.
   3. Watts Water Technologies, Inc.
   4. Wilkins: a Zurn Company.
   5. Conbraco Industries, Inc.

2.08 DOUBLE CHECK DETECTOR VALVE BACKFLOW PREVENTERS

A. Provide double detector check valve assembly consisting of two spring loaded brass check valves, two cast iron bronze fitted gate valves and four test cocks, equal to Febco Model 856 or 876 as required. Construct in accordance with ASSE Standard 1048.

B. Provide minimum 13 gage one or two piece expanded metal backflow preventer enclosure, sized to suit size of backflow preventer. Furnish with mounting hardware and provision for locking enclosure in closed position. Install on concrete pad, in accordance with manufacturer's installation instructions.
   1. Manufacturer: Subject to compliance with requirements and local fire and water authorities having jurisdiction, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

      a. LeMeur Welding and Manufacturing: BF series.
      b. Backflow Protection Co.: Ultimate Tuff Cage.

C. Provide padlock and chain to lock valves in open position, and give key to Project Inspector.
   1. Padlocks shall be as specified under Section 08 70 00.
   2. Chain shall be of carbon steel, 3/8 inch wire diameter, fully welded links and weight of 140 pounds per 100 linear feet. Chain shall be hot galvanized.

D. Provide water flow alarm switch at each main valve. Arrange to provide alarm if valves are closed.

E. For units installed within buildings, provide drain, connected to unit, to collect spillage from atmospheric vent. Run drain to nearest floor sink or drain.

F. Provide capped connections at each test cock. Install in accordance with requirements of authorities having jurisdiction.

G. Manufacturer: Subject to compliance with requirements and local fire and water authorities having jurisdiction, available manufacturers offering products that may be incorporated into the Work include the following, or equal:
   1. Ames Fire and Waterworks: a division of Watts Water Technologies, Inc.
   2. Febco: a division of Watts Water Technologies, Inc.
   3. Watts Water Technologies, Inc.
   4. Wilkins: a Zurn Company.
   5. Conbraco Industries, Inc.

2.09 WATER FLOW ALARM SWITCH

A. UL listed water flow alarm switch suitable for variable pressure, complete with instantaneous recycling retard and two single pole double throw electrical contacts. Provide continuously monitored water flow alarm switch and trouble sensor, automatically transmitted to an approved control alarm station.

2.10 FIRE DEPARTMENT CONNECTION

A. Post mounted, complying with Local Fire Marshal standards cast brass two-way inlet body with drop clappers. Two brass double female snoots with rigid end N.P.T.X. pin lug house thread swivels, plugs and chain.

B. Provide check valve in the piping between the inlet connection and the fire protection system. Provide ball drip at low point of piping, below grade on the Siamese side of the check valve, and drain to gravel sump. Provide gravel sump with minimum 3 cubic feet of course gravel.

2.11 POST INDICATOR VALVE

A. Mueller, American Cast Iron Pipe Co., or equal, UL-listed; provide handle lock and water flow alarm switch.

2.12 UNION AND FLANGES

A. Size and Type:
1. Steel 2 inches and smaller: 150 pound screwed black or galvanized malleable iron, match pipe, ground joint, brass to iron seat.
2. Steel 2-1/ inches and larger: 150 pound black flange union, flat faced, full gasket.

B. Gaskets: 1/16 inch thick rubber Garlock #122, Johns-Manville, or equal.

C. Flange Bolts: Open hearth bolt steel, square heads, with cold pressed hexagonal nuts, cadmium plated in ground. Provide copper plated steel bolts and nuts or brass bolts and nuts for brass flanges.

2.13 GAUGES

A. Marsh "Quality Gage", U.S. Gage, Danton 800, or equal, with bronze bushed movement and front recalibration. Dials shall be white with black numerals, 3-1/2 inch dial face. Normal reading shall be at midscale. Provide a three-way valve on each gauge connection.

PART 3 - EXECUTION

3.01 GENERAL

A. Installation of the sprinkler system shall not be started until complete plans and specifications (including water supply information and type of existing sprinkler system, if any) have been approved by the State Fire Marshal.
1. Piping shall be concealed unless shown or otherwise directed.
2. Where piping is left exposed within a room, it shall be run true to vertical, horizontal or intended planes. Where possible, uniform margins shall be maintained between parallel lines and/or adjacent wall, floor or ceiling surfaces.
3. Horizontal runs of pipes and/or electrical conduit suspended from ceilings shall provide for maximum headroom clearance. This clearance shall not be less than 7'-6" without written approval from Architect.
4. Minor changes in locations of equipment, piping, etc., from locations shown shall be made when directed by Architect at no additional cost to Owner, providing such change is ordered before such items of work, or work directly connected to same, are installed and providing no additional material is required.
5. Grade all piping as required by NFPA 13.
6. Close ends of pipe immediately after installation; leave closure in place until removal is necessary for completion of installation.

7. Piping systems shall be thoroughly flushed and proved clean before connection to equipment.
8. Pipe discharge of each drain valve to floor sink or drain.

3.02 HANGERS AND SUPPORTS

A. General: Support piping so that it is firmly held in place by approved iron hangers and supports and by special hangers as required in accordance with NFPA 13. Hangers shall support loads specified in NFPA 13, and, in addition, shall support weight of pipe, fluid and pipe insulation, based on spacing between supports with a minimum factor of safety of five based on ultimate strength of material used. Do not exceed manufacturer's load rating. Pipe attachments, or hangers, shall be of same size as pipe or tubing on which used, or nearest larger size available. Materials, design, and type numbers per Manufacturers' Standardization Society (MSS) Standard Practice SP-58, provide branch line restraints where hangers exceed 6 inches long, in accordance with NFPA 13. Install concrete anchors required. Hanger material shall be approved by Architect before installation. Do not support piping by plumbers' tape, wire, rope, wood or other makeshift devices.

B. Suspend rods from angle clips, in accordance with Section 21 00 50.

3.03 SEISMIC REQUIREMENTS

A. Comply with CBC, Volume 2, Chapter 16A and CBC Chapter 9 and NFPA 13.

B. Seismic bracing system shall be a complete pre-engineered bracing system. Pre-engineered bracing system shall include plan layout, brace selection, specification, and calculations. Complete system shall be submitted to Architect for review. See Delegated Design Submittal paragraph in article, Submittals, in Section 21 00 50.

C. Anchorage for various manufactured and fabricated items is detailed and scheduled on the drawings or specified.
1. For proposed changes to anchorage shown, or specified, submit proposed methods of anchorage with calculations prepared by a California Registered Structural Engineer. Design of anchorage shall comply with the above regulations using minimum coefficients, CP, listed CBC Chapter 16A.

D. It is not intended that prototype or non-standard equipment or equipment frames be provided. However, items of equipment shown or specified to be anchored shall maintain integrity at point of anchor after being subjected to accelerations equivalent to those established herein.

E. Anchors: Piping shall be provided with anchors for protection of piping against damage due to earthquakes, as required by CBC Chapter 16A, NFPA 13, and other sections of this specification.

3.04 TESTS

A. At various stages and upon completion, the system must be tested in the presence of the enforcing agency.

B. Upon completion and prior to acceptance of the installation, subject the entire new system to the tests required in NFPA 13, and shall furnish the Owner with certificates as appropriate.

3.05 IDENTIFICATION

A. Coordinate requirements with the authority having jurisdiction.

B. Provide brass valve tags at each system valve, indicating valve service.

C. Provide signage at each sprinkler valve, with sign indicating specific portion of system controlled by valve.

D. Provide signage at each outdoor alarm device, with sign indicating which authority to call if device is activated.

E. Prior to final acceptance, Contractor shall provide accurate color-coded Building Plan at riser location, clearly depicting fire protection system area of coverage, location of inspectors' test/drain connection and auxiliary drain connections. Provide this information at each system or building at riser location for building. Plan(s) shall be ½ size and plastic laminated.

F. Provide hydraulic data signage permanently attached to risers, indicating location, basis of design, water supply and pressure requirements of system.

3.06 ELECTRICAL WIRING

A. Coordination of wiring systems is part of this work. Contractor shall ensure that the following is completed.
   1. Work provided in other Specification Sections:
      a. Supervised wiring to fire alarm control panel.
      b. Supervised wiring from main waterflow indicator to fire alarm panel.
      c. Supervised wiring from sprinkler flow switches to fire alarm panel.
      d. Supervised wiring from valve water flow alarm switches to fire alarm panel.
   2. Work provided in this Specification Section:
      a. Wiring diagrams for devices.
      b. Other wiring not specified to provide an operating system.

3.07 SPRINKLER HEADS

A. Heads shall be placed upright where on exposed piping, unless otherwise noted, and in pendant position on concealed piping, unless noted otherwise, with deflectors parallel to the ceiling or roof slope. Clearance between deflectors and ceilings, electric, or heating equipment, or other obstruction shall be in accordance with the requirements of NFPA 13. Provide sprinkler head guards where heads are subject to mechanical damage, for example, at mechanical rooms, and storage rooms and gymnasiums.

B. Mount box containing spare sprinkler heads and wrenches on wall in location selected by Owner.

C. Do not install pendant sprinkler heads until flushing of the piping has been completed.

D. Provide return bend as illustrated in NFPA 13 (NFPA exceptions do not apply) for each sprinkler head installed in finished ceiling.

3.08 INSTALLATION OF PIPING

A. Pipe shall be assembled in accordance with the requirements of NFPA 13 and NFPA 24.

B. Install pipe encasement on underground and under-slab metal piping.

C. Provide concrete thrust blocks in accordance with NFPA 24 and CBC.

3.09 VALVES

A. All valves shall be identified by permanent metal tags or other approved means.

3.10 DRAINS

A. Auxiliary drains shall be installed on low points in each system.
   1. Five or fewer trapped gallons will not require a drain valve but may be drained through a plugged fitting. Drain valves shall be in accordance with the requirements of NFPA 13.

B. Install one inspector's test drain on sprinkler system. Extend drain to outside in location approved by Architect. Water discharge shall be positioned such that landscaping will not be damaged.

C. Drain valves shall be piped to a safe place of discharge and discharge shall be visible either by open-end drainpipe or sight drain fitting.

D. Provide flushing connections at ends of cross-mains.

3.11 INSTALLATION OF BACKFLOW PREVENTERS

A. Install backflow preventers where indicated on Drawings. Provide available manufacturers drain connection, pipe drain outlet to nearest floor sink or drain.
   1. Where drain pans are shown on Drawings, pipe drain pan outlet to nearest floor sink or drain.

3.12 SLEEVES

A. Install AMI Products, Adjus-to-Crete, or equal, pipe sleeves of sufficient size to allow for free motion of pipe, 24 gauge galvanized steel. The space between pipe and sleeves through floor slabs on ground, through outside walls above or below grade, through roof, and other locations as directed shall be caulked with oakum and mastic and made watertight. The space between pipe and sleeve and between sleeve and slab or wall shall be sealed watertight.

B. At walls below grade Link-Seal casing seals, or equal, may be used in lieu of caulking. Pipes penetrating walls below grade shall be anchored at wall.

3.13 FLOOR, WALL, AND CEILING PLATES

A. Fit pipes with or without insulation passing through walls, floors, or ceilings and hanger rods penetrating finished ceilings with chrome plated or stainless steel plates.

3.14 FIRESAFING

A. The annular space between pipe sleeves and pipe passing through all floors and walls shall be packed with incombustible mastic or other suitable material, in accordance with U.L. Fire Resistance Directory.

B. Penetrations in fire rated assemblies shall also be protected in accordance with CBC Chapter 7, Section 712, and UL Fire Resistance Directory.

3.15 UNION AND FLANGES

A. Install unions whether shown or not at each connection to equipment and at one connection to each valve or cock.

B. Locate the unions for easy removal of the equipment or valve.

3.16 CLEANING

A. Upon completion of tests, clean equipment, piping, etc., installed under this Section of the Specifications.

3.17 FLUSH

A. Entire system shall be flushed out and cleaned after completion of piping, and prior to installation of sprinkler heads. Flush shall be continued until water runs clear at drain connections.

END OF SECTION

SECTION 22 00 50 - BASIC PLUMBING MATERIALS AND METHODS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Electric motors.

B. Motor starters.

C. Valves and fittings.

D. Strainers.

E. Valve boxes.

F. Gauges.

G. Thermometers.

H. Access Doors.

I. Expansion loops.

J. Flexible joints.

K. Insulation.

1.02 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. This Section is a part of each Division 22 Section.

1.03 ADDITIONAL REQUIREMENTS

A. Furnish and install any incidental work not shown or specified which is necessary to provide a complete and workable system.

B. Make all temporary connections required to maintain services during the course of this Contract without additional cost to the Owner. Notify the Owner seven days in advance before disturbing any service.

1.04 REFERENCED STANDARDS

A. Where material or equipment is specified to conform to referenced standards, it shall be assumed that the most recent edition of the standard in effect at the time of bid shall be used.
   1. CSA – Canadian Standards Association International.
   2. ANSI - American National Standards Institute.
   3. ASTM - American Society for Testing and Materials.
   4. CCR - California Code of Regulations.
      a. Title 8 - Division of Industrial Safety, Subchapter 7; General Industry Safety Orders, Articles 31 through 36.

5. NCPWB - National Certified Pipe Welding Bureau.
6. CEC - California Electrical Code.
7. NEMA - National Electrical Manufacturers' Association.
8. NFPA - National Fire Protection Association.
9. OSHA - Occupational Safety and Health Act.
10. UL - Underwriters' Laboratories, Inc.

1.05 DRAWINGS

A. Examine Contract Documents prior to bidding of work and report discrepancies in writing to Architect.

B. Drawings showing location of equipment and materials are diagrammatic and job conditions will not always permit installation in location shown. The Plumbing Drawings show general arrangement of equipment and materials, etc., and shall be followed as closely as existing conditions, actual building construction, and work of other trades permit.
   1. Architectural and Structural Drawings shall be considered part of the Work. These Drawings furnish Contractor with information relating to design and construction of the Project. Architectural Drawings take precedence over Plumbing Drawings.
   2. Because of the small scale of Plumbing Drawings, not all offsets, fittings, and accessories required are shown. Investigate structural and finish conditions affecting the Work and arrange Work accordingly. Provide offsets, fittings, and accessories required to meet conditions. Inform Architect immediately when job conditions do not permit installation of equipment and materials in the locations shown. Obtain the Architects approval prior to relocation of equipment and materials.
   3. Relocate equipment and materials installed without prior approval of the Architect. Remove and relocate equipment and materials at Contactors' expense upon Architects' direction.
   4. Minor changes in locations of equipment, piping, etc., from locations shown shall be made when directed by the Architect at no additional cost to the Owner providing such change is ordered before such items of work, or work directly connected to same are installed and providing no additional material is required.

C. Execute work mentioned in Specifications and not shown on Drawings, or vice versa, the same as if specifically mentioned or shown in both.

1.06 REQUIREMENTS OF REGULATORY AGENCIES

A. The publications listed below form part of this specification; comply with provisions of these publications except as otherwise shown or specified.
   1. California Building Code, 2016.
   2. California Electrical Code, 2016.
   3. California Energy Code, 2016.
   4. California Fire Code, 2016.
   5. California Green Building Standards Code, 2016.
   6. California Mechanical Code, 2016.
   7. California Plumbing Code, 2016.
   8. California Code of Regulations, Title 24.
   9. California Health and Safety Code.
   10. CAL-OSHA.
   11. California State Fire Marshal, Title 19 CCR.
   12. National Fire Protection Association.
   13. Occupational Safety and Health Administration.
   14. Other applicable state laws.

B. Nothing in Drawings or specifications shall be construed to permit work not conforming to these codes, or to requirements of authorities having jurisdiction. It is not the intent of Drawings or specifications to repeat requirements of codes except where necessary for clarity.

C. Comply with State of California 2016 Energy Code for all systems, equipment, and construction.

1.07 FEES AND PERMITS

A. Obtain and pay for all permits and service required in installation of this work; arrange for required inspections and secure approvals from authorities having jurisdiction. Comply with requirements of Division 01.

B. Arrange for utility connections and pay charges incurred, including excess service charges.

C. Prior to the start of construction, contact local gas company representative and coordinate location of gas meter and piping. In addition, coordinate time required for installation, in order to avoid delay to the Project.

D. Obtain permits to operate compressed air tanks required to be furnished under this Work. Pay costs, and perform tests required to obtain permits. Post permits under glass in a conspicuous place on or near tanks, or as required by authorities having jurisdiction.

1.08 UTILITY CONNECTIONS

A. Bear the cost of construction related to utility services, from point of connection to utility services shown on Contract Documents. This includes piping, excavation, backfill, meters, boxes, check valves, backflow prevention devices, general service valves, concrete work, and the like, whether or not Work is performed by Contractor, local water/sanitation district, public utility, other governmental agencies or agencies' assigns.

1.09 FRAMING, CUTTING AND PATCHING

A. Special framing, recesses, chases and backing for Work of this Section, unless otherwise specified, are covered under other Specification Sections.

B. Contractor is responsible for placement of pipe sleeves, hangers, inserts, supports, and location of openings for the Work.

1.10 SUBMITTALS

A. Submittal packages may be submitted via email as PDF electronic files, or as printed packages. PDFs shall be legible at actual size (100 percent). Provide seven copies of printed submittal packages.

B. Provide submittal of materials proposed for use as part of this Project. Product names in Specifications and on Drawings are used as standards of quality. Furnish standard items on specified equipment at no extra cost to the Contract regardless of disposition of submittal data. Other materials or methods shall not be used unless approved in writing by Architect. Architect's review will be required even though "or equal" or synonymous terms are used. Refer to Division 01 for complete instructions.
   1. Partial or incomplete submittals will not be considered.
   2. Quantities are Contractor's responsibility and will not be reviewed.
   3. Provide materials of the same brand or manufacturer for each class of equipment or material.

4. Identify each item by manufacturer, brand, trade name, number, size, rating, or other data necessary to properly identify and review materials and equipment. Words "as specified" are not sufficient identification.
5. Identify each submittal item by reference to items' Specification Section number and paragraph, by Drawing and detail number, and by unit tag number.
6. Organize submittals in same sequence as in Specification Sections.
7. Show physical arrangement, construction details, finishes, materials used in fabrications, provisions for piping entrance, access requirements for installation and maintenance, physical size, mechanical characteristics, foundation and support details, and weight.
    a. Submit Shop Drawings, performance curves, and other pertinent data, showing size and capacity of proposed materials.
    b. Specifically indicate, by drawn detail or note, that equipment complies with each specifically stated requirement of Contract Documents.
    c. Drawings shall be drawn to scale and dimensioned (except schematic diagrams). Drawings may be prepared by vendor but must be submitted as instruments of Contractor, thoroughly checked and signed by Contractor before submission to Architect for review.
    d. Catalog cuts and published material may be included with supplemental scaled drawings.

C. Review of submittals will be only for general conformance with design concept and general compliance with information given in Contract Documents. Review will not include quantities, dimensions, weights or gauges, fabrication processes, construction methods, coordination with work of other trades, or construction safety precautions, which are sole responsibility of Contractor. Review of a component of an assembly does not indicate acceptance of an assembly. Deviations from Contract Documents not clearly identified by Contractor are Contractor's responsibility and will not be reviewed by Architect.

D. Within reasonable time after award of contract and in ample time to avoid delay of construction, submit to Architect Shop Drawings or submittals on all items of equipment and materials provided. Provide submittal in at least seven copies and in complete package.
    1. Shop Drawings and submittals shall include Specification Section, Paragraph number, and Drawing unit symbol or detail number for reference. Organize submittals into booklets for each Specification section and submit in loose-leaf binders with index. Deviations from the Contract Documents shall be prominently displayed in the front of the submittal package and referenced to the applicable Contract requirement.

E. Furnish to the Project Inspector complete installation instructions on material and equipment before starting installation.

F. Provide product data for insulation products, including insulation, insulation facings, jackets, adhesives, sealants, and coatings, indicating compliance with requirement that these products contain less than 0.1 percent (by mass) polybrominated diphenyl ethers (PBDEs) in penta, octa, or deca formulations.

G. Sustainable Design Submittals:
    1. Product Data: For adhesives and sealants, documentation of compliance including printed statement of VOC content and chemical components.
    2. Laboratory Test Reports: For adhesives and sealants, indicating compliance with requirements for low-emitting materials.

H. Pipe, pipe or plumbing fittings, fixtures, solder and flux installed in a system providing water for human consumption shall comply with lead free requirements of the California Health and Safety Code Section 11 68 75. Provide submittal information for products third-party certified by an approved laboratory as complying with California Health and Safety Code Section 11 68 75.

I. Delegated-Design Submittal: For seismic supports, anchorages, and restraints indicated to comply with performance requirements and design criteria.
   1. Calculations performed for use in selection of seismic supports, anchorages, and restraints shall utilize criteria indicated in Structural Contract Documents.
   2. Supports, anchorage and restraints for piping, ductwork, and equipment shall be an OSHPD pre-approved system such as Tolco, Afcon, ISAT, Badger, Mason, or equal. Pipes, ducts and equipment shall be seismically restrained in accordance with requirements of current edition of California Building Code. System shall have current OPM number and shall meet additional requirements of authority having jurisdiction. Provide supporting documentation required by the reviewing authority and the Architect and Engineer. Provide layout drawings showing piping, ductwork and restraint locations.
      a. Bracing of Piping and Equipment: Specifically state how bracing attachment to structure is accomplished. Provide shop drawings indicating seismic restraints, including details of anchorage to building. In-line equipment must be braced independently of piping, and in conformance with applicable building codes. Provide calculations to show that pre-approval numbers have been correctly applied in accordance with general information notes of pre-approval documentation.
   3. In lieu of the above or for non-standard installations not covered in the above pre-approved systems, Contractor shall provide layout drawings showing piping, ductwork, and restraint locations, and detail supports, attachments and restraints, and furnish supporting calculations and legible details sealed by a California registered structural engineer, in accordance with 2016 California Building Code
   4. Additional Requirements: In addition to the above, conform to all state and local requirements.

1.11 SUBSTITUTIONS

A. Refer to Division 01 for complete instructions. Requirements given below are in addition to or are intended to amplify Division 01 requirements. In the case of conflict between requirements given herein and those of Division 01, Division 01 requirements shall apply.

B. It is the responsibility of Contractor to assume costs incurred because of additional work and or changes required to incorporate proposed substitute into the Project. Refer to Division 01 for complete instructions.

C. Substitutions will be interpreted to be all manufacturers other than those specifically listed in the Contract Documents by brand name, model or catalog number.

D. Only one request for substitution will be considered for each item of equipment or material.

E. Substitution requests shall include the following:
   1. Reason for substitution request.
   2. Complete submittal information as described herein; see “Submittals.”
   3. Coordinated scale layout drawings depicting position of substituted equipment in relation to other work, with required clearances for operation, maintenance and replacement.
   4. List optional features required for substituted equipment to meet functional requirements of the system as indicated in Contract Documents.
   5. Explanation of impact on connected utilities.
   6. Explanation of impact on structural supports.

F. Installation of reviewed substitution is the Contractors’ responsibility. Any mechanical, electrical, structural, or other changes required for installation of reviewed substituted equipment or material must be made by the Contractor without additional cost to the Owner. Review by the Architect of the substituted equipment or material, including dimensioned Drawings will not waive these requirements.

G. Contractor may be required to compensate the Architect for costs related to substituted equipment or material.

1.12 OPERATION AND MAINTENANCE MANUAL

A. Furnish three complete sets of Operation and Maintenance Manual bound in hardboard binder, and one compact disc containing complete Operation and Maintenance Manual in searchable PDF format. Provide Table of Contents. Provide index tabs for each piece of equipment in binder and disc. Start compiling data upon approval of submittals.
   1. Sets shall incorporate the following:
      a. Service telephone number, address and contact person for each category of equipment or system.
      b. Complete operating instructions for each item of plumbing equipment.
      c. Copies of guarantees/warrantees for each item of equipment or systems.
      d. Test data and system balancing reports.
      e. Typewritten maintenance instructions for each item of equipment listing lubricants to be used, frequency of lubrication, inspections required, adjustment, etc.
      f. Manufacturers' bulletins with parts numbers, instructions, etc., for each item of equipment.
      g. Control diagrams and literature.
      h. A complete list or schedule of all scheduled valves giving the number of the valve, location and the rooms or area controlled by the valve. Identify each valve with a permanently attached metal tag stamped with number to match schedule. Post list in frame under plastic on wall in mechanical room or where directed by Architect.
      i. Check test and start reports for each piece of plumbing equipment provided as part of the Work.
      j. Commissioning and Preliminary Operation Tests required as part of the Work.

B. Post service telephone numbers and/or addresses in an appropriate place as designated by the Architect.

1.13 SITE CONDITIONS

A. Information on Drawings relative to existing conditions is approximate. Deviations from Drawings necessary during progress of construction to conform to actual conditions shall be approved by the Architect and shall be made without additional cost to the Owner. The Contractor shall be held responsible for damage caused to existing services. Promptly notify the Architect if services are found which are not shown on Drawings.

1.14 WARRANTY

A. Refer to Division 01 for warranty requirements, including effective date of warranty. Refer to specific items of equipment specified herein for warranty duration if different from that specified in Division 01.

B. Repair or replace defective work, material, or part that appears within the warranty period, including damage caused by leaks.

C. On failure to comply with the above warranty within a reasonable length of time after notification is given, the Architect/Owner shall have the repairs made at the Contractor's expense.

1.15 RECORD DRAWINGS

A. Refer to Division 01, Record Documents, for requirements governing Work specified herein.

B. Upon completion of the work, deliver to Architect the following:
   1. Originals of drawings showing the Work exactly as installed.
   2. One complete set of reproducible drawings showing the Work exactly as installed.
   3. One compact disc with complete set of drawings in PDF format showing the Work exactly as installed.

C. Provide Contractor's signature, verifying accuracy of record drawings.

D. Obtain the signature of the Project Inspector for all record drawings.

1.16 DELIVERY AND STORAGE

A. Protect equipment and piping delivered to Project site from weather, humidity and temperature variations, dirt, dust and other contaminants.

1.17 COORDINATION

A. General:
   1. Coordinate Work in this Section with trades covered in other Specifications Sections to provide a complete, operable and sanitary installation of the highest quality workmanship.

B. Electrical Coordination:
   1. Refer to the Electrical Drawings and Specifications, Division 26, for service voltage and power feed wiring for equipment specified under this section. Contractor has full responsibility for the following items of work:
      a. Review the Electrical Drawings and Division 26 Specifications to verify that electrical services provided are adequate and compatible with equipment requirements.
      b. If additional electrical services are required above that indicated on Electrical Drawings and in Division 26, such as more control interlock conductors, larger feeder, or separate 120 volt control power source, include cost to furnish and install additional electrical services as part of the bid.
      c. Prior to proceeding with installation of additional electrical work, submit detailed drawings indicating exact scope of additional electrical work.

C. Mechanical Coordination:
   1. Arrange for pipe spaces, chases, slots and openings in building structure during progress of construction, to accommodate mechanical system installation.
   2. Coordinate installation of supporting devices. Set sleeves in poured-in-place concrete and other structural components during progress of construction.
   3. Coordinate requirements for access panels and doors for mechanical items requiring access where concealed behind finished surfaces. Access panels and doors are specified in Division 08 Section "Access Doors and Frames."

PART 2 - PRODUCTS

2.01 GENERAL

A. Materials or equipment of the same type shall be of the same brand wherever possible. All materials shall be new and in first class condition.

B. All sizes, capacities, and efficiency ratings shown are minimum, except that gas capacity is maximum available.

C. Refer to Sections 22 10 00 and 23 80 00 for specific system piping materials.

2.02 MATERIALS

A. No material installed as part of this Work shall contain asbestos.

2.03 ELECTRIC MOTORS

A. General Motor Requirements: Comply with NEMA MG 1 unless otherwise indicated. Comply with IEEE 841 for severe-duty motors.
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:
      a. U.S. Motors.
      b. Century Electric.
      c. General Electric.
      d. Lincoln.
      e. Gould.

B. Motor Characteristics: Designed for continuous duty at ambient temperature of 40 deg. C and at altitude of 3300 feet above sea level. Capacity and torque shall be sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.
   1. Motors exceeding the nameplate amperage shall be promptly replaced at no cost to the Owner. Horsepower shown is minimum and shall be increased as necessary to comply with above requirements. Furnish motors with splash-proof or weatherproof housings, where required or recommended by the manufacturer. Match the nameplate voltage rating with the electrical service supplied. Check Electrical Drawings. Provide a transformer for each motor not wound specifically for system voltage.

C. Polyphase Motors: NEMA MG 1, Design B, medium induction motor, premium efficiency as defined in NEMA MG 1. Select motors with service factor of 1.15. Provide motor with random-wound, squirrel cage rotor, and permanently lubricated or regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading. Temperature rise shall match insulation rating. Provide Class F insulation.
   1. Multispeed motors shall have separate windings for each speed.

D. Polyphase Motors with Additional Requirements:
   1. Motors Used with Reduced-Voltage and Multispeed Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.
   2. Motors Used with Variable Frequency Controllers:
      a. Separately Connected Motors: Ratings, characteristics, and features coordinated with and approved by controller manufacturer.
      b. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse-width modulated inverters.
      c. Energy- and Premium-Efficient Motors: Class B temperature rise; Class F insulation.
      d. Inverter-Duty Motors: Class F temperature rise; Class H insulation.
      e. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.
      f. Each motor shall be provided with a shaft grounding device for stray current protection.
   3. Severe-Duty Motors: Comply with IEEE 841, with 1.15 minimum service factor.

E. Single-Phase Motors:
   1. Select motors with service factor of 1.15.

2. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:
   a. Permanent-split capacitor.
   b. Split phase.
   c. Capacitor start, inductor run.
   d. Capacitor start, capacitor run.
3. Multispeed Motors: Variable-torque, permanent-split-capacitor type.
4. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.
5. Motors 1/20 HP and Smaller: Shaded-pole type.

F. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

2.04 MOTOR STARTERS

A. Square D, Allen Bradley, or equal, in NEMA Type 1 enclosure, unless otherwise specified or required. Minimum starter size shall be Size 1. Provide NEMA 3R enclosure where exposed to outdoors.

B. Provide magnetic motor starters for equipment provided under the Mechanical Work. Starters shall be non-combination type. Provide part winding or reduced voltage start motors where shown or as hereinafter specified. Minimum size starter shall be Size 1.
1. All starters shall have the following:
   a. Cover mounted hand-off-automatic switch. Starters installed exposed in occupied spaces shall have key operated HOA switch.
   b. Ambient compensated thermal overload.
   c. Fused control transformer (for 120 or 24 volt service).
   d. Pilot lights, integral with the starters. Starters located outdoors shall be in NEMA IIIR enclosures.
2. Where three phase motors are provided for two-speed operation, provide two speed motor starters.
3. Starters for single-phase motors shall have thermal overloads. NEMA I enclosure for starters located indoors, NEMA IIIR enclosure for starters located outdoors.
4. Provide OSHA label indicating the device starts automatically.

2.05 VALVES AND FITTINGS FOR POTABLE WATER SYSTEMS

A. General:
1. Provide valves and fittings conforming to lead-free requirements of California Health and Safety Code Section 11 68 75.
   a. Provide valves listed to NSF/ANSI 61-G or NSF/ANSI 372 for valve materials for potable-water service.
      1) Exception: Main distribution gate valves above 1-1/2 inches located underground outside building are not required to conform lead-free requirements of California Health and Safety Code Section 11 68 75.

B. Gate Valves:
1. General: Furnish valves in copper lines with adapters to suit valve/line requirements.
2. 1-1/2 inches and smaller: Minimum 200 psi CWP, bronze body, threaded bonnet, rising or non-rising stem, solid wedge, threaded or solder ends, conforming to MSS SP-80. Milwaukee UP148, UP149, Nibco T-113-LF, S-113-LF, or equal.

3. 2 inches through 3 inches: Minimum 200 psi CWP, bronze body, threaded bonnet, non-rising stem, solid wedge, threaded or solder ends, conforming to MSS SP-80. Nibco T-113-LF, S-113-LF, or equal.
4. Main distribution gate valves underground outside building above 1-1/2 inches:
   a. Underground valves 2 inches thru 12 inches: 250 psi, iron body, Non-rising stem, bolted bonnet, resilient wedge valves, conforming to AWWA C509, equipped with operating nuts, Mueller Series 2360, Nibco F-619-RW-SON, or equal.
      1) Underground valves 3 inches and smaller may be furnished with operating nuts or hand-wheels, and with Ring-Tite joint ends.
      2) Furnish and deliver to Owner one wrench of each size required for operating underground valves.

C. Ball Valves:
1. 2 inches and smaller: 600 psi CWP, cast bronze or brass body, full port, two piece, threaded ends, and reinforced PTFE seal, conforming to MSS SP-110. Nibco T-685-80-LF, Milwaukee UPBA400, Apollo 77C-LF10, Kitz 868, or equal.
2. 2-1/2 inches: Apollo 77C-LF10, or equal.

D. Swing Check Valves:
1. Minimum 200 psi CWP, bronze or brass body, suitable for regrinding, threaded ends, conforming to MSS SP-80. Milwaukee UP509, Nibco T-413LF, Kitz 822T, or equal.

E. Butterfly Valves:
1. General: Tight closing, full lug type, with resilient seat suitable for minimum working pressure of 200 psig, conforming to MSS SP-67. Bi-direction dead end service with downstream flange removed.
2. Provide valves with the following:
   a. Seats: suitable for 40 degrees F for cold water service and 250 degrees F for hot water service. Seats shall cover inside surface of body and extend over body ends.
   b. Bodies: ductile iron or cast iron.
   c. Discs: Bronze or stainless steel.
   d. Stems or Shafts: Stainless steel. Install valves with stems horizontal.
   e. Control Handles: Suitable for locking in any position or with 10 degree or 15 degree notched throttling plates to hold valve in selected position. Provide extended necks to compensate for insulation thickness. Provide gear operator for valves 5 inches and larger.
3. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:
   a. 2 through 12 inches: Watts Regulator Co., model DBF-03.

F. Silent Check Valves (for use on pump discharge):
1. General: Provide spring loaded check valves at pump discharge of all pumps.
   a. 2 inches and smaller: Minimum 300 psi CWP, bronze body, Apollo 61LF, Milwaukee UP548-T, or equal.
   b. 2-1/2 inches and larger: Class 250, cast iron body, suitable for regrinding, Mueller 103MAP, or equal.

G. Calibrated Balancing Valves:
1. General: Calibrated orifice ball type rated for 400 psig maximum operating pressure and 250 degrees F. maximum operating pressure.
   a. Body: Brass.
   b. Ball: 304 Stainless Steel.
   c. Seat: Glass and Carbon filled TFE.
   d. End Connections: Threaded.
   e. Pressure Gage connections: Integral capped readout valves with internal check valves and drain port, for use with portable pressure differential meter.

f. Handle Style: Dial, with memory stops to retain set position.

2. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:
   a. 1 inch and smaller: Bell & Gossett model CB, “LF” series.

2.06 VALVES AND FITTINGS FOR NON-POTABLE WATER, COMPRESSED AIR, AND GAS SYSTEMS

A. Gate Valves:
1. 2-1/2 inches and smaller: Class150, bronze body, union bonnet, rising stem, solid wedge, threaded or solder ends, conforming to MSS SP-80. Hammond IB641, IB648, Nibco T-134, S-134, Milwaukee 1151, 1169, or equal.
2. 3 inches and larger: Class 125, iron body, bronze mounted, bolted bonnet, non-rising stem, solid wedge, flanged ends, conforming to MSS SP-70. Hammond IR-1138, Nibco F619, Milwaukee F2882A, Stockham G-612, or equal.
3. Underground valves 2 inches thru 12 inches: 250 psi, iron body, Non-rising stem, bolted bonnet, resilient wedge valves, conforming to AWWA C509, equipped with operating nuts, Mueller Series 2360, Nibco F-619-RW-SON, or equal.
   a. Underground valves 3 inches and smaller may be furnished with operating nuts or hand-wheels, and with Ring-Tite joint ends.
   b. Furnish and deliver to Owner one wrench of each size required for operating underground valves.

B. Ball Valves:
1. 2 inches and smaller: 600 psi CWP, 150 psi SWP, cast bronze body, full port, two piece, threaded ends, and reinforced PTFE seal, conforming to MSS SP-110. Nibco T585-70, Milwaukee BA-400, Stockham T-285, or equal.
2. 2-1/2 inches and larger: Class 150, carbon steel body, full port, two piece, stainless steel vented ball, flanged ends, and reinforced PTFE seal, conforming to MSS SP-72. Nibco F-515-CS-F-66-FS, Milwaukee F20-CS-15-F-02-GO-VB, or equal.
3. Compressed Air Services: 600 psi CWP, 150 psi SWP, bronze body, full port, three piece, threaded ends, and reinforced PTFE seal, conforming to MSS SP-110. Nibco Model T-595-Y, Milwaukee BA-300, or equal.

C. Swing Check Valves: Class 125 or 150, bronze body, suitable for regrinding, threaded ends, conforming to MSS SP-80. Stockham B-321, Milwaukee 509, Nibco T-433, or equal.

D. Butterfly Valves:
1. General: Tight closing, full lug type, with resilient seat suitable for minimum working pressure of 200 psig, conforming to MSS SP-67. Bi-direction dead end service with downstream flange removed.
2. Provide valves with the following:
   a. Seats: Suitable for 40 degrees F for cold water service and 250 degrees F for hot water service. Seats shall cover inside surface of body and extend over body ends.
   b. Bodies: Ductile iron or cast iron.
   c. Discs: Bronze or stainless steel.
   d. Stems or Shafts: Stainless steel.
   e. Control Handles: Suitable for locking in any position or with 10 degree or 15 degree notched throttling plates to hold valve in selected position. Provide extended necks to compensate for insulation thickness. Provide gear operator for valves 5 inches and larger.
3. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:
   a. 2 through 12 inches: Milwaukee Valve, CL series, Nibco, Inc., Model LD2000-3, or equal.

E. Silent Check Valves (for use on pump discharge):
   1. General: Provide spring loaded check valves at pump discharge of all pumps.
   2. 2 inches and smaller: 250 psi CWP, bronze body, Nibco Model T-480, Milwaukee 548-T, or equal.
   3. 2-1/2 inches and larger: Class 250, cast iron body, wafer style, suitable for regrinding. Nibco Model F960, Milwaukee 1400, Mueller 103MAP, or equal.

F. Calibrated Balance Valves (Symbol CBV): Provide globe style valves for precision regulation and control rated 175 psi for sizes 2-1/2 inches through 12 inches and rated 240 psi for bronze sizes 2 inches and below. Each valve shall have two metering/test ports with internal check valves and protective caps. All valves must be equipped with visual position readout and concealed memory stops for repeatable regulation and control.
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:
      a. Bell & Gossett Circuit Setter Plus.
      b. Armstrong CBV.
      c. Flow Design Inc. Accusetter.
      d. Tour & Andersson.
      e. Circuit Sensor with butterfly valve above 3 inches.
      f. Illinois Series 5000 through 2 inches.

G. Flow Control Valve: Automatic pressure compensating flow control valves shall be Griswold, Flow Design, Inc., or equal.

H. Building Gas Shut-Off Valve:
   1. 2 inches and smaller: Provide 175 psi SWP ball valve, CSA listed, full port, lockwing type, with AGA painted grey finish. Jomar 175-LWN, or equal.
   2. Above 2 inches: Provide ReSun D-126, Key Port, or equal, lubricated plug cock, CSA listed, rectangular port, full pipe area, 125 psi SWP, flanged ends. Provide T-Handle socket wrench and adapter fittings as required for operation of valves. Provide one package of spare lubricant sticks, sizes as required for valve sizes. Lubricant shall be the product recommended by valve manufacturer for use with type of gas conveyed by the piping system.
   3. Provide valves same size as upstream piping. Make any reduction in size of gas piping downstream of shutoff valves.

I. Gas Shut-off Valve Above Grade:
   1. 2 inches and smaller: Provide Milwaukee BB2-100, Jomar T-100NE, or equal, ball valve, CSA listed, full port.
   2. Above 2 inches: Provide ReSun D-126, Key Port, or equal, CSA listed, rectangular port, full pipe area, 125 psi SWP, flanged ends. Provide T-Handle socket wrench and adapter fittings as required for operation of valves. Provide one package of spare lubricant sticks, sizes as required for valve sizes. Lubricant shall be the product recommended by valve manufacturer for use with type of gas conveyed by the piping system.
   3. Provide valves same size as upstream piping. Make any reduction in size of gas piping downstream of shutoff valves.

J. For Gas Service Below Grade:
   1. Lubricated plug cocks: ReSun Model D-126, Key Port, or equal, lubricated plug cock, CSA listed, rectangular port, full pipe area, 125 psi SWP, flanged ends. Provide extended lubrication stem, arranged to allow for lubrication of the valve from grade. The extension must be constructed to allow for lubrication of the valve and for operation of the valve from grade. Provide T-Handle socket wrench and adapter fittings as required for operation of valves. Provide one package of spare lubricant sticks, sizes as required for valve sizes. Lubricant shall be the product recommended by valve manufacturer for use with type of gas conveyed by the piping system.

a. Provide flanged ends on valves installed below grade. Connect to polyethylene piping with flanges and stainless steel bolts.
b. Anchor each valve flange to valve box with welded angle iron, or provide vertical stiff leg, minimum 18 inches into earth.
c. Provide Central Double O Seal Transition Fittings, or equal, flanged style for connection between valve and piping system.
d. Wrap valve, flanges and exposed pipe with PASCO Specialty & Mfg., Inc., or equal tape wrap, installed in accordance with requirements listed under “Pipe Protection”.

2. Molded polyethylene body ball valve: Nordstrom Valves - Polyvalve II for sizes 1-1/4 inches to 2 inches, and Polyvalve for sizes 2 inches and larger, or equal. Valves 1 inch and smaller shall be listed lubricated plug cocks, with transition fittings.
a. Provide stub ends to match SDR of the piping, arranged for butt fusion welding. Provide valve body material to suit the adjacent piping system.
b. Provide wrench to suit the valve operator.

K. Seismic Gas Shut-Off Valve: Certified by State of California and compliant with ASCE 25. Provide standard or high pressure model as required to match site gas pressure. Provide unit arrangement per Drawings schedule and details.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Little Firefighter Corporation, models NAGV, VAGV, and AGV.
b. Seismic Safety Products, LLC, Northridge series.

2.07 JOINING MATERIALS

A. Refer to Division 22 and 23 piping sections for special joining materials not listed below.

B. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.
1. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch (3.2-mm) maximum thickness unless thickness or specific material is indicated
a. Full-Face Type: For flat-face, Class 125, cast iron and cast bronze flanges.
b. Narrow-Face Type: For raised-face, Class 250, cast iron and steel flanges.
2. AWWA C111, rubber, flat face, 1/8-inch (3.2mm) thick, unless otherwise indicated; and full-face or ring type, unless other indicated.
3. Flange Bolts and Nuts: AWWA C111, carbon steel, unless otherwise indicated.
4. Plastic, Pipe-Flange Gasket, Bolts and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.

C. Brazing Filler Metals: AWS A5.8, BCup-5 Series, copper-phosphorus unless otherwise indicated. Sil-Fos 15, or equal.

D. Welding Filler Metals: Comply with ASME B31.1 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

E. Solvent Cements for Joining CPVC Piping: ASTM F 493.
1. CPVC solvent cement shall have VOC content of 490 g/L or less.
2. Adhesive primer shall have VOC content of 550 g/L or less.
3. Solvent cement and adhesive primer shall comply with testing and product requirements of South Coast Air Quality Management District, Rule 1168.

F. Solvent Cements for Joining PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.
1. PVC solvent cement shall have VOC content of 510 g/L or less.
2. Adhesive primer shall have VOC content of 550 g/L or less.

3. Solvent cement and adhesive primer shall comply with testing and product requirements of South Coast Air Quality Management District, Rule 1168.

2.08 STRAINERS FOR POTABLE WATER SYSTEMS

A. Strainers: Full line size, conforming to lead-free requirements of California Health and safety Code Section 11 68 75. "Y" pattern, 125 psi SWP minimum, with 304 stainless steel screens. Install all strainers with a blow-off hose valve with hose adapter. Strainer shall have gasketed cover with straight thread.
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:
      a. 3 inches and smaller: bronze or brass body, threaded ends, with 20 mesh screen. Watts LF777SI, Wilkins SXL.
      b. 4 inches and larger: Cast iron body, flanged ends, 1/16 inch or 1/8 inch screen as normally supplied for each size. Watts 77F-DI-125, Mueller 758.

2.09 STRAINERS FOR NON-POTABLE WATER SYSTEMS

A. Charles M. Bailey #100A, Armstrong, Muessco, or equal, Fig. 11 "Y" pattern, 125 psi WP minimum, with monel screens with 20 square mesh for 2 inches and smaller and 3/64 inch perforations for 2-1/2 inches and larger. Install all strainers with a blow-off hose valve with hose adapter. Strainer shall have gasketed cover with straight thread.

2.10 VALVE BOXES

A. General:
   1. Where several valves or other equipment are grouped together, provide larger boxes of rectangular “vault” type adequately sized for condition and similar in construction to those specified above.
   2. Provide valve box extensions as required to set bottom of valve box tight up to top of piping in which valve is installed.
   3. Provide a tee handle wrench for each size, Alhambra Foundry Co. #A-3008, or equal.

B. Valve Boxes in Traffic Areas: Provide Christy No. G5 traffic valve box, Brooks, or equal, 10-3/8 inches inside diameter with extensions to suit conditions, with cast iron or steel locking cover. Provide Owner with set of special wrenches or tools as required for operation of valves.

C. Valve Boxes in Non-Traffic Areas: Provide Christy No. F22, Brooks, or equal, 8 inches inside diameter by 30 inches long, with cast iron or steel locking cover. Provide Owner with set of special wrenches or tools as required for operation of valves. Cut bottom of plastic body for operation of valves.

D. Valve Box (Rectangular Vault Type): Precast concrete or cast iron with cast iron or steel locking type covers lettered to suit service – Brooks No. 3-TL, Christy No. B3, Fraser No. 3, Alhambra A-3004 or A-3005, Alhambra E-2202, or E-2702, or equal, with extension to suit conditions.

2.11 GAUGES

A. Marsh "Series J", U.S. Gage, Danton 800, or equal, with bronze bushed movement and front recalibration. Dials shall be white with black numerals, 3-1/2 inch dial face. Normal reading shall be at mid-scale. Provide a needle valve on each gauge connection. Supply a gauge piped with branch isolation valves across the inlet and outlet of each pump and where shown on the Drawings.

B. Provide Pete's Plug II, Sisco P/T, or equal, test plug with Nordel core {and gasketed cap}, on inlet and outlet of each coil, boiler, condenser, chiller and heat exchanger and where shown on Drawings.

2.12 THERMOMETERS

A. Marsh, Taylor, Palmer, or equal, 5 inch diameter bimetal dial, adjustable from face, with adjustable positioner, located to be easily read from normal personnel approach. Normal reading shall be at mid-scale.
1. Provide extension for insulation.
2. Provide thermometers with steel bulb chambers and brass separable sockets.

B. Provide Pete's Plug II, Sisco P/T, or equal, test plug with Nordel core, on inlet and outlet of each coil, boiler, and heat exchanger and provide two digital electronic test thermometers for each range of fluid temperature and where shown on Drawings.

2.13 ACCESS DOORS

A. Where floors, walls, or ceilings must be penetrated for access to mechanical equipment, provide access doors, 14 inch by 14 inch minimum size in usable opening. Where entrance of a serviceman may be required, provide 20 inch by 30 inch minimum usable opening. Locate access doors/panels for non-obstructed and easy reach.
1. All access doors less than 7'-0" above floors and exposed to public access shall have keyed locks.

B. Access doors shall match those supplied in Division 08 in all respects, except as noted herein.

C. Provide stainless steel access doors for use in toilet rooms, shower rooms, kitchens and other damp areas. Provide steel access doors with prime coat of baked-on paint for all other areas.

D. Do not locate access doors in highly visible public areas such as lobbies, waiting areas, and primary entrance areas. Coordinate with the Architect when access is required in these areas.

E. Where specific information or details relating to access panels different from the above is shown or given on the Drawings or other Divisions of work, then that information shall supersede this specification.

F. Manufacturers: Subject to compliance with requirements, available manufacturers offering products which may be incorporated into the Work include Milcor, Karp, Nystrom, or Cesco, equal to the following:
1. Milcor
   a. Style K (plaster).
   b. Style DW (gypsum board).
   c. Style M (Masonry).
   d. Style "Fire Rated” where required.

2.14 EXPANSION LOOPS

A. Manufactured assembly consisting of inlet and outlet elbow fittings, two sections of flexible metal hose and braid, and 180-degree return bend or center section of flexible hose. Flexible hose shall consist of corrugated metal inner hose and braided outer sheath. Provide assembly selected for 4 inches of movement.

B. Provide CSA certified expansion loops listed for 4 inches of movement for use in natural or propane gas piping systems.

C. Where used in potable water systems, provide expansion loops of certified lead-free construction.

D. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:
   1. Metraflex Inc., Metraloop series.
   2. Unisource Manufacturing, Inc., V series.

2.15 FLEXIBLE JOINTS

A. Where indicated on Drawings, provide Metraflex Metrasphere, Style R, Mason Industries, or equal, Spherical Expansion Joints. Provide control units at each expansion joint, arranged to limit both expansion and compression.

B. Flexible joints at entry points to building shall be Barco Ductile iron, Advanced Thermal Systems, or equal, threaded style with stainless ball and mineral filled seal.

2.16 PIPE GUIDES

A. Where flexible connections are indicated on Drawings, provide Metraflex style IV, B-Line, or equal, pipe guides in locations recommended by manufacturer. Maximum spacing from flexible connection to first pipe guide is 4 pipe diameters, and maximum spacing from second pipe guide is 14 pipe diameters.

2.17 EQUIPMENT IDENTIFICATION

A. Identify each piece of equipment with a permanently attached engraved bakelite plate, 1/2 inch high white letters on black background.

2.18 PIPE IDENTIFICATION

A. Identify each piping system and indicate the direction of flow by means of Seton, Inc., Marking Services Inc., Reef Industries, Inc., or equal, pre-tensioned, coiled semi-rigid plastic pipe labels formed to circumference of pipe, requiring no fasteners or adhesive for attachment to pipe.

B. The legends and flow arrows shall conform to ASME A13.1.

2.19 INSULATION WORK

A. General:
   1. Insulation products, including insulation, insulation facings, jackets, adhesives, sealants and coatings shall not contain polybrominated diphenyl ethers (PBDEs) in penta, octa, or deca formulations in amounts greater than 0.1 percent (by mass).
   2. Adhesives and sealants shall comply with testing and product requirements of South Coast Air Quality Management District, Rule 1168.
   3. The term "piping" used herein includes pipe, valves, strainers and fittings.
   4. Apply insulating cement to fittings, valves and strainers and trowel smooth to the thickness of adjacent covering. Cover with jacket to match piping. Extend covering on valves up to the bonnet. Leave strainer cleanout plugs accessible.
   5. Provide pre-formed PVC valve and fitting covers.
   6. Provide Calcium Silicate rigid insulation and sheet metal sleeve, 18 inch minimum length at each pipe hanger. Seal ends of insulation to make vapor tight with jacket.
   7. Test insulation, jackets and lap-seal adhesives as a composite product and confirm flame spread of not more than 25 and a smoke developed rating of not more than 50 when tested in accordance with UL723 or ASTM E84.

8. Clean thoroughly, test and have approved, all piping and equipment before installing insulation and/or covering.
9. Repair all damage to existing pipe and equipment insulation whether or not caused during the work of this contract, to match existing adjacent insulation for thickness and finish, but conforming to flame spread and smoke ratings specified above.

B. Insulation of Piping:
1. Insulate domestic hot and tempered water with minimum 3-1/2 pounds per cubic foot density fiberglass with ASJ-SSL jacket. Insulation thickness shall be the following:
   a. Pipe 3/4 inches and smaller: 1 inch thick.
   b. Pipe 1 inch through 1-1/2 inches: 1-1/2 inches thick.
   c. Pipe 2 inches and larger: 2 inches thick.
2. Insulate domestic hot water piping under slab on grade and cold water piping exposed to the weather with 3/4 inch thick Therma-Cel, Armaflex, or equal; seal water tight per manufacturer's directions.
3. Insulate roof drain and overflow drain bodies, horizontal sections of rainwater leader piping and overflow piping, and condensate drains within the building envelope with 1 inch thick fiberglass, minimum 3-1/2 pound per cubic foot density, with ASJ-SSL jacket.
4. Insulate domestic cold water piping outside of insulation envelope in outside walls, vented attic spaces, and unheated spaces, including equipment rooms and below raised floor with 1 inch thick molded fiberglass, minimum 3-1/2 pound per cubic foot density, with ASJ-SSL jacket.
5. Exposed insulated piping within the building shall have a Zeston 2000 25/50, Proto Lo-Smoke, or equal, PVC jacket and fitting cover installed over the insulation, applied per manufacturer's instructions. Insulation shall be vapor tight before applying PVC jacket and fitting covers. Verify suitability with manufacturer of insulation. Insulation with pre-applied polymer jacket may be substituted at Contractor’s option.
6. Insulate condensate drain piping in freezer with 3/4 inch thick Therma-Cel, Armaflex, or equal. Seal water tight per manufacturer's directions. Install heat tape prior to insulation of piping, in accordance with manufacturer's directions.
7. Where insulated piping is exposed to the weather apply aluminum jacket secured with 1/2 inch stainless-steel bands on 12 inch centers. Insulation shall be vapor tight before applying metal jacket, and aluminum fitting covers. Install jacketing with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Cover fittings with glass cloth, two coats of Foster Sealfas 30-36, and factory-fabricated aluminum fitting covers, of same material, finish, and thickness as jacket. Insulation shall be vapor tight before applying metal jacket and fitting covers.
   a. Fitting covers:
      1) Preformed 2-piece or gore, 45- and 90-degree, short- and long-radius elbows.
      2) Tee covers.
      3) Flange and union covers.
      4) End caps.
      5) Beveled collars.
      6) Valve covers.
      7) Field fabricate fitting covers only if factory-fabricated fitting covers are not available.
   b. Jacket thickness:
      1) Pipes 10 inches diameter and smaller: Minimum .016 inch thick jacket with smooth finish.
      2) Pipes 12 inches diameter and larger: Minimum .020 inch thick jacket with smooth finish.

PART 3 - EXECUTION

3.01 ELECTRICAL REQUIREMENTS

A. Provide adequate working space around electrical equipment in compliance with the California Electrical Code. Coordinate the Mechanical Work with the Electrical Work to comply.

B. Furnish necessary control diagrams and instructions for the controls. Before permitting operation of any equipment which is furnished, installed, or modified under this Section, review all associated electrical work, including overload protection devices, and assume complete responsibility for the correctness of the electrical connections and protective devices. Motors and control equipment shall conform to the Standards of the National Electrical Manufacturers' Association. All equipment and connections exposed to the weather shall be NEMA IIIR with factory-wired strip heaters in each starter enclosure and temperature control panel where required to inhibit condensation.

C. All line voltage and low voltage wiring and conduit associated with the Temperature Control System are included in this Section. Wiring and conduit shall comply with Division 26.

3.02 PIPING SYSTEM REQUIREMENTS

A. Drawing plans, schematic and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.

3.03 PRIMING AND PAINTING

A. Perform all priming and painting on the equipment and materials as specified herein.

B. Priming:
1. Exposed ferrous metals, including piping, which are not galvanized or factory-finished shall be primed. Black steel pipe exposed to the weather shall be painted one coat of Rust-Oleum #1069 primer for black steel piping or Rust-Oleum #5260, Kelly Moore, or equal, primer for galvanized piping.
2. Metal surfaces of items to be jacketed or insulated except piping shall be given two coats of primer unless furnished with equivalent factory finish. Items to be primed shall be properly cleaned by effective means free of rust, dirt, scale, grease and other deleterious matter and then primed with the best available grade of zinc rich primer. After erection or installation, all primed surfaces shall be properly cleaned of any foreign or deleterious matter that might impair proper bonding of subsequent paint coatings. Any abrasion or other damage to the shop or field prime coat shall be properly repaired and touched up with the same material used for the original priming.
3. Where equipment is provided with nameplate data, the nameplate should be masked off prior to painting. When painting is completed, remove masking material.

C. See Painting Section for detailed requirements.

3.04 EXCAVATING

A. Perform all excavating required for work of this Section. Provide the services of a pipe/cable locating service prior to excavating activities to determine location of existing utilities.

B. Unless shown otherwise, provide a minimum of 2'-6" cover above top of pipe to finished grade for all service piping, unless otherwise noted. Trim trench bottom by hand or provide a 4 inch deep minimum bed of sand to provide a uniform grade and firm support throughout entire length of pipe. For all PVC pipe and for PE gas pipe, bed the pipe in 4 inch sand bed. Pipe bedding

materials should be clean crushed rock, gravel or sand of which 100 percent will pass a 1 inch sieve. For pipes that are larger than 10 inches in diameter, at least 95 percent should pass a 3/4 inch sieve, and for pipes 10 inches in diameter or smaller, 100 percent should pass a 1/2 inch sieve. All other materials should have a minimum sand equivalent of 50. Only a small proportion of the native soils will meet these requirements without extensive processing; therefore, importation of pipe bedding materials should be anticipated. Pipe bedding materials shall be compacted in lifts not exceeding 6 inches in compacted thickness. Each lift shall be compacted to not less than 90 percent relative compaction at or above the optimum moisture content, in accordance with ASTM Specification D2940, except that bedding materials graded such that less than 100 percent will pass a No. 200 sieve shall be compacted in 6 inch lifts using a single pass of a flat-plate, vibratory compactor or vibratory drum. Pipe bedding materials should extend at least to the spring line.

C. Maintain all warning signs, barricades, flares, and red lanterns as required.

D. For all trenches 5 feet or more in depth, submit copy of permit detailed drawings showing shoring, bracing, sloping, or other provisions to be made for worker protection from the hazard of caving ground during the excavation of such trenches. Obtain a permit from the Division of Industrial Safety prior to beginning excavations. A copy of the permit shall be available at the site at all times.

3.05 BACKFILLING

A. Backfill shall comply with applicable provisions of Division 31 of these Specifications.

B. Except under existing or proposed paved areas, walks, roads, or similar surfaces, backfill for other types of pipe shall be made using suitable excavated material or other approved material. Place backfill in 8 inch layers, measured before compaction, and compact with impact hammer to at least 90 percent relative compaction per ASTM D2940.
   1. Backfill plastic pipe and insulated pipe with sand for a minimum distance of 12 inches above the top of the pipe. Compact using mechanical tamping equipment.

C. Entire backfill for excavations under existing or proposed pavements, walks, roads, or similar surfaces, under new slabs on grade, shall be made with clean sand compacted with mechanical tamping equipment vibrator to at least 90 percent relative compaction per ASTM D2940. Remove excess earth. Increase the minimum compaction within the uppermost two feet of backfill to 95 percent.

D. Replace or repair to its original condition all sod, concrete, asphalt paving, or other materials disturbed by the trenching operation. Repair within the guarantee period as required.

3.06 INSTALLATION OF VALVES

A. Install valves as indicated on Drawings and in the following locations:
   1. Shutoff Valves: Install on inlet of each plumbing equipment item, and on inlet of each plumbing fixture, and elsewhere as indicated.
   2. Drain Valves: Install on each plumbing equipment item located to completely drain equipment for service or repair. Install at base of each riser, at base of each rise or drop in piping system, and elsewhere indicated or required to completely drain potable water system.
   3. Provide gate or globe valves on inlet and outlet of each water heater or pump.

B. General:
   1. Valves shall be full line size unless indicated otherwise on Drawings.
   2. Install horizontal valves with valve stem above horizontal, except butterfly valves.

3. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.
4. Locate valves for easy access and provide separate support where necessary.
5. Install valves in position to allow full stem movement.
6. Install exposed polished or enameled connections with special care showing no tool marks or exposed threads.
7. Butterfly valves conforming to the paragraph “Butterfly Valves” may be used in lieu of gate or globe valves for locations above grade.
8. Ball valves conforming to the paragraph “Ball Valves” may be used in lieu of gate valves for locations above grade for services 2-1/2 inches and smaller.
9. Valves 2-1/2 inches and smaller (except ball valves) in nonferrous water piping systems may be solder joint type with bronze body and trim.
10. Rigidly fasten hose bibbs, hydrants, fixture stops, compressed air outlets, and similar items to the building construction.

C. Gate Valves:
1. Furnish valves in copper lines with adapters to suit valve / line requirements.
2. Underground gate valves:
a. Underground valves 3 inches and smaller may be furnished with operating nuts or hand-wheels, and with Ring-Tite joint ends.
b. Furnish and deliver to Owner one wrench of each size required for operating underground valves.

D. Swing Check Valves: Install in horizontal position with hinge pin level.

E. Butterfly Valves: Install with stems horizontal.

F. Silent Check Valves: Install in horizontal or vertical position between flanges.

G. Calibrated Balancing Valves: Install calibrated balancing valves per manufacturers’ recommendations, including requirements for straight pipe lengths at valve inlet and outlet.

H. Gas Shut-Off Valves:
1. Provide line size ball valve in gas line to each appliance.

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

3.07 INSTALLATION OF PIPING SYSTEMS

A. At time of final connection, and prior to opening valve to allow pressurization of water and gas piping from existing systems, on site or off site, perform a pressure test to indicate static pressure of existing systems. If pressure on water piping is greater than 80 psi, or gas pressure is not as indicated on Contract Documents, inform Architect immediately. Do not allow piping systems to be pressurized without written consent of the Architect.

B. General:
1. All piping shall be concealed unless shown or otherwise directed. Allow sufficient space for ceiling panel removal.
2. Installation of piping shall be made with appropriate fittings. Bending of piping will not be accepted.
3. Install piping to permit application of insulation and to allow valve servicing.

4. Where piping or conduit is left exposed within a room, the same shall be run true to plumb, horizontal, or intended planes. Where possible, uniform margins are to be maintained between parallel lines and/or adjacent wall, floor, or ceiling surfaces.
5. Horizontal runs of pipes and/or electrical conduit suspended from ceilings shall provide for a maximum headroom clearance. The clearance shall not be less than 6'-6" without written approval from the Architect.
6. Close ends of pipe immediately after installation. Leave closure in place until removal is necessary for completion of installation.
7. Each piping system shall be thoroughly flushed and proved clean before connection to equipment.
8. Pipe the discharge of each relief valve, air vent, backflow preventer, and similar device to floor sink or drain.
9. Install exposed polished or enameled connections with special care showing no tool marks or threads at fittings.
10. Install horizontal valves with valve stem above horizontal.
11. Use reducing fittings; bushings shall not be allowed. Use eccentric reducing fittings wherever necessary to provide free drainage of lines and passage of air.
12. Verify final equipment locations for roughing-in.
13. Service Markers: Mark the location of each plugged or capped pipe with a 4 inch round by 30 inch long concrete marker, set flush with finish grade. Provide 2-1/2 inch diameter engraved brass plate as part of monument marker.
14. Furnish and install anchors or thrust blocks on PVC water lines in the ground, at all changes in direction of piping, and at all connections or branches from mains 1-1/2 inch and larger. Form anchors or thrust blocks by pouring concrete between pipe and trench wall. Thrust blocks shall be of adequate size and so placed as to take thrusts created by maximum internal water pressure. Sizing and placement shall be per manufacturer's recommendations, CPC, and IAPMO installation standards. Anchor piping to building construction.
15. Sanitary Sewer and Storm Drain: Grade piping inside building uniformly 1/4 inch per foot if possible but not less than 1/8 inch per foot. Run piping as straight as possible. Make piping connections between building piping and outside service pipe with cast iron reducers or increasers. Slope sewers uniformly between given elevations where invert elevations are shown.
16. Where piping is installed in walls within one inch of the face of stud, provide a 16 gauge sheet metal shield plate on the face of the stud. The shield plate shall extend a minimum of 1-1/2 inches beyond the outside diameter of the pipe.

C. Expansion Loops:
1. Install expansion loops where piping crosses building expansion or seismic joints, between buildings, between buildings and canopies, and as indicated on Drawings.
2. Install expansion loops of sizes matching sizes of connected piping.
3. Install grooved-joint expansion joints to grooved-end steel piping.
4. Materials of construction and end fitting type shall be consistent with pipe material and type of gas or liquid conveyed by the piping system in which expansion loop is installed.

D. Sleeves:
1. Install Adjus-to-Crete, Pipeline Seal and Insulator, or equal, pipe sleeves of sufficient size to allow for free motion of pipe, 24 gauge galvanized steel. The space between pipe and sleeves through floor slabs on ground, through outside walls above or below grade, through roof, and other locations as directed shall be caulked with oakum and mastic and made watertight. The space between pipe and sleeve and between sleeve and slab or wall shall be sealed watertight.
2. At Contractor's option, Link-Seal, Metraflex Metraseal, or equal, casing seals may be used in lieu of caulking. Wrap pipes through slabs on grade with 1 inch thick fiberglass insulation to completely isolate the pipe from the concrete.

E. Floor, Wall, and Ceiling Plates:
   1. Fit all pipes with or without insulation passing through walls, floors, or ceilings, and all hanger rods penetrating finished ceilings with chrome-plated or stainless escutcheon plates.

F. Firestopping:
   1. Pack the annular space between the pipe sleeves and the pipe through all floors and walls with UL listed fire stop, and sealed at the ends. All pipe penetrations shall be UL listed, Hilti, 3M Pro-Set, or equal.
      a. Install fire caulking behind mechanical services installed within fire rated walls, to maintain continuous rating of wall construction.
   2. Provide SpecSeal Systems UL fire rated sleeve/coupling penetrators for each pipe penetration or fixture opening passing through floors, walls, partitions or floor/ceiling assemblies. All Penetrators shall comply with UL Fire Resistance Directory (Latest Edition), and in accordance with Chapter 7, CBC requirements.
   3. Sleeve penetrators shall have a built-in anchor ring for waterproofing and anchoring into concrete pours or use the special fit cored hole penetrator for cored holes.
   4. Copper and steel piping shall have SpecSeal plugs on both sides of the penetrator to reduce noise and to provide waterproofing.
   5. All above Systems to be installed in strict accordance with manufacturer's instructions.
   6. Alternate firestopping systems are acceptable if approved equal. However, any deviation from the above specification requires the Contractor to be responsible for determining the suitability of the proposed products and their intended use, and the Contractor shall assume all risks and liabilities whatsoever in connection therewith.

G. Flashing:
   1. Flashing for penetrations of metal or membrane roof for mechanical items such as flues and pipes shall be coordinated with the roofing manufacturer and roofing installer for the specific roofing type. The work of this section shall include furnishing, layout, sizing, and coordination of penetrations required for the mechanical work.
      a. Furnish and install flashing and counterflashing in strict conformance with the requirements of the roofing manufacturer. Submit shop drawing details for review prior to installation.
      b. Furnish and install counterflashing above each flashing required. Provide Stoneman, or equal, vandalproof top and flashing combination. Provide vandalproof top for each plumbing vent through roof. Elmdor/Stoneman Model 1540, 1550, 1570, or equal.
   2. For all other types of roofing system, furnish and install around each pipe, where it passes through roof, a flashing and counterflashing. All flashing shall be made of four pound seamless sheet lead with 6 inch minimum skirt and steel reinforced boot. Counterflashing shall be cast iron. For vents, provide vandalproof top and flashing combination. Elmdor/Stoneman Model 1100-4, 1100-5, 1100-7, or equal.

H. Hangers and Supports:
   1. General: Support equipment and piping so that it is firmly held in place by approved iron hangers and supports and special hangers. Hanger and support components shall support weight of equipment and pipe, fluid, and pipe insulation based on spacing between supports with minimum factor of safety of five based on ultimate strength of material used. Do not exceed manufacturer's load rating. Pipe attachments or hangers, of same size as pipe or tubing on which used, or nearest available. Rigidly fasten hose faucets, fixture stops, compressed air outlets, and similar items to the building construction. The Architect shall approve hanger material before installation. Do not support piping with plumbers' tape, wire rope, wood, or other makeshift devices. Where building structural members do not match piping support spacing, provide “bridging” support members firmly attached to building structural members in a fashion approved by the structural engineer.

a. Materials, design, and type numbers per Manufacturers' Standardization Society (MSS), Standard Practice (SP)-58.
   1) Provide copper-plated or felt-lined hangers for use on copper tubing.

2. Hanger components shall be provided by one manufacturer: B-Line, Grinnell, Unistrut, Badger, or equal.
3. Riser clamps: B-line model B3373, or equal.
4. Pipe Hanger and Support Placement and Spacing:
   a. Vertical piping support spacing: Provide riser clamps for piping, above each floor, in contact with the floor. Provide support at joints, branches, and horizontal offsets. Provide additional support for vertical piping, spaced at or within the following maximum limits:

Pipe Diameter	Steel Threaded or Welded (Note 3)	Steel Gas	Copper Brazed or Soldered (Note 3)	CPVC & PVC (Note 2)
1/2 - 1”	12 ft.	6 ft.	Each Floor, Not to Exceed 10 ft.	Base and Each Floor (Note 1)
1-1/4 - 2”	12 ft.	Each Floor, Not to Exceed 10 ft.	Each Floor, Not to Exceed 10 ft..	Base and Each Floor (Note 1)
2-1/2 - 3”	12 ft.	Each Floor, Not to Exceed 10 ft.	Each Floor, Not to Exceed 10 ft.	Base and Each Floor (Note 1)
Over 4”	12 ft.	Each Floor, Not to Exceed 10 ft.	Each Floor, Not to Exceed 10 ft.	Base and Each Floor (Note 1)

   1) Note 1: Provide mid-story guides.
   2) Note 2: For PVC piping, provide for expansion every 30 feet per IAPMO installation standard. For CPVC piping, provide for expansion per IAPMO installation standard.
   3) Note 3: Spacing of hangers and supports for piping assembled with mechanical joints shall be in accordance with standards acceptable to authorities having jurisdiction.

   b. Vertical cast iron piping support spacing: Base and each floor not to exceed 15 feet.
   c. Horizontal piping, hanger and support spacing: Locate hangers and supports at each change of direction, within one foot of elbow, and spaced at or within following maximum limits:

Pipe Diameter	Steel Threaded or Welded (Note 2)	Steel Gas	Copper Brazed or Soldered (Notes 2, 3)	CPVC & PVC (Note 1)
1/2 - 1"	6 ft.	6 ft.	5 ft.	3 ft.
1-1/4 - 2"	7 ft.	10 ft.	6 ft.	4 ft.
2-1/2 - 3"	10 ft.	10 ft.	10 ft.	4 ft.
Over 4"	10 ft.	10 ft.	10 ft.	4 ft.

1) Note 1: For PVC piping, provide for expansion every 30 feet per IAPMO installation standard. For CPVC piping, provide for expansion per IAPMO installation standard.
2) Note 2: Spacing of hangers and supports for piping assembled with mechanical joints shall be in accordance with standards acceptable to authorities having jurisdiction.
3) Note 3: Includes all refrigerant piping, including vapor and hot gas pipes.

d. Horizontal cast iron piping support spacing:
1) Support piping at every other joint for piping length of less than 4 feet.
2) For piping longer than 4 feet, provide support on each side of the coupling, within 18 inches of each joint.
3) Hanger shall not be installed on the coupling.
4) Provide support at each horizontal branch connection.
5) Provide sway brace at 40 foot maximum spacing for suspended pipe with no-hub joints, except where a lesser spacing is required by the seismic design criteria used in delegated design for seismic systems. Refer to Article, Submittals.
6) Provide a brace on each side of a change in direction of 90 degrees or more.

5. Suspended Piping:
a. Individually suspended piping: B-Line B3690 J-Hanger or B3100 Clevis, complete with threaded rod, or equal. All hangers on supply and return piping handling heating hot water or steam shall have a swing connector at point of support.

Pipe Size	Rod Size Diameter
2" and Smaller	3/8"
2-1/2" to 3-1/2"	1/2"
4" to 5"	5/8"
6"	3/4"

b. Provide 3/8 inch rod for support of PVC and CPVC and provide continuous support.
c. Trapeze Suspension: B-Line 1-5/8 inch width channel in accordance with manufacturer's published load ratings. No deflection to exceed 1/180 of a span.
d. Trapeze Supporting Rods: Shall have a safety factor of five; securely anchor to building structure.
e. Pipe Clamps and Straps: B-Line B2000, B2400; isolate copper pipe with two thicknesses of 2 inches wide 10-mil polyvinyl tape. Where used for seismic support systems, provide B-Line B2400 series pipe straps.
f. Concrete Inserts: B-line B22-I continuous insert or B2500 spot insert. Do not use actuated fasteners for support of overhead piping unless approved by Architect.
g. Steel Connectors: Beam clamps with retainers.

6. Support to Structure:
a. Steel Structure: Provide and install additional steel bracing as required to suit structure. Provide through bolts with length to suit requirements of the structural components. Burning or welding on any structural member may only be done if approved by the Architect.

7. Rubber Neoprene Pipe Isolators:
a. Pipe isolators shall comprise an internal rubber or neoprene material that isolates pipe from hanger and structure. Install at all piping located in acoustical walls. Refer to Architectural Drawings for location of acoustical walls.

b. Isolation material shall be either a rubber or neoprene material that prevents contact between the pipe and the structure. The rubber shall have between a 45 to 55 durometer rating and a minimum thickness of 1/2 inch.
c. Acceptable Suppliers:
1) Vertical runs: Acousto-Plumb or equal.
2) Horizontal runs: B-Line, Vibraclamp; Acousto-Plumb or equal.

8. Provide continuous V channel support for all horizontal plastic piping.
9. Provide support for piping through roof, arranged to anchor piping solidly in place at the roof penetration.
10. Provide rigid insulation and a 12 inch long, 18 gauge galvanized sheet iron shield between the covering and the hanger whenever hangers are installed on the outside of the pipe covering.
11. Insulate copper tubing from ferrous materials and hangers with two thicknesses of 3 inch wide, 10 mil polyvinyl tape wrapped around pipe.
12. Provide a support or hanger close to each change of direction of pipe either horizontal or vertical and as near as possible to concentrated loads.
13. Suspend rods from concrete inserts with removable nuts where suspended from concrete decks. Power actuated inserts will not be allowed.

3.08 PIPE JOINTS AND CONNECTIONS

A. General:
1. Cutting: Cut pipe and tubing square, remove rough edges or burrs. Bevel plain ends of steel pipe.
2. Remove scale, slag, dirt and debris from inside and outside of pipe before assembly.
3. Boss or saddle type fittings or mechanically extracted tube joints will not be allowed.

B. Threaded Pipe: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
1. Apply thread compound to external pipe threads: Rectorseal No. 5, Permatex No. 1, or equal.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.

C. Flanged Joints: Select appropriate asbestos-free, nonmetallic gasket material in size, type, and thickness suitable for domestic water service. Join flanges with gasket and bolts according to ASME B31.9.

D. Joint Construction for Solvent-Cemented Plastic Piping: Clean and dry joining surfaces. Join pipe and fittings according to the following:
1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements. Apply primer.
2. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.
3. PVC Piping: Join according to ASTM D 2855.

E. Copper Pipe and Tubing (Except pneumatic control piping): All joints shall be brazed according to ASME Section IX, Welding and Brazing Qualifications, except domestic water piping 1-1/4 inches and smaller when not buried in the ground or concrete and type DWV plumbing piping may be soldered.
1. Soldered joints: Apply water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B 828.

F. Cast Iron Soil Pipe:
1. No-Hub fittings shall be made with a torque wrench.
2. Hub joints shall be with Ty-Seal couplings.

3. Wrought iron, steel, or copper pipe shall have a ring or part of a coupling screwed on to form a spigot end if caulked into a joint.
4. Connect cast iron sewer piping to outside service pipe with cast iron or vitrified clay reducers or increasers as required. Caulking of smaller pipe into the larger without a reducer or increaser will not be permitted.

G. Clay Sewer Pipe: Joints in bell and spigot clay sewer pipe shall comply with ASTM C-425, made with an approved type of interlocking, resilient mechanical compression joint, formed on the pipe at the factory. Lubricate inside of bells and outside of spigots with a solution as recommended by the pipe manufacturer.

H. Welded Pipe:
1. Make up with oxyacetylene or electric arc process.
2. All welding shall conform to the American Standard Code for Power Piping ASME B-31.1. When requested by the Architect, furnish certification from an approved testing agency or National Certified Pipe Welding Bureau that the welders performing the work are qualified.
3. All line welds shall be of the single "V" butt type. Welds for flanges shall be of the fillet type.
4. Where the branch is two pipe sizes smaller than the main or smaller, Bonney Weldolets, Threadolets, Nibco, or equal, may be used in lieu of welding tees.

I. PVC Sewer and Drainage Pipe (outside building as allowed only): Four inches and larger shall be bell and spigot, assembled in accordance with manufacturer's recommendations. Joint shall be tested in accordance with ASTM D3212. Solvent weld joints below 4 inches in size, schedule 40 PVC with matching fittings, assembled per manufacturer’s instructions.

J. PVC Pool Pipe: Assemble with flanged joints. Assemble joints in strict accordance with manufacturer's instructions. PVC Drain Pipe: Make joints with PVC couplings and rubber rings, except deck drain pipe shall be solvent welded.

K. Polyethylene Pipe: Assemble with fusion joints in strict accordance with manufacturer's instructions.

L. Make joints in PVC water pipe with PVC couplings and rubber rings, Manville Ring-Tite, PW Pipe, or equal. Check final location of rubber rings with the couplings with gauge or as recommended by the manufacturer. Make joints between PVC pipe and cast iron pipe or fittings using cast iron or PVC adapter fittings, installed as recommended by the manufacturer. Ring-Tite PVC or cast iron pipe fittings may be used in lieu of standard fittings. Make connection to valves with cast iron adapters connected to the water pipe with PVC couplings.

M. Flexible Connections:
1. Furnish and install Thermo Tech., Inc. F/J/R, Metraflex, or equal, flexible couplings with limiter bolts on piping connections to all equipment mounted on anti-vibration bases, on each connection to each base mounted pump and where shown. Couplings shall be suitable for pressure and type of service.
2. Anchor piping securely on the system side of each flexible connection.

3.09 UNIONS AND FLANGES

A. Install Watts, Epco, Nibco, or equal, dielectric unions or flanges at points of connection between copper or brass piping or material and steel or cast iron pipe or material except in drain, waste, vent, or rainwater piping. Bushings or couplings shall not be used. Dielectric unions installed in potable water systems shall conform to the lead-free requirements of the California Health and Safety Code Section 11 68 75.

B. Install unions in piping NPS 2” and smaller, and flanges in piping NPS 2-1/2” and larger whether shown or not at each connection to all equipment and tanks, and at all connections to all automatic valves, such as temperature control valves. Unions installed in potable water systems shall conform to the lead-free requirements of the California Health and Safety Code Section 11 68 75.

C. Locate the unions for easy removal of the equipment, tank, or valve.

3.10 ACCESS DOOR

A. Furnish and install access doors wherever required whether shown or not for easy maintenance of mechanical systems; for example, at concealed valves, strainers, traps, cleanouts, dampers, motors, controls, operating equipment, etc. Access doors shall provide for complete removal and replacement of equipment.

3.11 CONCRETE WORK

A. Concrete work required for work of this Section shall be included under another section of the Specification, unless otherwise noted, including poured-in-place concrete work for installing precast manholes, catch basins, etc., and shall include reinforced concrete bases for pumps, tanks, compressors, fan units, boilers, unless the work is specifically indicated on the Drawings to be furnished under this Section.

B. Thrust blocks, underground anchors, and pads for cleanouts, valve access boxes and washer boxes are included under this Section of the Specification. Concrete shall be 3000 psi test minimum. Refer to Division 03 for concrete types.

3.12 PIPE PROTECTION

A. Wrap bare galvanized and black steel pipe buried in the ground and to 6" above grade, including piping in conduit, with one of the following, or equal:
   1. Polyethylene Coating: Pressure sensitive polyethylene coating, "X-Tru-Coat" as manufactured by Pipe Line Service Corporation or "Green Line" wrap as manufactured by Roystron Products, or equal.
      a. Field Joints and Fittings: Protecto Wrap #1170 tape as manufactured by Pipe Line Service Corporation, or Primer #200 tape by Roystron Products, or equal. Installation shall be as per manufacturer's recommendation and instructions.
   2. Tape Wrap: Pressure-sensitive polyvinyl chloride tape, "Transtex #V-l0 or V-20", "Scotchwrap 50", Slipknot l00, PASCO Specialty & Mfg., Inc., or equal, with continuous identification. Tape shall be a minimum of 20 mils thick for fittings and irregular surfaces, two wraps, 50 percent overlap, 40 mils total thickness. Tape shall be laminated with a suitable adhesive; widths as recommended by the manufacturer for the pipe size. Wrap straight lengths of piping with an approved wrapping machine.

B. Field Joints: Valves and Fittings: double wrap polyvinyl chloride tape as above. Provide at least two thicknesses of tape over the joint and extend a minimum of 4 inches over adjacent pipe covering. Build up with primer to match adjacent covering thickness. Width of tape of fittings shall not exceed 3 inches. Tape shall adhere tightly to all surfaces of the fittings without air pockets.

C. Testing: Test completed wrap of piping, including all epoxy painted piping with Tinker and Rasor Co. test machine (San Gabriel, CA - 818-287-5259), Pipeline Inspection Company (Houston, TX - 713-681-5837), or equal.

D. Cleaning: Clean all piping thoroughly before wrapping.

1. Inspection: Damaged or defective wraps shall be repaired as directed. No wrapped pipe shall be covered until approved by Architect.

E. Sleeve copper piping/tubing installed below slab with “Polywrap-C” polyethylene sleeve, as manufactured by Northtown Pipe Protection Products, or equal. Sleeve shall be a minimum of 6 mils thick, colored blue for domestic water piping and orange for other piping. Install sleeve per manufacturer’s recommendations and instructions.

F. Sleeve copper piping/tubing installed outside building below grade with “Polywrap-C” polyethylene sleeve, as manufactured by Northtown Pipe Protection Products, or equal. Sleeve shall be a minimum of 6 mils thick, colored blue for domestic water piping. Install sleeve per manufacturer’s recommendations and instructions.

G. Sleeve cast iron and ductile iron pipe below grade and below slab with “Polywrap” polyethylene sleeve, as manufactured by Northtown Pipe Protection Products, or equal. Sleeve shall be a minimum of 8 mils thick, colored natural. Install sleeve per manufacturer’s recommendations and instructions.

H. Covering: No rocks or sharp edges shall be backfilled against the wrap or sleeve. When backfilling with other than sand, protect wrap with an outer wrapping of Kraft paper; leave in place during backfill.

3.13 PIPE IDENTIFICATION

A. Provide temporary identification of each pipe installed, at the time of installation. Temporary identification shall be removed and replaced with permanent identification as part of the work.

B. Apply the legend and flow arrow at all valve locations; at all points where the piping enters or leaves a wall, partition, cluster of piping or similar obstruction, at each change of direction and at approximately 20'-0" intervals on pipe runs. Variations or changes in locations and spacing may be made with the approval of the Architect. There shall be at least one marking in each room. Markings shall be located for maximum visibility from expected personnel approach.
1. Apply legend and flow arrow at approximately 10’-0” intervals in science classrooms and science prep rooms.

C. Wherever two or more pipes run parallel, the markings shall be supplied in the same relative location on each.

D. Each valve on non-potable water piping shall be labeled with a metal tag stamped "DANGER -- NON-POTABLE WATER" in 1/4 inch high letters.

E. Apply markings after painting and cleaning of piping and insulation is completed.

3.14 EXPANSION ANCHORS IN HARDENED CONCRETE

A. Refer to Structural Drawings.

B. Qualification Tests: The specific anchor shall have a current ICC-ES report and evaluated in cracked concrete in accordance with Acceptance Criteria AC193. If the specific anchor satisfies cyclic testing requirements per Acceptance Criteria AC01, Section 5.6, the full allowable shear and tension loads listed in the current ICC-ES report and manufacturer’s recommendations for the specific anchor may be used. Otherwise, the design shear and tension loads shall not be more than 80% of the listed allowable shear and tension loads for the specific anchor.

C. Installation: The anchors must be installed in accordance with the requirements given in ICC Research Committee Recommendations for the specific anchor.

D. Testing: Fifty percent of the anchors shall be load-tested on each job to twice the allowable capacity in tension, except that if the design load is less than 75 pounds; only one anchor in ten need be tested. If any anchor fails, all anchors must be tested. The load test shall be performed in the presence of a special inspector.

E. The load may be applied by any method that will effectively measure the tension in the anchor, such as direct pull with a hydraulic jack, a torque wrench calibrated using the specific anchor or calibrated spring-loading devices. Anchors in which the torque is used to expand the anchor without applying tension to the bolt may not be verified with a torque wrench.

3.15 PIPING SYSTEM PRESSURE TESTING

A. General:
1. Perform operational tests under simulated or actual service conditions, including one test of complete plumbing installation with fixtures and other appliances connected.
2. Repair leaks and defects with new materials, and retest piping or portion thereof until satisfactory results are obtained.

B. Piping Systems: Test piping systems in accordance with the following requirements and applicable codes:
1. Authority having jurisdiction shall witness tests of piping systems.
2. Notify Architect at least seven days in advance of testing.
3. All piping shall be tested at completion of roughing-in, or at other times as directed by Architect.
4. Furnish necessary materials, test pumps, gases, instruments and labor required for testing.
5. Isolate from system equipment that may be damaged by test pressure.

C. Test Schedule: No loss in pressure or visible leaks shall show after four hours at the pressures indicated.

D. Testing of Sanitary Sewer, Drain, Vent, and Storm Drain may be done in segments in order to limit pressure to within manufacturer's recommendations. Test to 10 feet above highest point in the system.

System Tested	Test Pressure PSI	Test With
Sanitary Sewer, Drain, Vent	10 Ft. Hd.	Water
Storm Drain, Condensate Drains	10 Ft. Hd.	Water
Domestic Water	125	Water
Natural Gas (PE)	60	Air & Non-corrosive Leak Test Fluid
Natural Gas (Steel)	100	Air & Non-corrosive Leak Test Fluid
Compressed Air	200 lb.	Air & Non-corrosive Leak Test Fluid
Deionized Water	50	Water

1. Flush deionized water lines with deionized water after test and approval.

2. Non-corrosive leak test fluid shall be suitable for use with piping material specified, and with the type of gas conveyed by the piping system.

3.16 TRACER WIRES

A. Provide tracer wire for non-metallic gas and water pipe in ground outside of buildings. Use AWG #12 tracer wire with low density high molecular weight polyethylene insulation, and lay continuously on pipe so that it is not broken or stressed by backfilling operations. Secure wire to the piping with tape at 18 inch intervals. Solder all joints. Tracer wire insulation shall be colored yellow for gas piping, blue for water piping.

B. Terminals: Precast concrete box and cast iron locking traffic cover, Brooks 3TL, or equal; cover marked with name of service; 6 inches of loose gravel below box. Plastic terminal board with brass bolts; identify line direction with plastic tags. Test for continuity between terminals, after backfilling, in presence of Inspector.

C. Alternate: Use electronically detectable plastic tape with metallic core, Terra Tape D, manufactured by Reef Industries, Inc., Seton, Inc., Marking Services, Inc., or equal; tape 2 inches wide, continuously imprinted "CAUTION WATER (GAS, etc.) LINE BELOW". Install, with printed side up, directly over pipe, 18 inches below finish grade. Backfill material shall be as specified for the particular condition where pipe is installed, but avoid use of crushed rock or of earth with particles larger than l/2 inch within the top 12 inches of backfill. Take precautions to insure that tape is not damaged or misplaced during backfill operations. Terminal boxes not required.

3.17 OPERATION OF SYSTEMS

A. Do not operate any plumbing equipment for any purpose, temporary or permanent, until all of the following has been completed:
1. Complete all requirements listed under “Check, Test and Start Requirements.”
2. Piping has been properly cleaned. Piping systems shall be flushed and treated prior to operation.
3. Filters, strainers etc. are in place.
4. Bearings have been lubricated, and alignment of rotating equipment has been checked.
5. Equipment has been run under observation, and is operating in a satisfactory manner.

B. Provide test and balance agency with one set of Contract Drawings, Specifications, Addenda, Change Orders issued, applicable shop drawings and submittals and temperature control drawings.

3.18 CHECK, TEST AND START REQUIREMENTS

A. An authorized representative of the equipment manufacturer shall perform check, test and start of each piece of plumbing equipment. The representative may be an employee of the equipment manufacturer, or a manufacturer-certified contractor. Submit written certification from the manufacturer stating that the representative is qualified to perform the check test and start of the equipment.
1. As part of the submittal process, provide a copy of each manufacturer’s printed startup form to be used.
2. Some items of specified equipment may require that check, test and start of equipment must be performed by the manufacturer, using manufacturer’s employees. See specific equipment Articles in these Specifications for this requirement.
3. Provide all personnel, test instruments, and equipment to properly perform the check, test and start work.
4. When work has been completed, provide copies of reports for review, prior to final observation of work.

B. Provide copies of the completed check, test and start report of each item of equipment, bound with the Operation and Maintenance Manual.

C. Upon completion of the work, provide a schedule of planned maintenance for each piece of equipment. Indicate frequency of service, recommended spare parts (including filters and lubricants), and methods for adjustment and alignment of all equipment components. Provide a copy of the schedule with each operating and maintenance manual. Provide a copy of certification from the Owner's representative indicating that they have been properly instructed in maintenance requirements for the equipment installed.

3.19 PRELIMINARY OPERATIONAL REQUIREMENTS AND TESTS

A. Prior to observation to determine final acceptance, put all mechanical systems into service and check that work required for that purpose has been done, including but not limited to the following condensed check list. Provide indexed report to tabulating the results of all work.
1. All equipment has been started, checked, lubricated and adjusted in accordance with the manufacturer's recommendations.
2. Correct rotation of motors and ratings of overload heaters are verified.
3. Specified filters are installed and spare filters have been turned over to Owner.
4. All manufacturers' certificates of start-up specified have been delivered to the Owner.
5. All equipment has been cleaned, and damaged painted finishes touched up.
6. Missing or damaged parts have been replaced.
7. Flushing and chemical treatment of piping systems has been completed and water treatment equipment, where specified, is in operation.
8. Equipment labels, pipe marker labels, ceiling markers and valve tags are installed.
9. Valve tag schedules, corrected control diagrams, sequence of operation lists and start-stop instructions have been posted.
10. Preliminary test and balance work is complete, and reports have been forwarded for review.
11. Automatic control set points are as designated and performance of controls checks out to agree with the sequence of operation.
12. Operation and Maintenance Manuals have been delivered and instructions to the operating personnel have been made.

B. Prior to the observation to determine final acceptance, operate all mechanical systems as required to demonstrate that the installation and performance of these systems conform to the requirements of these specifications.
1. Operate and test all mechanical equipment and systems for a period of at least five consecutive 8 hour days to demonstrate the satisfactory overall operation of the project as a complete unit.
2. Commence tests after preliminary balancing and adjustments to equipment have been checked. Immediately before starting tests, install air filters and lubricate all running equipment. Notify the Architect at least seven calendar days in advance of starting the above tests.
3. During the test period, make final adjustments and balancing of equipment, systems controls, and circuits so that all are placed in first class operating condition.
4. Where Utility District rebates are applicable, demonstrate that the systems meet the rebate program requirements.

C. Review of Contractor's Tests:
1. All tests made by the Contractor or manufacturers' representatives are subject to observation and review by the Owner. Provide timely notice prior to start of each test, in order to allow for observation of testing. Upon the completion of all tests, provide a letter to confirm that all testing has been successful.

D. Test Logs:

1. Maintain test logs listing the tests on all mechanical systems showing dates, items tested, inspectors' names, remarks on success or failure of the tests.

E. Preliminary Operation:
1. The Owner reserves the right to operate portions of the plumbing system on a preliminary basis without voiding the guarantee.

3.20 CERTIFICATES OF INSTALLATION

A. Contractor shall complete applicable “Certificates of Installation” forms contained in the California Building Energy Efficiency Standards and submit to the authorities having jurisdiction for approval and issuance of final occupancy permit, as described in the California Energy Code.

3.21 DEMONSTRATION AND TRAINING

A. An authorized representative of the equipment manufacturer shall train Owner-designated personnel in maintenance and adjustment of equipment. The representative may be an employee of the equipment manufacturer, or a manufacturer-certified contractor. Submit written certification from the manufacturer stating that the representative is qualified to perform the Owner training for the equipment installed.
1. As part of the submittal process, provide a training agenda outlining major topics and time allowed for each topic.
2. Some items of specified equipment require that training must be performed by the manufacturer, using manufacturer’s employees. See specific equipment Articles in these Specifications for this requirement.
3. Contractor shall provide three copies of certification by Contractor that training has been completed, signed by Owner’s representative, for inclusion in Operation and Maintenance Manual. Certificates shall include:
a. Listing of Owner-designated personnel completing training, by name and title.
b. Name and title of training instructor.
c. Date(s) of training.
d. List of topics covered in training sessions.
4. Refer to specific equipment Articles for minimum training period duration for each piece of equipment.

END OF SECTION

SECTION 22 10 00 - PLUMBING PIPING SYSTEMS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Pipe and fittings.

B. Backwater valves.

C. Water hammer arrestors.

D. Hose bibbs.

E. Wall hydrants.

F. Gas and air outlets.

G. Reduced pressure backflow preventer for potable water system.

H. Reduced pressure backflow preventer for non-potable water system.

I. Double check valve backflow preventer.

J. Water meter.

K. Potable water pressure-regulating valve.

L. Gas pressure regulating valve.

M. Relief valves.

N. Trap primer.

O. Thermostatic water temperature control valve.

P. Cleanouts.

Q. Floor drains.

R. Floor sinks.

S. Area drain.

T. Roof drains and overflow drains.

U. Hopper drains.

V. Heat tracing.

1.02 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. Section 22 00 50 Basic Plumbing Materials and Methods.

1.03 ADDITIONAL REQUIREMENTS

A. Furnish and install any incidental work not shown or specified which is necessary to provide a complete and workable system.

B. Coordinate all of work in this Section with all of the trades covered in other Sections of the Specifications to provide a complete, operable and sanitary installation of the highest quality workmanship.

C. All plumbing work required in the course of this contract shall be performed in strict accordance with all codes and regulations. Plumbing work done under this contract shall not adversely affect the operation of the existing plumbing systems. All materials shall be new and shall match existing.

1.04 DESCRIPTION OF WORK

A. Furnish and install all plumbing work indicated on the drawings and described herein.

1.05 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of plumbing piping systems products, of types, materials, and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.

B. Contractor's Qualifications: Firm with at least 5 years of successful installation experience on projects with piping systems work similar to that required for project.

C. Gas Pipe Installer Qualifications: Individuals performing tasks requiring qualifications under Federal and State regulations shall be Qualified by the gas utility supplying the Project site. The qualifications shall be current at the time of performing the Work.

D. Requirements of Regulatory Agencies: The publications listed below form a part of this specification; comply with provisions of these publications except as otherwise shown or specified.
   1. Plumbing Code Compliance: Comply with applicable portions of California Plumbing Code pertaining to selection and installation of plumbing materials and products.
      a. NSF Compliance:
         1) Pipe, tube, and fittings used in potable water systems intended to supply drinking water shall meet the requirements of NSF-61 2012, “Drinking Water System Components – Health Effects.”
         2) Plastic potable water-service piping shall meet the requirements of NSF 14 2012, “Plastic Piping Components and Related Materials.”
   2. California Health and Safety Code Compliance: For products covered under the scope of HSC 116875 for potable water service. Products for potable water service shall be third-party certified by an approved laboratory as complying with California Health and Safety Code Section 11 68 75.
   3. NFPA/ANSI Compliance: Fabricate and install natural gas systems in accordance with latest edition of NFPA 54/ANSI Z223.1 "National Fuel Gas Code."
   4. Utility Compliance: Fabricate and install natural gas systems in accordance with local gas utility company requirements.
   5. CPC Compliance: Fabricate and install natural gas systems in accordance with California Plumbing Code.

6. Provide certified gas welder as defined in California Plumbing Code to weld all joints in welded gas piping.

1.06 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data and installation instructions for plumbing piping systems materials and products.

B. Provide welding certificate for all gas pipe welders.

C. Gas Pipe Installer Qualifications: Provide evidence of current qualifications for individuals performing work requiring qualifications.

D. Record Drawings: At project closeout, submit Record Drawings of installed piping systems, in accordance with requirements of Division 01.

E. Maintenance Data: Submit maintenance data and parts lists for plumbing piping systems materials and products. Include this data, product data, shop drawings, and record drawings in Operation and Maintenance Manual; in accordance with requirements of Division 01.

F. Pipe, pipe or plumbing fittings, fixtures, solder and flux installed in a system providing water for human consumption shall comply with lead free requirements of the California Health and Safety Code Section 11 68 75. Provide submittal information for products third-party certified by an approved laboratory as complying with California Health and Safety Code Section 11 68 75.

1.07 JOB CONDITIONS

A. Cooperation with other trades: Coordinate Work of this Section with that of other Sections to ensure that Work is carried out in an orderly fashion.

B. Coordinate with other trades all equipment locations, pipe, duct and conduit runs, electrical outlets and fixtures, air inlets and outlets, and structural and architectural features. Provide information on location of piping and seismic bracing to all other trades as required for a completely coordinated project.

PART 2 - PRODUCTS

2.01 MATERIALS AND PRODUCTS

A. Provide piping materials and factory-fabricated piping products of sizes, types, pressure ratings, temperature ratings, and capacities as indicated. Provide materials and products complying with California Plumbing Code. Where more than one type of material or product is indicated, selection from materials or products specified is Contractor's option.

2.02 PIPE AND FITTINGS ATTACHED TO AND BELOW BUILDINGS INCLUDING 5 FEET FROM BULDINGS

A. Piping and fittings attached to covered walkways and corridors shall comply with the requirements of this article.

B. Drain and Waste Pipe Above Grade: Cast iron soil pipe and fittings, asphaltic coated, conforming to ASTM A888 and Cast Iron Soil Pipe Institute Standard (CISPI) 301 and so marked. Pipe and fittings shall be as manufactured by AB&I, Charlotte, Tyler Pipe, or equal. Pipe and fittings shall be the products of a single manufacturer. At Contractor’s option, vertical piping above floor from

lavatories, sinks, and drinking fountains may be Schedule 40 galvanized steel pipe with black cast iron drainage fittings, or DWV copper pipe and fittings.

1. Joints above grade: No-Hub pipe conforming to ASTM A888 and CISPI 301. Couplings conforming to ASTM 1277 and CISPI 310, with stainless steel bands. Provide products by ANACO-Husky, Tyler, Ideal or equal. Provide sway brace at 20'-0" maximum spacing for suspended pipe with No-Hub joints. Provide a brace on each side of a change in direction of 90 degrees or more. Brace riser joints at each floor and at 15 foot maximum intervals (also see Specification Section 22 00 50).

C. Drain and Waste Pipe Below Grade: Cast iron soil pipe and fittings, asphaltic coated, conforming to ASTM A888 and CISPI 301 and so marked. Pipe and fittings shall be as manufactured by AB&I, Charlotte, Tyler Pipe, or equal. Pipe and fittings shall be the products of a single manufacturer. At Contractor's option, hub and spigot cast iron soil pipe and fittings, asphaltic coated, conforming to ASTM A-74 and so marked, may be used.

1. Joints below grade: ANACO-Husky SD 4000, Clamp-All 125, or equal couplings and No-Hub fittings, meeting the requirements of FM 1680, SD Class I and ASTM C1540.
2. Joints below grade (hub and spigot option): Neoprene gaskets conforming to ASTM C564, as manufactured by Ty-Seal, Dual-Tite, or equal.

D. Vent Pipe:

1. 3 inch and larger: Cast iron soil pipe and fittings conforming to ASTM A888 and Cast Iron Soil Pipe Institute Standard 301 and so marked.
2. 2-1/2 inch and smaller: Schedule 40 galvanized steel pipe with black cast iron drainage fittings, or DWV copper pipe and fittings.
3. Vent pipe buried in ground and to 6 inches above ground: Cast iron soil pipe and fittings conforming to ASTM A888 and Cast Iron Soil Pipe Institute Standard 301 and so marked. Joints in cast iron vent pipe shall be the same as specified for cast iron waste pipe below ground.

E. Type DWV copper tubing or No-Hub cast iron pipe and fittings may be used for concealed rainwater leaders. Where no-hub piping is used, the fittings and couplings shall match those used for waste piping.

F. Water Pipe (Tempered Water, Tempered Water Return, Hot Water, Hot Water Return and Cold Water): ASTM B88, Type L copper tubing, hard-temper, with wrought copper fittings. Provide full solder cup for all fittings. Capped or plugged outlets shall be Schedule 40 screwed brass. Water piping below slab: ASTM B88, Type K copper tubing, hard temper, with wrought copper fittings. At Contractor's option, pipe runs below slab having no branches may be ASTM B88, Type K annealed copper tubing without joints. See Section 22 00 50 for pipe protection requirements for below slab copper piping.

G. Temperature and Pressure Relief Valve Piping: ASTM B88, Type L copper tubing, hard-temper, with wrought copper fittings. Provide full solder cup for all fittings. Capped or plugged outlets shall be Schedule 40 screwed brass.

H. Gas Pipe: Schedule 40 black steel conforming to ASTM A53, with malleable iron screwed fittings above grade for piping 2 inch and smaller; welded piping below grade and for above grade piping larger than 2 inches, with Class 150 welding fittings.

1. Appliance fuel connectors, as defined in the CPC, are not acceptable for connection of equipment, except where specifically indicated on the Contract Documents.
2. Where Drawings indicate installation of mechanical equipment on spring isolation rails spring mounted curbs, or spring hangers, provide metal flexible connectors, Metraflex Metraloop, or equal by Unisource Mfg. Co., or Flexicraft Industries, CSA listed for 4 inches of movement.
    a. Provide CSA certification for gas connections.

I. Compressed Air Pipe: Type K copper tubing, hard temper, with wrought copper fittings. Capped or plugged outlets shall be screwed brass.

J. Condensate Drain Piping:
1. Inside buildings provide ASTM B88, Type L copper tubing and fittings. Provide Wye fittings with capped cleanout plug for tubing up to 1 inch size. Provide wrought or cast DWV fittings for sizes 1-1/4 inch and larger.
2. Outside buildings provide ASTM B88, Type L copper pipe and fittings, cast iron drain pipe and fittings or Schedule 40 galvanized steel pipe and cast iron drain or vent fittings.
3. Connect condensate drains to mechanical equipment per equipment manufacturer's recommendations; provide P-trap where required. Slope piping to drain, with 1 inch in 10 foot minimum pitch. Provide di-electric couplings or unions at connections to dissimilar materials.
4. Where Drawings indicate installation of mechanical equipment on spring isolation rails spring mounted curbs, or spring hangers, provide threaded metal connector at mechanical equipment, Metraflex Model SST or BST, or equal by Unisource Mfg. Co., or Flexicraft Industries, CSA listed for 4 inches of movement. Arrange flexible connection to ensure drainage of condensate, and support flexible connection at each end of connector, to ensure proper alignment.
5. Where condensate drain P-traps are required, install trap using Wye fitting on inlet and outlet of trap. Provide cap on top of each Wye, made removable for cleaning and inspection. Drill 1/8 inch diameter hole in cap at outlet of the trap to allow venting of the system. Minimum depth of trap should be 4 inches, or as recommended by the manufacturer in printed literature.
6. Provide cleanout tees or “Y” at each change in direction.

2.03 SITE PIPING AND FITTINGS TO 5 FEET FROM BUILDINGS

A. Buried Drain, Waste, and Vent Piping:
1. Install piping from street connection to the property line in accordance with local requirements.
2. 4 inches and larger: PVC, ASTM D3034 - SDR 35; use matching Ring Tite fittings.
3. 3 inches and smaller: Cast iron soil pipe and fittings, asphaltic coated, conforming to ASTM A888 and Cast Iron Soil Pipe Institute Standard 301 and so marked. Pipe and fittings shall be as manufactured by AB&I, Charlotte, Tyler pipe, or equal. Provide ANACO-Husky SD 4000, Clamp-All 125, or equal couplings and No-Hub fittings, meeting the requirements of FM 1680, SD Class I and ASTM C1540. Pipe and fittings shall be the product of a single manufacturer.

B. Water Service Piping:
1. Sizes 2 inches and larger (not under building): Gasket style PVC conforming to ASTM D2241-SDR21, Class 200 with gasket type fittings or ductile iron mechanical joint couplings. Gasket fittings shall be one piece injection molded PVC fittings, equal to Flo-Seal water main fittings for PVC pressure pipe, 200 psi, ASTM D-3139.
2. Sizes less than 2 inches: Type K copper tubing, hard temper, with wrought copper fittings. See Section 22 00 50 for pipe protection requirements for below grade copper piping.
3. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:
a. J.M. Eagle.
b. P.W. Pipe.
c. Ipex Series Pipe.

C. Water Service Piping Above Grade:
1. Sizes 2 inches and larger: Class 150 flanged ductile cast iron water pipe conforming to AWWA/ANSI C150/A21.50 and manufactured in accordance with AWWA/ANSI C151/A21.51. Fittings shall conform to AWWA/AWWA C110/A21.10, Class 250 pattern.

Pipe and fittings shall have factory applied cement-mortar lining in accordance with AWWA/ANSI C104/A21.4. Flanges shall conform to ASME/ANSI B16.1.

2. Piping 1-1/2 inches and smaller: Type L copper tubing, hard temper, with brazed wrought copper fittings.

D. Gas Piping Underground: Performance Pipe, “DriscoPlex” 6500 PE 2708 (yellow), Polypipe, Inc., “Polypipe”, or equal, polyethylene gas distribution pipe, ASTM D2513, ASTM D3261, and ASTM D2683 fittings with fusion welded joints. Provide piping labeled for natural gas in accordance with CPC.

1. Electrically isolate underground ferrous gas piping from the rest of the gas system with listed or approved isolation fittings installed a minimum of six inches above grade.
2. Provide Central Plastics Corp., Perfection, or equal, anodeless, single seal riser for transition from below grade polyethylene to schedule 40 steel piping above grade. Minimum horizontal length shall be 30 inches. Minimum vertical length shall be 30 inches, or greater as required. Provide fusion connection to polyethylene pipe below grade, and screwed connection to steel pipe above grade.

E. Gas Piping Aboveground to 30 inches Belowground: Schedule 40 black steel with beveled ends for welding, with Class 150 welding fittings. Mitering to form elbows or tees will not be permitted; where branch tee connections of welded piping are required, Bonney "Weldolet" Allied Pipe Fittings, or equal fittings may be used if the branch is one-half of the diameter of the main or less.

F. Drainage Pipe, Perforated or Un-perforated: J-M PVC, P.W. Pipe, or equal drainage pipe and fittings or non-reinforced concrete sewer pipe ASTM C14.

2.04 FIRE PROTECTION PIPING

A. Refer to specification Section 21 10 00 “Fire Protection.”

2.05 BACKWATER VALVES

A. Provide Zurn Model Z-1090 J. R. Smith 7012, or equal flapper type backwater valve where indicated on drawings. Install in accordance with manufacturer’s recommendations.

B. Provide Christy Model B16, Brooks, or equal utility box, 12 inches by 22 inches size, for installation of backwater valve.

C. Provide Zurn Model Z-1091, J.R. Smith 7070, or equal terminal type backwater valve, and install in catch basin piping at the outlet of the catch basin.

2.06 WATER HAMMER ARRESTORS

A. Provide water hammer arrestors conforming to lead-free requirements of California Health and Safety Code Section 11 68 75, with nesting type bellows contained within a casing having sufficient displacement volume to dissipate the calculated kinetic energy generated in the piping system. Water hammer arrestors shall be sized for type and number of fixtures served. Provide all stainless steel shell construction with stainless steel bellows and threaded connection to water system.

B. Water hammer arrestors shall be certified under P.D.I. Standard WH201 and by ASSE Standard 1010.

C. Select units in accordance with the requirements of Plumbing and Drainage Institute Standard P.D.I. WH201. Install above ceilings or behind wall access door at each plumbing fixture, or where plumbing fixtures are installed in groups, at each group of fixtures.

D. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:
   1. Josam Company, series 75000.
   2. Smith (Jay R.) Mfg. Co., Hydrotrol 5005-5050.
   3. Mifab, series WHB.

2.07 HOSE BIBBS

A. Hose Bibbs:
   1. Manufacturers: Drawing schedules indicate Basis of Design products. Subject to compliance with requirements, provide product indicated on Drawings, or comparable product by one of the following, or equal:
      a. Acorn Engineering Co.
      b. Woodford Manufacturing Co.

2.08 WALL HYDRANTS

A. Manufacturers: Drawing schedules indicate Basis of Design products. Subject to compliance with requirements, provide product indicated on Drawings, or comparable product by one of the following, or equal:
   1. Acorn Engineering Co.
   2. Woodford Manufacturing Co.
   3. Mifab, Inc.

2.09 GAS AND AIR OUTLETS

A. Gas Outlets: Deck mounted Chicago 982-907BC duplex, T&S Brass, or equal; deck mounted Chicago 980-907BC single, or equal, deck-mounted Chicago 984-907BC, four outlets, or equal. Provide integral check valve, and single lever handle in compliance with ADA requirements.

B. Air Outlets: Panel mounted Chicago 986-937CH; deck-mounted Chicago 980-937CH, T&S Brass, or equal. Provide integral check valve, and single lever handle in compliance with ADA requirements.

C. Air Hose Valve: Lincoln 815 coupler and 11659 nipple, Grover, or equal, with ball valve on inlet. Refer to drawing details for additional requirements. Provide Wilkerson Model CB6-04-000 air pressure regulator, or equal.

D. Hose Reels: Lincoln Model 85062, Grover or equal. Provide heavy-duty type with delivery hose, universal swivel, ball stop, shut-off valve, control valve and filter as required. Connect services to reels with ball valve.

2.10 REDUCED PRESSURE BACKFLOW PREVENTER FOR POTABLE WATER SYSTEMS

A. Provide reduced pressure principle backflow preventer conforming to lead free requirements of California Health and Safety Code Section 11 68 75.
   1. Reduced-pressure principle backflow preventer assembly, consisting of shutoff valves on inlet and outlet, and strainer on inlet., Backflow preventer shall include test cocks, and pressure differential relief valve located between two positive seating check valves. Construct in accordance with ASSE Standard 1013.
   2. Manufacturers: Subject to compliance with requirements and local water authorities having jurisdiction, available manufacturers offering products that may be incorporated into the Work include the following, or equal:
      a. 2 inches and smaller: Wilkins 975XL2, Febco LF825YRP, Watts LF919.
      b. 2-1/2 thru 10 inches: Wilkins 475AXL, Febco LF860RP.

c. 2-1/2 and 3 inches: Watts LF009.

B. Provide LeMeur, Hot-Box, WattsBox, or equal, two piece reinforced aluminum, fiberglass, welded angle with expanded metal, backflow preventer enclosure, sized to suit the size of backflow preventer. Install on concrete pad, in accordance with manufacturer's written installation instructions.

C. Provide substantial padlock and chain to lock valves in open position, and turn key over to Project Inspector.
1. Padlocks shall be as specified under Section 08 70 00.
2. Chain shall be of carbon steel, 3/8 inch wire diameter, fully welded links and weight of 140 pounds per 100 lineal feet. Chain shall be hot galvanized.

D. Provide capped connections at each test cock. Install in accordance with requirements of Authority Having Jurisdiction.

E. Provide two concrete filled, 6-inch diameter pipe bollards to protect all exposed piping from motor vehicle damage.

2.11 REDUCED PRESSURE BACKFLOW PREVENTER FOR NON-POTABLE WATER SYSTEMS

A. Refer to Section 21 10 00 for backflow preventers for fire protection service.

B. Provide reduced-pressure principle backflow preventer consisting of assembly, including shutoff valves on inlet and outlet, and strainer on inlet, equal to Febco 825Y or 880, as required Wilkins, Aames, or equal. Backflow preventer shall include test cocks, and pressure differential relief valve located between two positive seating check valves. Construct in accordance with ASSE Standard 1013.

C. Provide LeMeur, Hot-Box, or equal, two piece backflow preventer enclosure, sized to suit the size of backflow preventer. Install on concrete pad, in accordance with manufacturer's written installation instructions.

D. Provide substantial padlock and chain to lock valves in open position, and turn key over to Project Inspector.
1. Padlocks shall be as specified under Section 08 70 00.
2. Chain shall be of carbon steel, 3/8 inch wire diameter, fully welded links and weight of 140 pounds per 100 lineal feet. Chain shall be hot galvanized.

E. Provide capped connections at each test cock. Install in accordance with requirements of Authority Having Jurisdiction.

F. For units installed within buildings, provide drain, connected to unit, to collect spillage from atmospheric vent. Run drain to nearest floor sink or drain.

G. Provide two concrete filled, 6-inch diameter pipe bollards to protect all exposed piping from motor vehicle damage.

H. Manufacturers: Subject to compliance with requirements and local water authorities having jurisdiction, available manufacturers offering products that may be incorporated into the Work include the following, or equal:
1. Ames.
2. Febco Sales, Inc.
3. Watts Regulator Company.
4. Clow.

2.12 DOUBLE CHECK VALVE BACKFLOW PREVENTERS

A. Refer to Section 21 10 00 for backflow preventers for fire protection service.

B. Provide double detector check valve assembly consisting of two spring loaded brass check valves, two cast iron bronze fitted gate valves and four test cocks, equal to Febco Model 856 or 876 as required. Construct in accordance with ASSE Standard 1048.

C. Provide LeMeur, Hot-Box, or equal, two-piece backflow preventer enclosure, sized to suit the size of backflow preventer. Install on concrete pad, in accordance with manufacturer's written installation instructions.

D. Provide substantial padlock and chain to lock valves in open position and turn key over to Project Inspector.
   1. Padlocks shall be as specified under Section 08 70 00.
   2. Chain shall be of carbon steel, 3/8 inch wire diameter, fully welded links and weight of 140 pounds per 100 lineal feet. Chain shall be hot galvanized.

E. Provide capped connections at each test cock. Install in accordance with requirements of Authority Having Jurisdiction.

F. Provide two concrete filled, 6 inch diameter pipe bollards to protect all exposed piping from motor vehicle damage.

G. Provide Christy, or equal, utility box sized as required to suit backflow assembly, complete with two piece reinforced concrete lid, concrete extensions, insulation and other construction details shown on the drawings.

H. Manufacturers: Subject to compliance with requirements and local water authorities having jurisdiction, available manufacturers offering products that may be incorporated into the Work include the following, or equal:
   1. Ames.
   2. Febco Sales, Inc.
   3. Watts Regulator Company.
   4. Clow.

2.13 WATER METER

A. Provide and install prefabricated water meter and bypass assembly, sized as indicated on the Drawings, complete with strainer, adapter, couplings, spool piece and test nipple. The meter shall be compound type, with two measuring chambers and a single billing register. Pipe materials used in construction of the assembly shall be ductile iron, and the meter shall be bronze with stainless steel trim.

B. Install the meter and accessories in a Christy, Brooks, or equal, series "R" pit Model R37, 4 feet by 7 feet by 3 feet deep; complete with 4 piece checker plate parkway lid (screw down type), and 8 inch round meter reading lid. Install meter in accordance with the requirements of the Authority Having Jurisdiction.

C. Manufacturers: Subject to compliance with requirements and local water authorities having jurisdiction, available manufacturers offering products that may be incorporated into the Work include the following, or equal:
   1. Badger Meter, Inc.
   2. Sensus North America Water.
   3. Neptune Technology Group.

4. Hershey Meters.

2.14 POTABLE WATER PRESSURE-REGULATING VALVE

A. Provide pressure-regulating valves, single-seated, direct-operated type, bronze body, integral strainer, complying with requirements of ASSE Standard 1003, and the lead-free requirements of California Health and Safety Code Section 11 68 75. Size for maximum flow rate and inlet and outlet pressure indicated on Drawings.

B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:
1. Cla-Val Company.
2. Watts Regulator Company.

2.15 GAS PRESSURE REGULATING VALVES

A. Provide single-stage, spring-loaded, corrosion-resistant gas pressure regulators, with die-cast aluminum or cast iron body, complying with ANSI Z21.80. Unit shall be with atmospheric vent, internal relief overpressure protection, threaded ends for 2 inches and smaller, flanged ends for 2-1/2 inches and larger. For inlet and outlet gas pressures, specific gravity, and volume flow refer to Drawings schedule.

B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

Size	Manufacturer/Model
1/2 inch	Elster (American, Singer) model 1213B Itron (Actaris, Slumberger, Sprague) model B42R.
3/4 thru 1-1/4inches	Elster (American, Singer) model 1813C Sensus (Ivensys, Equimeter, Rockwell) model 143-80-12 Itron (Actaris, Slumberger, Sprague) models B42R, B57R, B58R
1-1/2 thru 2 inches	Elster (American, Singer) models 1813, 1813B Sensus (Ivensys, Equimeter, Rockwell) model 243 Itron (Actaris, Slumberger, Sprague) models B43SR, B34R, B38R

2.16 RELIEF VALVES

A. Provide relief valves as indicated, of size and capacity as selected by Contractor for proper relieving capacity, in accordance with ASME Boiler and Pressure Vessel Code.

B. Combined Pressure-Temperature Relief Valves: Bronze body, test lever, thermostat, complying with ANSI A21.22 listing requirements for temperature discharge capacity. Provide temperature relief at 210 degrees F, and pressure relief at 150 psi.

C. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

D. Watts Regulator Company.

E. Cash (A.W.) Valve Manufacturing Corporation.

F. Zurn Industries, Inc.; Wilkins-Regulator Division.

2.17 TRAP PRIMER

A. Manufacturers: Drawing schedules indicate Basis of Design products. Subject to compliance with requirements, provide product indicated on Drawings, or comparable product by one of the following, or equal:
1. MiFab, Inc.
2. Precision Plumbing Products.
3. Sioux Chief Manufacturing Company.

2.18 THERMOSTATIC WATER TEMPERATURE CONTROL VALVE

A. Provide thermostatic water temperature control valve conforming to lead free requirements of California Health and Safety Code Section 11 68 75, with size as noted on Drawings, complete with union angle strainer checkstops. Valves shall be thermostatic type, with a maximum temperature setting as follows:

B. Provide surface recessed semi-recessed mounted, white enameled or stainless steel cabinet with locking door for control valves. Including:
1. Control valve cabinet and valve shall be provided as a package, and include thermostatic water mixing valve, thermometer, safety checkstops, volume control valve and internal piping.

C. Where indicated on drawings, provide a temperature alarm system, utilizing a micro-processor based controller and solid state temperature controller. Provide audible and visual indication of high and low temperature set points. Provide required hardware and wiring for a complete operating system.
1. Provide isolation transformer for control of the alarm system.
2. Provide solenoid valve and shock absorber, installed and wired to the alarm module.

D. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:
1. Leonard Valve Company.
2. Lawler Manufacturing Co., Inc.
3. Powers.

2.19 CLEANOUTS

A. General: Install cleanouts of same diameter as pipe (4 inch maximum) in all horizontal soil and waste lines where indicated and at all points of change in direction. Cleanouts shall be located not less than 18 inches from building construction so as to provide sufficient space for rodding. No horizontal run over 50 feet inside buildings or 100 feet outside buildings shall be without cleanout, whether shown on Drawings or not. Provide two-way cleanouts where indicated on drawings, and where required for satisfactory use.
1. Provide cleanouts in waste drop from each sink and urinal.
2. Provide one wrench for each size and type of cleanout used. Turn over to Owner at completion of the project, and obtain receipt. Place receipt in Operation and Maintenance Manuals.

B. Cleanouts in floor and in concrete sidewalks: Ducco Cast Iron with nickel bronze top, clamping collar and ABS plastic plug: Zurn ZN-1400-KC, or equal, with square or round top to suit floor construction.

C. Cleanouts in composition floors: Zurn ZN-1400-X-DX, or equal (nickel bronze top).

D. Cleanouts in concealed, aboveground cast-iron soil or waste lines: Zurn Z-1440A, or equal, with ABS plastic plug.

E. Cleanouts in walls: Zurn Z-1441 or Z-1443, or equal, with stainless steel cover. Provide long sweep elbow or combination wye at connection to riser and install with surface of cleanout within 1/2 inch of front face of finished wall.
   1. Where space does not permit the above installation, provide Zurn Z-1446, or equal, with stainless steel access cover, and vandal resistant screw.
   2. Install face of cleanout plug within 1/2 inch of front face of finished wall.

F. Cleanouts exterior to building in landscaped areas: Zurn Z-1449-BP, or equal, cleanout ferrule with tapered bronze plug. Where located at grade, provide 18 by 18 by 6 inch concrete pad; Trowel concrete smooth and edge; set flush with finished grade.

G. Cleanouts in drive areas: Zurn -1400-HD-KC, or equal, with heavy-duty top and ABS plastic plug.

H. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:
   1. Zurn.
   2. J.R. Smith.
   3. Josam.

2.20 FLOOR DRAINS Manufacturers: Drawing schedules indicate Basis of Design products. Subject to compliance with requirements, provide product indicated on Drawings, or comparable product by one of the following, or equal:
   1. J.R. Smith
   2. MIFAB
   3. Watts
   4. Zurn

2.21 FLOOR SINKS

A. Floor Sinks: Provide anchoring flange (seepage pan) at all floor sinks, and provide flashing clamp in locations where floor membrane is used. Provide cast iron "P" trap and trap primer connection at P-Trap.

B. Manufacturers: Drawing schedules indicate Basis of Design products. Subject to compliance with requirements, provide product indicated on Drawings, or comparable product by one of the following, or equal:
   1. J.R. Smith
   2. MIFAB
   3. Watts
   4. Zurn

2.22 AREA DRAIN

A. Manufacturers: Drawing schedules indicate Basis of Design products. Subject to compliance with requirements, provide product indicated on Drawings, or comparable product by one of the following, or equal:
   1. Brooks
   2. J.R. Smith
   3. Old Castle Precast
   4. Watts

5. Zurn

2.23 ROOF DRAINS AND OVERFLOW DRAINS

A. See Architectural Drawings for drain style to be used.

B. Provide offset downspout boots where required for connection of exposed sheet metal downspouts to underground cast iron or PVC piping.

C. Provide rainwater leader nozzles on overflow piping. Nozzle body shall be bronze with threaded inlet and bronze wall flange with mounting holes. Size nozzle to match connected rainwater leader.

D. Manufacturers: Drawing schedules indicate Basis of Design products. Subject to compliance with requirements, provide product indicated on Drawings, or comparable product by one of the following, or equal:
1. J.R. Smith.
2. Mifab.
3. Zurn.

2.24 HOPPER DRAINS

A. Manufacturers: Drawing schedules indicate Basis of Design products. Subject to compliance with requirements, provide product indicated on Drawings, or comparable product by one of the following, or equal:
1. Zurn.
2. J.R. Smith.

2.25 HEAT TRACING

A. Domestic Hot Water: Provide U.L. listed, 115 degrees F nominal temperature operation heat cable, in locations indicated on drawings. Provide all components required for complete system, including cable, power connections, end seals, splices, tees and accessories. Manufacturer shall be Raychem HWAT-R2, Thermon, or equal, 208 volt single phase.

B. Label all heat traced piping every 10 feet with "ELECTRIC TRACED" label.

PART 3 - EXECUTION

3.01 INSPECTION

A. Examine areas and conditions under which plumbing piping systems are to be installed. Do not proceed with Work until unsatisfactory conditions have been corrected in manner acceptable to Contractor.

B. Make all arrangements for the utilities required. Pay all costs involved in obtaining the services including gas service and meter, water meter, pressure reducing valve, access boxes, street work. Connect to site utilities. Verify the location of all services. No extra cost will be allowed if services are not as shown.

C. Determine sanitary sewer and storm drain location and elevation at all points of connection before installing any piping. Notify Architect immediately if indicated grades cannot be maintained.

D. At time of final connection, and prior to opening valve to allow pressurization of water and gas piping from existing systems, on site or off site, perform a pressure test to indicate static pressure

of existing systems. If pressure on water piping is greater than 80 psi, or gas pressure is not as indicated on Contract Documents, inform Architect immediately. Do not allow piping systems to be pressurized without written consent of the Architect.

3.02 INSTALLATION OF WATER PIPING

A. Run all water piping generally level, free of traps or unnecessary bends, arranged to conform to the building requirements, and to suit clearance for other mechanical work such as ducts, flues, conduits, and other work. No piping shall be installed so as to cause unusual noise from the flow of water therein under normal conditions.

B. Provide manufactured water hammer arrestors, sized and installed in accordance with Plumbing and Drainage Institute Standard PDI WH201.
   1. Locate water hammer arrestors at every plumbing fixture, or, where fixtures are located in groups, at every group of fixtures, and as indicated on Drawings.
   2. Install water hammer arresters above accessible ceilings, or install access doors for service.

C. In freezing locations arrange water piping to drain as shown.

D. Install piping on room side of building insulation.

E. Check final location of rubber rings within couplings on PVC water piping with gauge or as recommended by manufacturer. Make connection to valves with cast iron adapters connected to water pipe with cast iron couplings. Furnish and install anchors or thrust blocks.

F. For all faucets, hose bibbs, or other water outlets delivering industrial hot and/or cold water, provide a sign, permanently mounted, indicating "CAUTION: NON-POTABLE WATER, DO NOT DRINK". Each sign shall be permanently engraved with black uppercase letters on a yellow background. Letters shall be minimum 1-1/4 inch high.

3.03 INSTALLATION OF SANITARY AND STORM DRAINAGE SYSTEMS

A. Make joints in PVC sewer pipe with PVC-type couplings and rubber rings.

B. Check final location of rubber rings within the couplings with gauge or as recommended by the manufacturer. Make joints between PVC pipe and cast iron pipe or fittings using cast iron adapter fittings, installed as recommended by the manufacturer.
   1. Ring-Tite cast iron pipe fittings may be used in lieu of standard fittings. Make connection to valves with cast iron adapters connected to the pipe with PVC couplings.

C. Sewer Piping: Run all horizontal sanitary drain piping inside of building on a uniform grade of not less than 1/4 inch per foot unless otherwise noted or later approved. Unless otherwise noted on the plans, piping shall have invert elevations as shown and slope uniformly between given elevations.

D. Storm Drain Piping: Run all horizontal storm drain piping inside of building on a uniform grade of not less than 1/4 inch per foot. Unless otherwise noted on the plans, piping shall have invert elevations as shown and slope uniformly between given elevations.

E. Install rainwater leader nozzles at exposed bottom of leaders where they spill onto grade.

F. Run all drainage piping as straight as possible and provide easy bends with long turns; make all offsets at an angle of 45 degrees or less.

G. Grade all vent piping so as to free itself quickly of any water condensation.

H. Where possible, join groups of vent risers together with one enlarged outlet through roof. Maintain minimum of 10 foot horizontal or 3 foot vertical clearance from air intakes.

I. Hubless Cast Iron Joints: Comply with coupling manufacturer's installation instructions.

3.04 INSTALLATION OF CLEANOUTS

A. Cleanouts: Install in piping as indicated, as required by California Plumbing Code, at each change in direction of piping greater than 45 degrees. Install at maximum intervals of 50 feet for piping 4 inches and smaller and 100 feet for larger piping inside buildings, and at base of each conductor.

B. Flashing Flanges: Install flashing flange and clamping device with each cleanout passing through water resistant membrane.

3.05 INSTALLATION OF FLOOR DRAINS AND FLOOR SINKS

A. Install drains in accordance with manufacturer's written instructions and in locations indicated. Install floor drains with lip of drain slightly below finished floor to ensure drainage. Install floor sinks flush with finished floor. Coordinate with other Contractors to ensure that floor slopes to drain. Provide flashing flange and clamping device with each drain passing through water resistant membrane.

B. Install vented P-trap below each drain. Where trap primers are indicated, install trap primer connection in the P-trap.

3.06 INSTALLATION OF ROOF DRAINS AND OVERFLOW DRAINS

A. Install roof drains and overflow roof drains in accordance with manufacturer's written instructions and in locations indicated.

B. Coordinate with roofing as necessary to interface roof drains with roofing work.

3.07 INSTALLATION OF HOPPER DRAINS

A. Install hopper drain in wall, in sheet metal box, with access door.
   1. Size access door and box to suit the size required for hopper drain and trap primer, and solder all seams of box. Seal all penetrations to box with non-hardening waterproof sealant. Provide locking door in occupied spaces.

B. Grind top and sides of funnel, if required, to suit wall thickness.

3.08 INSTALLATION OF NATURAL GAS PIPING

A. Install natural gas piping in accordance with Division 22 Basic Plumbing Materials and Methods sections.

B. Use sealants on metal gas piping threads that are chemically resistant to natural gas. Use sealants sparingly, and apply to only male threads of metal joints.

C. Remove cutting and threading burrs before assembling piping.

D. Do not install defective piping or fittings. Do not use pipe with threads that are chipped, stripped, or damaged.

E. Plug each gas outlet, including valves, with threaded plug or cap immediately after installation and retain until continuing piping or equipment connections are completed.

F. Ground gas piping electrically and continuously within project, and bond tightly to grounding connection.

G. Install drip-legs in gas piping where indicated and where required by code or regulation.
   1. Install "Tee" fitting with bottom outlet plugged or capped at bottom of pipe risers.

H. Install piping with 1/64 inch per foot (1/8 percent) downward slope in direction of flow.

I. Install piping parallel to other piping.

J. Paint all gas piping installed in exposed exterior locations.

K. Provide shutoff valve downstream of meter.

L. Provide exterior shutoff valve at each building. Provide sign affixed to wall at valve location reading: “Gas Shut-Off.” Size and location of the sign shall be as required by the Authority Having Jurisdiction. Where gas piping enters a building in more than one location, exterior shutoff valves shall have a permanently attached metal tag identifying the area served by that valve, in addition to sign on wall.

M. Maintain minimum of 12 inch clearance between gas piping and steam piping above 200 degrees F.

3.09 GAS PRESSURE REGULATING VALVES

A. Install as indicated; comply with utility requirements. In locations where regulators are installed in confined spaces, pipe atmospheric vent to outdoors, full size of outlet. Install gas shutoff valve upstream and downstream of each pressure-regulating valve.

3.10 GAS PIPING EQUIPMENT CONNECTIONS

A. Connect gas piping to each gas-fired equipment item, with union, drip leg and shutoff gas cock full size of supply line shown. Reduce only at connection to equipment. Comply with equipment manufacturer's instructions.
   1. Appliance fuel connectors, as defined in 1203 of the CPC, are not acceptable for connection of equipment, except where specifically indicated on the Contract Documents.
   2. Route gas vent and gas relief to outside.
   3. Gas shutoff valve shall be placed as close as possible to equipment in a location where it can be serviced. Distance from equipment to valve shall not exceed 6 feet.

3.11 INSTALLATION OF BACKFLOW PREVENTERS

A. Install backflow preventers where indicated on Drawings. Provide drain connection available from the manufacturer at drain connection, pipe drain outlet to the nearest floor drain.
   1. Where drain pans are shown on the Drawings, pipe drain pan outlet to nearest floor drain.

3.12 INSTALLATION OF TRAP PRIMERS

A. Install as indicated in manufacturers printed literature, with 1/2 inch, Type L, hard copper piping to trap primer connection on floor drains and floor sinks where indicated on Drawings. At Contractor’s option, Type K annealed copper tubing without joints may be used be used below

slab only. See Section 22 00 50 for pipe protection requirements for below slab copper piping/tubing.

B. Install trap primer piping with 1/4 inch per foot slope, to insure that the line will drain fully to the floor drain or floor sink.
   1. Provide ball valve to the inlet at each trap primer location.

C. Install trap primer and distribution unit exactly as called for in manufacturers printed installation instructions. Connect to domestic water piping from the top of the water line, in order to prevent foreign material from entering directly into primer assembly.

D. Mount trap primer in wall, in sheet metal box, with Karp or equal access door. Size access door and box to suit valve operation, and solder all seams of box. Seal all penetrations to box with non-hardening waterproof sealant. Provide locking door where installed in occupied spaces.

E. Where one trap primer will be used for more than one trap, provide a distribution unit with feeder piping for a maximum of four traps sized for equal pressure drop to each trap.

3.13 EQUIPMENT CONNECTIONS

A. Piping Runouts to Fixtures: Provide hot and cold water piping runouts to fixtures of sizes indicated.

B. Mechanical Equipment Connections: Connect hot and cold water piping system and gas piping system to mechanical equipment as indicated, and provide with shutoff valve and union for each connection.

3.14 HEAT TRACING INSTALLATION

A. Provide heat cable on all domestic hot water piping.

B. Manufacturer's installation recommendation shall be considered as part of this specification.

C. Field testing of insulation resistance and continuity of the units shall be carried out with a 500 volt meter and recorded by the contractor. Testing shall be done when received on the job site, after installation on the pipe, and after the heat insulation has been installed. Insulation resistance shall be consistently not less than 50 megohms with no decline in reading.

D. Where source of supply does not coincide with location of thermostat, cable shall be run along the pipe under the insulation to the thermostat.

E. All junction boxes shall be located above grade level. Covers shall be kept on boxes at all times when not working therein. Where allowable, a hole shall be provided in bottom of junction boxes to permit moisture to escape.

F. All terminations shall be protected from the water and from physical damage.

G. Any field alterations or deviations shall proceed only after authority via signed change order has been issued by Architect. All changes shall be accurately recorded by the Contractor and shall be turned over to the Engineer upon completion of that phase of the work.

H. All lines shall be insulated within 24 hours upon cable installation and acceptance.

I. Junction boxes, thermostats, transformers and the like shall not be attached to the insulation, but shall be mounted on brackets fabricated of galvanized angle, channel or other material of

sufficient strength to support equipment mounted on them. Brackets shall not be mounted on pipe, but rather on separate supports.

J. Heating cables to be laid out along sections of piping to be traced to ensure reasonably uniform distribution of heat. It is recommended that the cable first be "roughed-in" using tape or rubber bands which are to be removed after permanent bending. The cable shall not be pulled taut, but allowed reasonable waving along axis of pipe.

K. Cable sheaths shall not cross or touch one another nor shall cables be installed directly on top of pipe.

L. Heating cable shall be strapped to two-inch and larger pipe using one-half inch wide stainless steel banding at intervals not exceeding one foot per CEC. Stainless steel tie wire #18 AWG, or larger, shall be used to hold the cable to irregular surfaces such as valves. Tie wire and strapping shall be snug but not so tight as to indent cable sheath. On small diameter and low temperature pipe, nylon ties or glass tape may be used.

M. Extra cable to be provided at areas of increased heat loss such as valves and flanges to allow dismantling and removal of equipment.

N. Thermostat bulb to be located as far away from heating cable as possible. Thermostat capillary and control wire shall have mechanical protection between the equipment rack and the pipelines.

O. Apply "ELECTRICALLY HEATED" signs to the outside of the thermal insulation.

3.15 KITCHEN EQUIPMENT

A. Coordinate all work with Specification Section for Kitchen Equipment.

B. All equipment shall be fully connected.

C. Furnish and install all required "P" traps.

D. Provide stops on all hot and cold water lines at equipment, in an accessible position. Include lines to kettle and range swing faucets.

E. Water pressure for dishwasher and glass-washer to be 25 pound maximum. Provide pressure reducing valves on water line to washers.

F. All floor openings are to be sealed watertight.

G. Indirect waste lines required for standard or fabricated items of kitchen equipment, except sinks, shall be furnished and installed by the Kitchen Equipment Contractor.

H. Provide all sink drains. All indirect drains shall terminate above floor sinks at least 1-1/2 times ID of drain line and shall be so set that flare will not spill on floor area.

I. Provide approved vacuum breaker or anti siphon device on water lines to equipment wherever required.

J. Provide gas pressure regulators for modular front manifold cooking equipment assemblies. Pressure regulators shall be adjustable from 2 inch to 7 inch water column and shall be set for approximately 6 inches W.C. at manifold connection.

K. All gas pressure regulators shipped loose with gas fired equipment shall be installed by Plumbing Contractor.

L. The Kitchen Equipment Contractor will provide all equipment trim including faucets and sink wastes and swing faucets at kettles all to be installed by Plumbing Contractor.

M. All horizontal piping lines connected to equipment shall be run at the highest possible elevation not less than 6 inches above floor. Piping rough-in shall be stubbed in walls wherever possible.

N. Vent piping for waste lines shall be concealed wherever possible and vertical vents for island or free-standing equipment shall be avoided. Any required exposed vents shall be submitted to the Architect for approval.

O. Kitchen Equipment Contractor to furnish coffee maker. Plumbing Contractor shall provide a cold water connection terminating in a 3′-0″ length of 1/4 inch OD soft copper tubing with a 1/4 inch female flare fitting on the end.

3.16 SPARE PARTS

A. Furnish to Owner, with receipt, one valve key for each key operated hydrant, bibb, or faucet installed.

3.17 DOMESTIC WATER SYSTEM STERILIZATION

A. Clean and disinfect new or altered hot and cold water piping connected to domestic water systems using methods prescribed by the Health Authority. If the Health Authority does not prescribe methods, clean and disinfect new or altered hot and cold water piping using methods given in the California Plumbing Code.
   1. A water treatment company that has a current state EPA license to apply disinfectant chlorine in potable water shall perform the procedure.

3.18 CARE AND CLEANING

A. Repair or replace broken, damaged, or otherwise defective parts, materials, and work. Leave entire work in condition satisfactory to Architect. At completion, carefully clean and adjust equipment, fixtures, and trim that are installed as part of this work. Remove labels from stainless steel sinks, except 316 stainless steel sink labels should be retained to confirm that the correct material has been provided. Leave systems and equipment in satisfactory operating condition.

3.19 OPERATION TEST

A. Test each piece of equipment to show that it will operate in accordance with indicated requirements.

3.20 TESTING AND BALANCING

A. See Section 23 05 93 of these specifications for testing and balancing requirements.

3.21 CLEANING UP

A. Upon completion of Work remove materials, equipment, apparatus, tools, and the like, and leave premises clean, neat, and orderly.

END OF SECTION

SECTION 22 40 00 - PLUMBING FIXTURES

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Water supplies and stops.

B. Plumbing fixture hangers and supports.

C. Refrigerator ice maker.

D. Solids interceptor.

E. Washing machine hose/supply box.

1.02 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. Section 22 00 50 Basic Plumbing Materials and Methods.

1.03 ADDITIONAL REQUIREMENTS

A. Furnish and install any incidental work not shown or specified which is necessary to provide a complete and workable system.

B. Coordinate all of work in this Section with all of the Trades covered in other Sections of the Specifications to provide a complete, operable and sanitary installation of the highest quality workmanship.

1.04 DESCRIPTION OF WORK

A. Furnish and install all plumbing work indicated on the Drawings and described herein.

1.05 QUALITY ASSURANCE

A. Manufacturers: Firms regularly engaged in manufacture of plumbing fixtures of the type, style and configuration required. All companies providing products with warranties must have been engaged in manufacturing of such products for as long as the warranty states.

B. Plumbing Fixture Standards: Comply with applicable portions of the following codes and requirements for all work in this section:
   1. California Building Code – CBC
   2. California Plumbing Code – CPC
   3. California Health and Safety Code
   4. American National Standards Institute - ANSI
   5. Federal Standards - F.S.
   6. National Sanitary Foundation – NSF International

C. ANSI Standards: Comply with ANSI/NSF 61, “Drinking Water System Components – Health Effects.”

D. PDI Compliance: Comply with standards established by Plumbing and Drainage Institute pertaining to plumbing fixture supports.

E. UL Labels: Provide water coolers that have been listed and labeled by Underwriters' Laboratories.

F. ARI Labels: Provide water coolers that are rated and certified in accordance with applicable Air-Conditioning and Refrigeration Institute Standards.

G. Americans with Disabilities Act (ADA).

H. California Health and Safety Code Compliance: For products covered under the scope of HSC 116875 for potable water service. Products for potable water service shall be third-party certified by an approved laboratory as complying with California Health and Safety Code Section 11 68 75.

1.06 SUBMITTALS

A. Product Data: Submit manufacturer's specifications for plumbing fixtures and trim, including catalog cut of each fixture type and trim item furnished.

B. Maintenance Data: Submit maintenance data and parts lists for each fixture type and trim item, including instructions for care of finishes. Include this data in Operation and Maintenance Manual.

C. Pipe, pipe or plumbing fittings, fixtures, solder and flux installed in a system providing water for human consumption shall comply with lead free requirements of the California Health and Safety Code Section 11 68 75. Provide submittal information for products third-party certified by an approved laboratory as complying with California Health and Safety Code Section 11 68 75.

1.07 QUALITY ASSURANCE

A. California Green Building Standards Code Requirements:
   1. Single Showerheads shall be certified to the performance criteria of the U.S. EPA WaterSense Specification for Showerheads.

PART 2 - PRODUCTS

2.01 PLUMBING FIXTURES

A. General: Provide factory fabricated fixtures of type, style and material indicated. For each type fixture, provide fixture manufacturer's standard trim, carrier, seats, and valves as indicated by their published product information; either as designed and constructed, or as recommended by the manufacturer, and as required for a complete, installation. Where more than one type is dedicated, selection is Contractor's option; but, all fixtures of same type must be furnished by single manufacturer.
   1. Take special care with the roughing-in and finished plumbing where batteries of fixtures occur.
   2. Take location and mounting heights for roughing-in from Architectural Drawings.
   3. Follow schedule on Plumbing Drawings for roughing-in connections. Set roughing-in for all fixtures exactly as per measurements furnished by the manufacturers of the fixtures used.
   4. Roughing-in for lavatories and sinks shall be brought in through the wall under the centerline of the drain from the fixture wherever possible and as close to the fixture as possible.

2.02 MATERIALS

A. Provide materials that have been selected for their surface flatness and smoothness. Exposed surfaces that exhibit pitting, seam marks, roller marks, foundry sand holes, stains, discoloration, or other surface imperfections on finished units are not acceptable.

B. Where fittings, trim and accessories are exposed or semi-exposed, provide, chromium plated 17 gauge seamless brass and match faucets and fittings. Provide 17 gauge seamless copper or brass where not exposed.

C. Handles on all faucets and stops shall be all metal chromium plated.

2.03 PLUMBING FITTINGS, TRIM AND ACCESSORIES

A. Water Outlets: At locations where water is supplied (by manual, automatic or remote control), provide commercial quality faucets, valves, or dispensing devices, of type and size indicated, and as required to operate as indicated.
   1. Include manual shutoff valves and connecting stem pipes to permit outlet servicing without shut-down of water supply piping systems.

B. P-Traps: Include IAPMO approved removable P-traps where drains are indicated for direct connection to drainage system. P-Traps shall be less trap screw cleanout, and incorporate a chrome plated cast brass body, brass connection nuts, 17 gauge seamless brass wall return and chrome plated wall escutcheon to match trap finish.

C. Carriers: Provide cast iron supports for fixtures of graphitic gray iron, ductile iron, or malleable iron as indicated. Where the carrier for wall mounted water closets are installed more than 6 inches behind the finished wall, provide water closet support for wide pipe chase.

D. Fixture Bolt Caps: Provide manufacturer's standard exposed fixture bolt caps finished to match fixture finish.

E. Escutcheons: Where fixture supplies and drains penetrate walls in exposed location, provide chrome-plated cast brass escutcheons with setscrews.

F. Aerators: Provide aerators of types approved by Health Departments having jurisdiction. Delete aerators where not allowed by CPC for health care occupancies.

G. Comply with additional fixture requirements contained in Fixture Schedule shown on the drawings.

2.04 MANUFACTURERS

A. In accordance with California Plumbing Code, provide indelibly marked or embossed manufacturers name or logo, arranged so as to be visible after installation.

B. Manufacturers: Drawing schedules indicate Basis of Design products. Subject to compliance with requirements, provide product indicated on Drawings, or comparable product by one of the following:
   1. Vitrified China Plumbing Fixtures:
      a. American Standard, U.S. Plumbing Products.
      b. Crane Plumbing.
      c. Eljer Plumbingware Div., Wallace-Murray Corp.
      d. Kohler Co.
      e. VitrA.

2. Modular Lavatories:
   a. Bradley.
   b. Acorn.
   c. Willoughby Industries, Inc.
3. Plumbing Trim:
   a. McGuire Manufacturing Co., Inc.
   b. Delta Commercial.
   c. Chicago Faucet Co.
   d. T&S Brass and Bronze Works, Inc.
4. Flush Valves:
   a. Sloan Valve Co.
   b. Zurn Industries, Hydromechanics Div.
   c. Toto USA, Inc.
5. Faucets:
   a. Chicago Faucet Co.
   b. Symmons Scott.
   c. T&S Brass and Bronze Works, Inc.
   d. Delta Commercial.
6. Fixture Seats:
   a. Church Seat Co.
   b. Bemis Mfg. Co.
   c. Beneke Corp.
7. Water Coolers and Drinking Fountains:
   a. Haws Corporation.
   b. Halsey Taylor Mfg. Co.
   c. Elkay Mfg. Co.
   d. Acorn Aqua.
8. Service Sinks:
   a. American Standard.
   b. Kohler Co.
   c. Williams Serviceptor.
   d. Florestone.
   e. Acorn.
9. Stainless Steel Sinks:
   a. Elkay Mfg. Co.
   b. Just Mfg. Co.
   c. Haws Corporation.
10. Showers:
   a. Acorn.
   b. Bradley.
   c. Symmons.
   d. Powers.
11. Emergency Equipment:
   a. Haws Corporation.
   b. Gardian.
   c. Symmons.
   d. Bradley.
   e. Encon.
12. Fixture Carriers:
   a. Josam Mfg. Co.
   b. J. R. Smith.
   c. Tyler Pipe; Wade Div.
   d. Zurn Industries; Hydromechanics Div.
   e. Mifab, Inc.

2.05 FLUSH VALVE REQUIREMENTS

A. Metering flush valves where required and specified shall be non-hold open type with exposed parts chrome plated. Conform to all codes and manufacturers' recommendations. All diaphragms are to have multiple filtered bypass and be chloramine resistant synthetic rubber with internal components suitable for l80 degree hot water to l50 pounds pressure, plastic or leather diaphragm not acceptable.

B. Electronic flush valves where required and specified shall be non-hold open type with exposed parts chrome plated. Conform to all codes and manufacturers' recommendations. All diaphragms are to have multiple filtered by pass and be chloramine and resistant synthetic rubber with rubber and internal components suitable for 180 degree hot water to 150 pounds pressure, plastic or leather diaphragm not acceptable. All flush valve solenoids and sensors shall be UL listed.

2.06 FIXTURE CONNECTIONS

A. Make connection between fixtures and flanges on soil pipe absolutely gastight and watertight with neoprene type gaskets (wall hung fixtures) or bowl wax (floor outlet fixtures). Rubber gaskets or putty will not be permitted.

B. Provide fixtures not having integral traps with P-traps of chromium-plated 17 gauge cast brass, with 17 gauge seamless brass wall return, connected to concealed waste in wall and sanitary fittings. Provide IAPMO approval for trap, and provide less trap screw cleanout.
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:
      a. Dearborn Brass, Commercial series with brass nuts.
      b. Delta Commercial.
      c. McGuire Manufacturing Co., Inc.

C. Connections from stacks or horizontal wastes to wall or floor finish for wastes from lavatories, urinals, sinks, and drinking fountains and connection between floor drains and traps shall be IPS 85 percent red brass pipe.

D. Plumbing fixture traps connected to special waste systems shall be constructed of materials to suit the waste system.
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:
      a. Orion.
      b. Enfield

E. Unions on waste pipes on fixture side of traps may be slip or flange joints with soft rubber or lead gaskets. Traps shall rough in full size to waste and vent connection, using deep escutcheon plate to cover wall penetration. Compression adaptor extensions or sweat adaptors are not acceptable.

2.07 WATER SUPPLIES AND STOPS

A. Provide 85 percent IPS threaded red brass nipple, conforming to the lead-free requirements of California Health and Safety Code Section 11 68 75, securely anchored to building construction, for each connection to stops, hose bibbs, etc. Each fixture, except hose bibbs, shall have stop valves installed on water supply lines.

B. Provide water supplies to fixtures with compression shut-off stops with threaded inlets and lock shield-loose key handles. Provide combination fixtures with compression stop and threaded inlet on each water supply fitting. Provide lock shield-loose key handle for each stop.

C. Provide 1/2 inch riser tubes with reducing coupling for fixtures, unless otherwise noted.

D. Provide cast brass escutcheon.

E. Furnish shut-off valves on hose bibbs where directly connected to mains with no intervening valves.

F. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:
1. McGuire Manufacturing Company, Inc., model LFH2167LK.
2. T & S Brass and Bronze Works, Inc., model B-1305.

2.08 PLUMBING FIXTURE HANGERS AND SUPPORTS

A. Residential type fixture supports are not acceptable.

B. Install wall mounted water closets with combination support and waste fittings, with feet of support securely anchored to floor.

C. Install floor mounted water closets with J.R. Smith, Zurn, or equal government pattern cast iron closet flanges with brass bolts, nuts, washers, and porcelain caps secured with Spackle.

D. Install the following fixtures on concealed support with feet of support securely anchored to floor. Anchor top of support to wall construction in an approved manner.
1. Wall hung lavatories.
2. Wall mounted urinals.
3. Drinking fountains.
4. Electric water coolers.

2.09 PLUMBING FIXTURES

A. Install all plumbing fixtures at height indicated on Architectural Drawings. Where mounting height is not indicated, install at height required by Code.

B. Special Requirements For Accessible Fixtures:
1. Operating handle or valve for accessible water closets, urinals, lavatories, and sinks shall operate with less than 5 pounds force. Metering faucets shall be adjusted to operate between 10 and 15 seconds.
2. Insulate exposed waste piping and domestic water supplies below accessible fixtures with CBC access code compliant molded “closed-cell” vinyl covers. Covers shall be installed using vandal resistant fasteners and must be removable. Covers shall meet flame spread rating not to exceed 25 and smoke density not to exceed 50 when tested in accordance with ASTM E-84, and shall comply with the requirements of California Code of Regulations, Title 24. Plumberex – Handy Shield, Johns Manville – Zeston 2000, or equal.

C. Refrigerator Ice Maker:
1. Manufacturers: Drawing schedules indicate Basis of Design products. Subject to compliance with requirements, provide product indicated on Drawings, or comparable product by one of the following, or equal:
2. Guy Gray.
3. Water-Tite.

D. Solids Interceptor:

1. Manufacturers: Drawing schedules indicate Basis of Design products. Subject to compliance with requirements, provide product indicated on Drawings, or comparable product by one of the following, or equal:
2. J.R. Smith Mfg. Co.

E. Washing Machine Hose/Supply Box:
1. Manufacturers: Drawing schedules indicate Basis of Design products. Subject to compliance with requirements, provide product indicated on Drawings, or comparable product by one of the following, or equal:
2. Acorn Engineering Co.

PART 3 - EXECUTION

3.01 PRODUCT HANDLING AND PROTECTION

A. Deliver packaged materials in their original, unopened wrapping with labels intact. Protect materials from water, the elements and other damage during delivery, storage and handling.

3.02 PREPARATORY PROVISIONS

A. The Contractor is responsible for the examination and acceptance of all conditions affecting the proper construction and/or installation of the Work of this Section. Do not proceed until all unsatisfactory conditions have been corrected. Commencing work will be construed as acceptance of all conditions by the Contractor as satisfactory for the construction and/or installation of the Work.

3.03 INSPECTION AND PREPARATION

A. Examine roughing-in work of domestic water and waste piping systems to verify actual locations of piping connections prior to installing fixtures. Also examine floors and substrates, and conditions under which fixture work is to be accomplished. Correct any incorrect locations of piping, and other unsatisfactory conditions for installation of plumbing fixtures. Do not proceed with work until unsatisfactory conditions have been corrected.

B. Install plumbing fixtures of types indicated where shown and at indicated heights; in accordance with fixture manufacturer's written instructions, roughing-in drawings. Ensure that plumbing fixtures comply with requirements and serve intended purposes. Comply with applicable requirements of the National Standard Plumbing Code pertaining to installation of plumbing fixtures.

C. Fasten plumbing fixtures securely to supports or building structure; and ensure that fixtures are level and plumb. Secure plumbing supplies to blocking behind or within wall construction so as to be rigid, and not subject to pull or push movement.

D. Install CBC accessible fixtures in accordance with Chapter 4 California Plumbing Code, and Chapters 11A and 11B California Building Code.

E. Refer to Division 26 for wiring for electronic flush valves.

3.04 INSTALLATION OF FAUCETS

A. Provide 85 percent IPS red brass pipe, conforming to lead-free requirements of California Health and Safety Code Section 11 68 75, securely anchored to building construction, for each connection to faucets, stops, hose bibbs, etc. Each fixture, except hose bibbs, shall have a stop valve installed on water supply lines to permit repairs without shutting off water mains.

B. Adjust metering faucets to run for 10 to 15 seconds.

3.05 CLEAN AND PROTECT

A. Clean plumbing fixtures of dirt and debris upon completion of installation.

B. Protect installed fixtures from damage during the remainder of the construction period.

C. Grout voids between all fixtures and adjacent surfaces with white Dow Silicone Sealant, arranged to shed water.

3.06 FIELD QUALITY CONTROL

A. Upon completion of installation of plumbing fixtures and after units are water pressurized, test fixtures to demonstrate capability and compliance with requirements. When possible, correct malfunctioning units at site, then retest to demonstrate compliance; otherwise, remove and replace with new units and proceed with retesting.

3.07 EXTRA STOCK

A. General: Furnish special wrenches and other devices necessary for servicing plumbing fixtures and trim to Owner with receipt. Furnish one device for every ten units.

END OF SECTION

SECTION 22 50 00 – PLUMBING EQUIPMENT

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Gas fired water heaters.

B. Expansion tanks.

C. In-line domestic hot water recirculation pumps.

D. Oil interceptor.

E. Air compressors.

F. Air dryer.

G. Manholes.

1.02 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. Section 22 00 50 Basic Plumbing Materials and Methods.

1.03 ADDITIONAL REQUIREMENTS

A. Furnish and install any incidental work not shown or specified which is necessary to provide a complete and workable system.

B. Coordinate all of work in this Section with all of the Trades covered in other Sections of the Specifications to provide a complete, operable and sanitary installation of the highest quality workmanship.

1.04 DESCRIPTION OF WORK

A. Furnish and install all plumbing work indicated on the Drawings and described herein.

1.05 QUALITY ASSURANCE

A. Manufacturers: Firms regularly engaged in manufacture of plumbing equipment of type and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.

B. Trade names or catalog numbers stated herein indicates grade or quality of materials desired.

C. Dimensions, sizes, and capacities shown are minimum and shall not be changed without permission of Architect.

D. UL and NEMA Compliance: Provide electric motors and electrical components required as part of plumbing equipment, which have been listed and labeled by Underwriters Laboratories and comply with NEMA standards.

E. CEC Compliance: Comply with California Electrical Code (Title 24, Part 3) as applicable to installation and electrical connections of ancillary electrical components of plumbing equipment.

F. ANSI Compliance: Comply with ANSI Z223.1 (NFPA 54) "National Fuel Gas Code", as applicable to installation of gas-fired water heaters.

G. CSA/UL Labels:
1. Provide gas-fired water heaters that have been listed and labeled by CSA International or Underwriters Laboratories, certifying design according to ANSI Z21.10.3-CSA 4.3 standards governing storage-type water heaters with input ratings of greater than 75,000 BTU/hr.

H. ASME Relief Valve Stamps: Provide water heaters with safety relief valves bearing ASME valve markings.

I. California Energy Commission Compliance: Provide written confirmation of listing of all water heaters in the "Appliance Efficiency Database."

J. California Health and Safety Code Compliance: For products covered under the scope of HSC 116875 for potable water service. Products for potable water service shall be third-party certified by an approved laboratory as complying with California Health and Safety Code Section 11 68 75.

1.06 SUBMITTALS

A. Product Data: Submit manufacturer's plumbing equipment specifications, installation and start-up instructions, capacity and ratings, with selection points clearly indicated.

B. Maintenance Data: Submit maintenance data and parts lists for each item of plumbing equipment. Include "trouble-shooting" maintenance guides. Include this data in Operation and Maintenance Manual.

C. Pipe, pipe or plumbing fittings, fixtures, solder and flux installed in a system providing water for human consumption shall comply with lead free requirements of the California Health and Safety Code Section 11 68 75. Provide submittal information for products third-party certified by an approved laboratory as complying with California Health and Safety Code Section 11 68 75.

D. Special Seismic Certification: Submit certification that gas-fired water heaters will withstand seismic forces indicated in Contract Documents. Include the following:
1. OSHPD Special Seismic Certification Pre-Approval (OSP) number and back-up data.
a. Back-up data shall include copy of OSHPD form OSH FDD 735, “Application for Pre-Approval,” signed by OSHPD representative.
b. If compliance is achieved by alternate method approved by OSHPD, provide document indicating compliance method. Include back-up data. IBC Certification is not an acceptable alternate compliance method.
2. Letter from equipment manufacturer indicating:
a. The equipment manufacturer has reviewed seismic forces indicated in Contract Documents and that seismic forces utilized in testing equipment and obtaining an OSP number meet or exceed Project requirements.
b. The manufacturer shall indicate that submitted equipment with OSP number meets criteria in Contract Documents, including features, options, dimensions, weights, anchorage devices, etc. Include Specification Section article reference number or Drawing sheet number with reference to physical location of equipment. If submitted equipment with OSP number does not meet these requirements, the letter shall contain detailed list noting variances from the product specified in Contract Documents.

3. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
4. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Insulation products, including insulation, insulation facings, jackets, adhesives, sealants and coatings shall not contain polybrominated diphenyl ethers (PBDEs) in penta, octa, or deca formulations in amounts greater than 0.1 percent (by mass).

2.02 GAS FIRED WATER HEATERSGeneral: All units shall comply with the emissions requirements of the Air Quality Management District (AQMD) in which they are to be installed.

B. Direct Vented Sealed Combustion Condensing Gas-Fired Water Heater:
1. General: Provide commercial direct vented sealed combustion condensing gas-fired water heater of size, capacity, and electrical characteristics as noted on Drawings. Provide UL or CSA International listing. Design unit to conform to the following:
   a. ASHRAE/IESNA 90.1.
   b. California NOx emission requirements.
   c. Units with gas input above 200 MBH shall be ASME constructed and listed, stamped for 150 PSIG.
   d. Minimum efficiency of 95 percent.
2. Storage Tank Construction: Seamless steel with 150 psig working-pressure rating, glass lining on internal surfaces exposed to water.
3. Factory-Installed Storage Tank Appurtenances:
   a. Anode Rods: Magnesium.
   b. Jacket: Heavy-gauge steel with enameled finish.
   c. Cleanout: Hand-hole cleanout though tank and jacket.
   d. Burner: Low NOx, pre-mix powered type, down-fired configuration.
   e. Insulation: Non-CFC foam.
   f. Drain Valve: Brass construction.
   g. Heat Exchanger Coil: Located within submerged combustion chamber.
   h. Combination Temperature and Pressure Relief Valve.
   i. Dielectric Fittings.
4. Warranty: Furnish three-year minimum limited warranty on tank.
5. Accessories: Provide thermometer, installed in the top 1/3 of the tank or at hot water discharge at the tank.
6. Controls: Adjustable electronic immersion thermostat with safety shutoff.
7. Condensate Drain Piping: CPVC piping as defined in Section 22 10 00.
8. Vent and Exhaust Piping: CPVC piping as defined in Section 22 10 00
9. See equipment Schedule and details on Drawings for additional accessories and requirements.
10. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:
    a. Bradford White Corporation.
    b. Lochinvar Corporation.
    c. PVI Industries, LLC.
    d. Rheem Manufacturing Company.
    e. Smith, A.O. Water Products Co.; a division of A.O. Smith Corporation.

2.03 EXPANSION TANKS

A. Provide thermal expansion tanks of size and number as indicated on Drawings, conforming to lead-free requirements of California Health and Safety Code Section 11 68 75. Construct tank of welded steel for working pressure of 125 psi. Provide specially compounded flexible diaphragm securely sealed into tank to permanently separate air charge from system water, to maintain design expansion capacity.
   1. Tanks shall be IAPMO approved and listed for use with domestic water systems.

B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:
   1. Amtrol, Inc.
   2. A.O. Smith Water Products Company.
   3. Watts Water Technologies, Inc.

2.04 IN-LINE DOMESTIC HOT WATER RECIRCULATION PUMPS

A. Provide lead-free in-line domestic water recirculation pumps where indicated on Drawings and of capacities as scheduled on Drawings. Pumps shall be third-party certified by an approved laboratory as complying with California Health and Safety Code Section 11 68 75.

B. Pumps shall be of the centrifugal type with non-overloading characteristics and shall not overload the motor above its nameplate horsepower rating under any operating condition. No allowance for service factor shall be used in pump selection. Motor horsepower shown is minimum; furnish larger motors if necessary to meet the non-overloading requirements.

C. Type: Horizontal, designed for 125 thru 150 psi maximum working pressure and 225 degrees F continuous water temperature.

D. Construction: Bronze casing, non-metallic impeller.

E. Shaft: Ceramic, supported by carbon bearings. Bearings shall be lubricated by the pumped water.

F. Motors shall have permanently lubricated ball bearings. Motors shall meet NEMA specifications. Motors shall have built-in thermal overload or impedance protection.

G. Provide control wiring between field-installed controls, indicating devices, and pump control panels as work of this section, complying with requirements of Division 26 sections:
   1. Control wiring specified as work of Division 23 for Automatic Temperature Controls is work of that section.

H. Wire pumps to mechanical control circuits to shut down pump when building is not occupied. Where no control system is installed, furnish pump manufacturers standard timer to automatically turn off circulating pump when hot water is not required.

I. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:
   1. Grundfos Pumps Corporation.
   2. Bell & Gossett, ITT Corporation.
   3. Taco Incorporated.
   4. Armstrong Pumps, Inc.

2.05 OIL INTERCEPTOR – COMPRESSOR LOCATIONS

A. Furnish and install Oil/Sediment interceptor with minimum capacity of 12 pounds of sludge, complete as cataloged. Interceptor shall be coated fabricated steel with acid-resistant coating on interior and exterior. Provide fabricated extension, anchor flange, and single grate.

B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:
1. J.R. Smith 8925-F-ARC.
2. Zurn Model Z-1189.

2.06 AIR COMPRESSORS

A. Provide single package unit featuring belt driven rotary screw compressor. Compressor shall be driven by TEFC electric motor. Provide enclosed weatherproof casing and include factory wired starter, control panel with stop-start push buttons, indicator lights, gauges, run time meter and reset button.
1. Provide control panel with, discharge air pressure and lubricant discharge temperature, operating hours, start/stop switch, power on light, emergency stop button, and control safety system with compressor ON light.
2. Provide high air pressure shutdown switch, 3-phase motor overload protection, safety valve and oil sight glass. Compressor control shall be by a fully adjustable dual operating control providing idle time and time delay controls. Main air and oil piping shall be rigid steel with flexible connections. The unit shall be delivered with full operating charge of oil and shall be ready for full operation.

B. Provide ASME stamped receiver, pressure gauge. ASME Code pressure relief valve, tank drain, manual valve on main air line, intake filter and muffler, belt guards, and pressure reducing valve. Provide pipe line filter and refrigerated after-cooler.

C. Provide soundproof enclosure around compressor unit, complete with filter media on air intake, and locking access doors. Where installed in locations exposed to weather conditions, provide rain hood.

D. Furnish permit by State Division of Industrial Safety prior to project completion.

E. Manufacturer shall be Powerex, Kaeser, Quincey, or equal.

2.07 AIR DRYER

A. Air dryer shall be a single package refrigerated compressed air dryer with built in controls and push button graphic control panel. Unit shall be contained in a weatherproof cabinet.

B. Manufacturer shall be Kaeser, Quincy, or equal.

2.08 AIR COMPRESSOR CONDENSATE DRAIN SYSTEM

A. Provide high efficiency condensate drain system to automatically remove oil from compressed air condensate line. Install in accordance with manufacturer’s recommendations.

B. Manufacturer shall be Kaeser, Quincy, or equal.

2.09 MANHOLES

A. Provide standard precast concrete as shown on the plans and specified herein. Where special details are shown on Drawings or vary from requirements stated herein, follow Drawings.
   1. Provide manholes that comply with local utility company standards.

B. Manholes shall be 48 inch diameter base section size with a minimum wall thickness of 4 inches. Taper manhole to 24 inch diameter. All dimensions given above are inside diameters.

C. Install a minimum of two 6 inch and one 3 inch adjusting or grade rings on the top of manhole taper.

D. Manhole frames and cover shall be Teichert Precast, Pinkerton, Alhambra Foundry Company, or equal, 24 inch diameter clear opening, unless otherwise specified on the plans, in which case numbers given on plans shall be used. Indicate weight on the bottom outside of rim of cover, and machine seat of the frame sufficiently so that the cover will set evenly and firmly in place without rocking. Letter cover as required to identify service. Information as to finish grade elevations must be adhered to when setting manhole frame and cover.

E. Seal joints between base, manhole barrel, grade rings, taper section, and manhole frame to grade ring with Portland cement-sand-water grout or with resilient gasket material specifically formulated for such use. Make joints with care for watertight installation.

F. Extend sewer pipe through the concrete manhole walls at the invert elevations given on the Drawings. Provide PVC manhole adapter connections at the manhole wall. Adapters shall be arranged to eliminate leaks around the pipe entrance.
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:
      a. Indiana Seal.
      b. CPK Products, Inc.

G. Accurately shape inverts of all manholes to a "U" section as shown on the Drawings, using Portland cement concrete of suitable mix to assure a smooth, dense surface. Align inverts through manholes to provide good hydraulic transitions, including changes in direction as required. Make joints between manhole walls and sewer pipe neat and watertight.

H. Provide manhole with polyproplyene coated steel safety type manhole steps of the Edison type manufactured by the Alhambra Foundry Company, Alhambra, California, or equal. Manhole steps shall be installed with a maximum spacing of 15 inches.

I. Where indicated on the drawings and where required by site conditions provide Santa Rosa Precast shallow manhole, or equal. Provide field poured base section, 48 inch diameter manhole section and 48 inch eccentric reducer slab for manhole. All other material and work, including cast iron frame and cover, grade rings, joints and gaskets, and formation of manhole base shall be in accordance with other manhole requirements.

PART 3 - EXECUTION

3.01 PRODUCT HANDLING AND PROTECTION

A. Deliver packaged materials in their original, unopened wrapping with labels intact. Protect materials from water, the elements and other damage during delivery, storage and handling.

3.02 PREPARATORY PROVISIONS

A. The Contractor shall be responsible for the examination and acceptance of all conditions affecting the proper construction and/or installation of the Work of this Section and shall not proceed until all unsatisfactory conditions have been corrected. Commencing work shall be construed as acceptance of all conditions by the Contractor as satisfactory for the construction and/or installation of the Work.

3.03 INSTALLATION OF GAS-FIRED WATER HEATERS

A. Install gas-fired water heaters as indicated, in accordance with manufacturer's installation instructions and in compliance with applicable codes.

B. Furnish wiring diagram to Electrical Installer. Refer to Division 26 for wiring of units, not work of this section.

C. Connect to hot and cold water lines with shutoff valves and dielectric unions. Install ASME standard pressure and temperature relief valve. Connect drain and relief piping as noted on Drawings.

D. Start-up, test, and adjust water heaters in accordance with manufacturer's start-up instructions. Check and calibrate controls.

E. Install thermometer, in the top 1/3 of the tank or at hot water discharge at the tank.

F. Confirm that water heater proposed is suitably equipped to be brought into the building through building openings provided, and that heater may be installed and removed through building openings provided.

G. Additional requirements for direct vented sealed combustion condensing water heaters:
   1. Install vent and exhaust piping for direct vented sealed combustion condensing gas-fired water heaters strictly in accordance with unit manufacturers’ recommendations.
   2. Trap condensate drain line per manufacturers’ recommendations and run to nearest code-compliant point of disposal.

3.04 INSTALLATION OF PUMPS

A. Install pumps where indicated, in accordance with manufacturer's published instructions, complying with recognized industry practices to ensure that pumps comply with requirements and serve intended purposes.

B. Provide access space around pumps for service as indicated, but in no case less than that recommended by manufacturer.

C. Install in-line pumps with support from overhead structure on each side of pump, or as indicated on Drawings.

D. Support piping from the building structure so as to prevent any strain on the pump casings. Provide a final check for perfect alignment of the piping connections after pump has been secured to its base. Provide valves, accessories, gauges, flexible connections, and supports as indicated.

E. Install electrical devices furnished by manufacturer but not specified to be factory mounted. Furnish copy of manufacturer's wiring diagram submittal to Electrical Installer.

F. Verify that electrical wiring installation is in accordance with manufacturer's submittal and installation requirements of Division 26 sections. Do not proceed with equipment start-up until wiring installation is complete and correct.

G. Check alignment, and where necessary, realign shafts of motors and pumps within recommended tolerances by manufacturer.

H. Lubricate pumps before start-up. Start-up in accordance with manufacturer's instructions.

I. Increase piping immediately at pump suction and discharge; flexible couplings and all valves shall be full line size.

J. Trim pump impeller to obtain the desired water flow after installation, without cost to Owner.

K. Pumps shall not be connected to piping before piping is thoroughly flushed and cleaned of all dirt and grit. After piping connections have been made, systems shall be filled before starting pumps. Pumps shall not be run dry under any circumstances.

3.05 INSTALLATION OF INTERCEPTORS

A. Install interceptors as indicated, in accordance with manufacturer's installation instructions and in compliance with applicable codes.

B. Support: Anchor interceptors securely to substrate. Locate interceptors so that adequate clearance is provided to remove covers and sediment baskets. Set recessed units so top of cover is flush with finished grade.

C. Piping: Connect inlet and outlet piping to interceptors.

D. Refer to local standards for special installation requirements.

3.06 INSTALLATION OF AIR COMPRESSORS

A. Install air compressors as indicated, in accordance with manufacturer's installation instructions and in compliance with applicable codes.

B. Prior to initial test run of air compressor, provide lubrication, confirm satisfactory operation of water cooled after cooler, and post operating instructions in a prominent location near the unit.

3.07 INSTALLATION OF MANHOLES

A. Install manholes as indicated on Drawings, in accordance with manufacturer's installation instructions and in compliance with applicable codes.

3.08 TRAINING

A. Provide a minimum of 8 hours of training and orientation of Owners staff in proper care and operation of Plumbing Equipment.

3.09 CARE AND CLEANING

A. Repair or replace broken, damaged, or otherwise defective parts, materials, and work. Leave entire work in condition satisfactory to Architect. At completion, carefully clean and adjust equipment, fixtures, and trim that are installed as part of this work. Leave systems and equipment in satisfactory operating condition.

3.10 OPERATION TEST

A. Test each piece of equipment to show that it will operate in accordance with indicated requirements.

3.11 CLEANING UP

A. Upon completion of Work remove materials, equipment, apparatus, tools, and the like, and leave premises clean, neat, and orderly.

END OF SECTION

SECTION 23 00 50 - BASIC HVAC MATERIALS AND METHODS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Electric motors.

B. Motor starters.

C. Valves and fittings.

D. Strainers.

E. Gauges.

F. Thermometers.

G. Access Doors.

H. Flexible joints.

I. Insulation.

1.02 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. This Section is a part of each Division 23 Section.

C. Refer to Section 23 08 00.13, T-24 Commissioning of HVAC for Title 24 commissioning requirements.

1.03 ADDITIONAL REQUIREMENTS

A. Furnish and install incidental work not shown or specified necessary to provide a complete and workable system.

B. Make all temporary connections required to maintain services, including adequate heat and cooling, during the course of the Contract without additional cost to Owner. Notify Owner seven days in advance before disrupting services.

C. Provide for adjustments or modifications to fan and motor sheaves, belts, damper linkages, and other components as required to achieve specified air balance at no additional cost to Owner.

1.04 REFERENCED STANDARDS

A. Where material or equipment is specified to conform to referenced standards, it shall be assumed that the most recent edition of the standard in effect at the time of bid shall be used.
   1. CSA – Canadian Standards Association International
   2. ANSI - American National Standards Institute
   3. ASTM - American Society for Testing and Materials
   4. CCR - California Code of Regulations

a. Title 8 - Division of Industrial Safety, Subchapter 7; General Industry Safety Orders, Articles 31 through 36
5. NCPWB - National Certified Pipe Welding Bureau
6. CEC - California Electrical Code
7. NEMA - National Electrical Manufacturers' Association
8. NFPA - National Fire Protection Association
9. OSHA - Occupational Safety and Health Act
10. UL - Underwriters' Laboratories, Inc.

1.05 DRAWINGS

A. Examine Drawings prior to bidding of work and report discrepancies in writing to Architect.

B. Drawings showing location of equipment and materials are diagrammatic and job conditions will not always permit installation in location shown. The HVAC Drawings show general arrangement of equipment and materials, etc., and shall be followed as closely as existing conditions, actual building construction, and work of other trades permit.
1. Architectural and Structural Drawings shall be considered part of the Work. These Drawings furnish Contractor with information relating to design and construction of the Project. Architectural Drawings take precedence over HVAC Drawings.
2. Because of the small scale of HVAC Drawings, not all offsets, fittings, and accessories required are shown. Investigate structural and finish conditions affecting the Work and arrange Work accordingly. Provide offsets, fittings, and accessories required to meet conditions. Inform Architect immediately when job conditions do not permit installation of equipment and materials in the locations shown. Obtain the Architects approval prior to relocation of equipment and materials.
3. Relocate equipment and materials installed without prior approval of the Architect. Remove and relocate equipment and materials at Contactors' expense upon Architects' direction.
4. Minor changes in locations of equipment, piping, ducts, etc., from locations shown shall be made when directed by the Architect at no additional cost to the Owner providing such change is ordered before such items of work, or work directly connected to same are installed and providing no additional material is required.

C. Execute work mentioned in the Specifications and not shown on the Drawings, or vice versa, the same as if specifically mentioned or shown in both.

1.06 REQUIREMENTS OF REGULATORY AGENCIES

A. The publications listed below form part of this Specification; comply with provisions of these publications except as otherwise shown or specified.
1. California Building Code, 2016.
2. California Electrical Code, 2016.
3. California Energy Code, 2016.
4. California Fire Code, 2016.
5. California Green Building Standards Code, 2016.
6. California Mechanical Code, 2016.
7. California Plumbing Code, 2016.
8. California Code of Regulations, Title 24.
9. California Health and Safety Code.
10. CAL-OSHA.
11. California State Fire Marshal, Title 19 CCR.
12. National Fire Protection Association.
13. Occupational Safety and Health Administration.
14. Other applicable state laws.

B. Nothing in Drawings or Specifications shall be construed to permit work not conforming to these codes, or to requirements of authorities having jurisdiction. It is not the intent of Drawings or Specifications to repeat requirements of codes except where necessary for clarity.

C. Comply with State of California 2016 Energy Code for systems, equipment, and construction.

1.07 FEES AND PERMITS

A. Obtain and pay for permits and service required in installation of the Work. Arrange for required inspections and secure approvals from authorities having jurisdiction. Comply with requirements of Division 01.

B. Arrange for utility connections and pay charges incurred, including excess service charges.

1.08 FRAMING, CUTTING AND PATCHING

A. Special framing, recesses, chases and backing for Work of this Section, unless otherwise specified, are covered under other Specification Sections.

B. Contractor is responsible for placement of pipe sleeves, hangers, inserts, supports, and location of openings for the Work.

1.09 SUBMITTALS

A. Submittal packages may be submitted via email as PDF electronic files, or as printed packages. PDFs shall be legible at actual size (100 percent). Provide seven copies of printed submittal packages.

B. Provide submittal of materials proposed for use as part of this Project. Product names in Specifications and on Drawings are used as standards of quality. Furnish standard items on specified equipment at no extra cost to the Contract regardless of disposition of submittal data. Other materials or methods shall not be used unless approved in writing by Architect. Architect's review will be required even though "or equal" or synonymous terms are used. Refer to Division 01 for complete instructions.
   1. Partial or incomplete submittals will not be considered.
   2. Quantities are Contractor's responsibility and will not be reviewed.
   3. Provide materials of the same brand or manufacturer for each class of equipment or material.
   4. Identify each item by manufacturer, brand, trade name, number, size, rating, or other data necessary to properly identify and review materials and equipment. Words "as specified" are not sufficient identification.
   5. Identify each submittal item by reference to items' Specification Section number and paragraph, by Drawing and detail number, and by unit tag number.
   6. Organize submittals in same sequence as in Specification Sections.
   7. Show physical arrangement, construction details, finishes, materials used in fabrications, provisions for piping entrance, access requirements for installation and maintenance, physical size, mechanical characteristics, foundation and support details, and weight.
      a. Submit Shop Drawings, performance curves, and other pertinent data, showing size and capacity of proposed materials.
      b. Specifically indicate, by drawn detail or note, that equipment complies with each specifically stated requirement of Contract Documents.
      c. Drawings shall be drawn to scale and dimensioned (except schematic diagrams). Drawings may be prepared by vendor but must be submitted as instruments of Contractor, thoroughly checked and signed by Contractor before submission to Architect for review.

d. Catalog cuts and published material may be included with supplemental scaled drawings.

C. Review of submittals will be only for general conformance with design concept and general compliance with information given in Contract Documents. Review will not include quantities, dimensions, weights or gauges, fabrication processes, construction methods, coordination with work of other trades, or construction safety precautions, which are sole responsibility of Contractor. Review of a component of an assembly does not indicate acceptance of an assembly. Deviations from Contract Documents not clearly identified by Contractor are Contractor's responsibility and will not be reviewed by Architect.

D. Within reasonable time after award of contract and in ample time to avoid delay of construction, submit to Architect shop drawings or submittals on all items of equipment and materials provided. Provide submittal as a complete package.
1. Shop drawings and submittals shall include Specification Section, Paragraph number, and Drawing unit symbol or detail number for reference. Organize submittals into booklets for each Specification section and submit in loose-leaf binders with index. Deviations from the Contract Documents shall be prominently displayed in the front of the submittal package and referenced to the applicable Contract requirement.

E. Provide coordinated layouts for HVAC Ductwork systems, in accordance with Specification Section 23 80 00.

F. Furnish to the Project Inspector complete installation instructions on material and equipment before starting installation.

G. Have fire damper and fire smoke damper installation instructions available at Project site during construction for use by Project Inspector.

H. Provide product data for insulation products, including insulation, insulation facings, jackets, adhesives, sealants, and coatings, indicating compliance with requirement that these products contain less than 0.1 percent (by mass) polybrominated diphenyl ethers (PBDEs) in penta, octa, or deca formulations.

I. Provide evidence of equipment certification to California Energy Code Section 110.1 or 110.2, if not providing Electrically Commutated motors for HVAC fans sized below 1 hp and above 1/12 hp. Refer to specific equipment articles requiring electrically commutated motors.

J. Sustainable Design Submittals:
1. Product Data: For adhesives and sealants, documentation of compliance including printed statement of VOC content and chemical components.
2. Laboratory Test Reports: For adhesives and sealants, indicating compliance with requirements for low-emitting materials.

K. Delegated-Design Submittal: For seismic supports, anchorages, and restraints indicated to comply with performance requirements and design criteria.
1. Calculations performed for use in selection of seismic supports, anchorages, and restraints shall utilize criteria indicated in Structural Contract Documents.
2. Supports, anchorage and restraints for piping, ductwork, and equipment shall be an OSHPD pre-approved system such as Tolco, Afcon, ISAT, Badger, Mason, or equal. Pipes, ducts and equipment shall be seismically restrained in accordance with requirements of current edition of California Building Code. System shall have current OPM number and shall meet additional requirements of authority having jurisdiction. Provide supporting documentation required by the reviewing authority and the Architect and Engineer. Provide layout drawings showing piping, ductwork and restraint locations.

a. Bracing of Piping, Ductwork, and Equipment: Specifically state how bracing attachment to structure is accomplished. Provide shop drawings indicating seismic restraints, including details of anchorage to building. In-line equipment must be braced independently of piping and ductwork, and in conformance with applicable building codes. Provide calculations to show that pre-approval numbers have been correctly applied in accordance with general information notes of pre-approval documentation.

3. In lieu of the above or for non-standard installations not covered in the above pre-approved systems, Contractor shall provide layout drawings showing piping, ductwork, and restraint locations, and detail supports, attachments and restraints, and furnish supporting calculations and legible details sealed by a California registered structural engineer, in accordance with 2016 California Building Code
4. Additional Requirements: In addition to the above, conform to all state and local requirements.

1.10 SUBSTITUTIONS

A. Refer to Division 01 for complete instructions. Requirements given below are in addition to or are intended to amplify Division 01 requirements. In case of conflict between requirements given herein and those of Division 01, Division 01 requirements shall apply.

B. It is the responsibility of Contractor to assume costs incurred because of additional work and or changes required to incorporate proposed substitute into the Project. Refer to Division 01 for complete instructions.

C. Substitutions will be interpreted to be manufacturers other than those specifically listed in the Contract Documents by brand name, model, or catalog number.

D. Only one request for substitution will be considered for each item of equipment or material.

E. Substitution requests shall include the following:
1. Reason for substitution request.
2. Complete submittal information as described herein; see “Submittals.”
3. Coordinated scale layout drawings depicting position of substituted equipment in relation to other work, with required clearances for operation, maintenance and replacement.
4. List optional features required for substituted equipment to meet functional requirements of the system as indicated in Contract Documents.
5. Explanation of impact on connected utilities.
6. Explanation of impact on structural supports.

F. Installation of reviewed substitution is Contractors’ responsibility. Any mechanical, electrical, structural, or other changes required for installation of substituted equipment or material must be made by Contractor without additional cost to Owner. Review by Architect of substituted equipment or material, will not waive these requirements.

G. Contractor may be required to compensate Architect for costs related to substituted equipment or material.

1.11 OPERATION AND MAINTENANCE MANUAL

A. Furnish three complete sets of Operation and Maintenance Manual bound in hardboard binder, and one compact disc containing complete Operation and Maintenance Manual in searchable PDF format. Provide Table of Contents. Provide index tabs for each piece of equipment in binder and disc. Start compiling data upon approval of submittals.
1. Sets shall incorporate the following:

a. Service telephone number, address and contact person for each category of equipment or system.
b. Complete operating instructions for each item of heating, ventilating and air conditioning equipment.
c. Copies of guarantees/warrantees for each item of equipment or systems.
d. Test data and system balancing reports.
e. Typewritten maintenance instructions for each item of equipment listing lubricants to be used, frequency of lubrication, inspections required, adjustment, etc.
f. Manufacturers' bulletins with parts numbers, instructions, etc., for each item of equipment.
g. Temperature control diagrams and literature.
h. Check test and start reports for each piece of mechanical equipment provided as part of the Work.
i. Commissioning and Preliminary Operation Tests required as part of the Work.

B. Post service telephone numbers and addresses in an appropriate place designated by Architect.

1.12 SITE CONDITIONS

A. Information on Drawings relative to existing conditions is approximate. Deviations from Drawings necessary during progress of construction to conform to actual conditions shall be approved by the Architect and shall be made without additional cost to the Owner. The Contractor shall be held responsible for damage caused to existing services. Promptly notify the Architect if services are found which are not shown on Drawings.

1.13 WARRANTY

A. Refer to Division 01 for warranty requirements, including effective date of warranty. Refer to specific items of equipment specified herein for warranty duration if different from that specified in Division 01.

B. Repair or replace defective work, material, or part that appears within the warranty period, including damage caused by leaks.

C. On failure to comply with warranty requirements within a reasonable length of time after notification is given, Architect/Owner shall have repairs made at Contractor's expense.

1.14 RECORD DRAWINGS

A. Refer to Division 01, Record Documents, for requirements governing Work specified herein.

B. Upon completion of the Work, deliver to Architect the following:
1. Originals of drawings showing the Work exactly as installed.
2. One complete set of reproducible drawings showing the Work exactly as installed.
3. One compact disc with complete set of drawings in PDF format showing the Work exactly as installed.
4. Provide Contractor’s signature, verifying accuracy of record drawings.

C. Obtain the signature of the Inspector of Record for all Record Drawings.

1.15 DELIVERY AND STORAGE

A. Protect equipment and materials delivered to Project site from weather, humidity and temperature variations, dirt, dust and other contaminants.

1.16 COORDINATION

A. General:
1. Coordinate Work in this Section with trades covered in other Specifications Sections to provide a complete, operable and sanitary installation of the highest quality workmanship.

B. Electrical Coordination:
1. Refer to the Electrical Drawings and Specifications, Division 26, for service voltage and power feed wiring for equipment specified under this section. Contractor has full responsibility for the following items of work:
a. Review the Electrical Drawings and Division 26 Specifications to verify that electrical services provided are adequate and compatible with equipment requirements.
b. If additional electrical services are required above that indicated on Electrical Drawings and in Division 26, such as more control interlock conductors, larger feeder, or separate 120 volt control power source, include cost to furnish and install additional electrical services as part of the bid.
c. Prior to proceeding with installation of additional electrical work, submit detailed drawings indicating exact scope of additional electrical work.

C. Mechanical Coordination:
1. Arrange for pipe spaces, chases, slots and openings in building structure during progress of construction, to accommodate mechanical system installation.
2. Coordinate installation of supporting devices. Set sleeves in poured-in-place concrete and other structural components during construction.
3. Coordinate requirements for access panels and doors for mechanical items requiring access where concealed behind finished surfaces. Access panels and doors are specified in Division 08 Section “Access Doors and Frames.”

PART 2 - PRODUCTS

2.01 GENERAL

A. Materials or equipment of the same type shall be of the same brand wherever possible. All materials shall be new and in first class condition.

B. All sizes, capacities, and efficiency ratings shown are minimum, except that gas capacity is maximum available.

C. Refer to Division 22 10 00 and 23 80 00 for specific system piping materials.

2.02 MATERIALS

A. No material installed as part of this Work shall contain asbestos.

B. California Green Building Code Compliance:
1. HVAC and refrigeration equipment shall not contain CFCs.
2. HVAC and refrigeration equipment shall not contain Halons.

2.03 ELECTRIC MOTORS

A. General Motor Requirements: Comply with NEMA MG 1 unless otherwise indicated. Comply with IEEE 841 for severe-duty motors.
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:
a. U.S. Motors.

b. Century Electric.
c. General Electric.
d. Lincoln.
e. Gould.

B. Motor Characteristics: Designed for continuous duty at ambient temperature of 40 deg. C and at altitude of 3300 feet above sea level. Capacity and torque shall be sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.
1. Motors exceeding the nameplate amperage shall be promptly replaced at no cost to the Owner. Horsepower shown is minimum and shall be increased as necessary to comply with above requirements. Furnish motors with splash-proof or weatherproof housings, where required or recommended by the manufacturer. Match the nameplate voltage rating with the electrical service supplied. Check Electrical Drawings. Provide a transformer for each motor not wound specifically for system voltage.

C. Polyphase Motors: NEMA MG 1, Design B, medium induction motor, premium efficiency as defined in NEMA MG 1. Select motors with service factor of 1.15. Provide motor with random-wound, squirrel cage rotor, and permanently lubricated or regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading. Temperature rise shall match insulation rating. Provide Class F insulation.
1. Multispeed motors shall have separate windings for each speed.

D. Polyphase Motors with Additional Requirements:
1. Motors Used with Reduced-Voltage and Multispeed Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.
2. Motors Used with Variable Frequency Controllers:
a. Separately Connected Motors: Ratings, characteristics, and features coordinated with and approved by controller manufacturer.
b. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse-width modulated inverters.
c. Premium-Efficient Motors: Class B temperature rise; Class F insulation.
d. Inverter-Duty Motors: Class F temperature rise; Class H insulation.
e. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.
f. Each motor shall be provided with a shaft grounding device for stray current protection.
3. Severe-Duty Motors: Comply with IEEE 841, with 1.15 minimum service factor.

E. Single-Phase Motors:
1. Select motors with service factor of 1.15.
2. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:
a. Permanent-split capacitor.
b. Split phase.
c. Capacitor start, inductor run.
d. Capacitor start, capacitor run.
3. Motors for HVAC exhaust, transfer, and supply fans larger than 1/12 hp and smaller than 1 hp shall be the following:
a. Electronically Commutated motor (EC type): Motor shall be electronically commutated type specifically designed for applications, with heavy duty ball bearings. The motor shall be speed controllable down to 20% of full speed and 85% efficient at all speeds.

1) Exceptions:
   a) Motors in fan-coils and terminal units that operate only when providing heating to the space served.
   b) Motors installed in space conditioning equipment certified under 2013 California Energy Code Section 110.1 or 110.2.

4. Contractor's Option: Motors scheduled on Drawings as single-phase, and larger than 1/12 hp and smaller than 1 hp, for applications other than HVAC fans, may be EC type.
5. Multispeed Motors: Variable-torque, permanent-split-capacitor type.
6. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.
7. Motors 1/20 HP and Smaller: Shaded-pole type.
8. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

2.04 MOTOR STARTERS

A. Square D, Allen Bradley, or equal, in NEMA Type 1 enclosure, unless otherwise specified or required. Minimum starter size shall be Size 1. Provide NEMA 3R enclosure where exposed to outdoors.

B. Provide magnetic motor starters for all equipment provided under the Mechanical Work. Starters shall be non-combination type. Provide part winding or reduced voltage start motors where shown or as hereinafter specified. Minimum size starter shall be Size 1.
   1. All starters shall have the following:
      a. Cover mounted hand-off-automatic switch. Starters installed exposed in occupied spaces shall have key operated HOA switch.
      b. Ambient compensated thermal overload.
      c. Fused control transformer (for 120 or 24 volt service).
      d. Pilot lights, integral with the starters. Starters located outdoors shall be in NEMA IIIR enclosures.
   2. Where three phase motors are provided for two-speed operation, provide two speed motor starters.
   3. Starters for single-phase motors shall have thermal overloads. NEMA I enclosure for starters located indoors, NEMA IIIR enclosure for starters located outdoors.
   4. Provide OSHA label indicating the device starts automatically.

2.05 VALVES AND FITTINGS

A. Ball Valves:
   1. 2 inches and smaller: 600 psi CWP, 150 psi SWP, cast bronze body, full port, two piece, threaded ends, and reinforced PTFE seal, conforming to MSS SP-110. Nibco T585-70, Milwaukee BA-400, Stockham T-285, or equal.
   2. 2-1/2 inches and larger: Class 150, carbon steel body, full port, two piece, stainless steel vented ball, flanged ends, and reinforced PTFE seal, conforming to MSS SP-72. Nibco F-515-CS-F-66-FS, Milwaukee F20-CS-15-F-02-GO-VB, or equal.
   3. Compressed Air Services: Class 150, bronze body, full port, three piece, threaded ends, and reinforced PTFE seal, conforming to MSS SP-110. Nibco Model T-595-Y, Milwaukee BA-300, or equal.

B. Swing Check Valves: Class 125 or 150, bronze body, suitable for regrinding, threaded ends, conforming to MSS SP-80. Stockham B-321, Milwaukee 509, or equal.

C. Silent Check Valves (for use on pump discharge):
   1. General: Provide spring loaded check valves at pump discharge of all pumps.

a. 2 inches and smaller: 250 psi CWP, bronze body, Nibco Model T-480, Milwaukee 548-T, or equal.
b. 2-1/2 inches and larger: Class 250, cast iron body, wafer style, suitable for regrinding. Nibco Model F960, Milwaukee 1400, Mueller 103MAP, or equal.

D. Flow Control Valve: Automatic pressure compensating flow control valves shall be Griswold, Flow Design, Inc., or equal.

2.06 JOINING MATERIALS

A. Refer to Division 22 and 23 piping sections for special joining materials not listed below.

B. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.
1. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch (3.2-mm) maximum thickness unless thickness or specific material is indicated
a. Full-Face Type: For flat-face, Class 125, cast iron and cast bronze flanges.
b. Narrow-Face Type: For raised-face, Class 250, cast iron and steel flanges.
2. AWWA C111, rubber, flat face, 1/8-inch (3.2mm) thick, unless otherwise indicated; and full-face or ring type, unless other indicated.
3. Flange Bolts and Nuts: AWWA C111, carbon steel, unless otherwise indicated.

C. Brazing Filler Metals:
1. General Duty: AWS A5.8, BCup-5 Series, copper-phosphorus unless otherwise indicated. Sil-Fos 15, or equal.
2. Refrigerant Piping:
a. Joining copper to copper: AWS A5.8, BCup-5 Series, copper-phosphorus unless otherwise indicated. Sil-Fos 15, or equal.
b. Joining copper to bronze or steel: AWS A5.8, Bag-1, silver alloy unless otherwise indicated.

D. Welding Filler Metals: Comply with ASME B31.1 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

2.07 STRAINERS

A. Charles M. Bailey #100A, Armstrong, Muessco, or equal, Fig. 11 "Y" pattern, 125 psi WP minimum, with monel screens with 20 square mesh for 2 inches and smaller and 3/64 inch perforations for 2-1/2 inches and larger. Install all strainers with a blow-off hose valve with hose adapter. Strainer shall have gasketed cover with straight thread.

2.08 GAUGES

A. Marsh "Series J", U.S. Gage, Danton 800, or equal, with bronze bushed movement and front recalibration. Dials shall be white with black numerals, 3-1/2 inch dial face. Normal reading shall be at mid-scale. Provide a needle valve on each gauge connection. Supply a gauge piped with branch isolation valves across the inlet and outlet of each pump and where shown on the Drawings.

B. Provide Pete's Plug II, Sisco P/T, or equal, test plug with Nordel core {and gasketed cap}, on inlet and outlet of each coil, boiler, condenser, chiller and heat exchanger and where shown on Drawings.

2.09 THERMOMETERS

A. Marsh, Taylor, Palmer, or equal, 5 inch diameter bimetal dial, adjustable from face, with adjustable positioner, located to be easily read from normal personnel approach. Normal reading shall be at mid-scale.
   1. Provide extension for insulation.
   2. Provide thermometers with steel bulb chambers and brass separable sockets.
   3. Thermometers for air temperature shall have 8 inch minimum stem.

B. Provide Ventlock, Durodyne, or equal thermometer test holes at each air conditioning unit, furnace, and make-up air unit, in mixed air and supply air, and at all locations shown or scheduled on the Drawings. Provide two portable thermometers, with sensing connection arranged to suit test connections.

C. Provide Pete's Plug II, Sisco P/T, or equal, test plug with Nordel core, on inlet and outlet of each coil, boiler, condenser, chiller and heat exchanger and provide two digital electronic test thermometers for each range of fluid temperature and where shown on Drawings.

2.10 ACCESS DOORS

A. Where floors, walls, or ceilings must be penetrated for access to mechanical equipment, provide access doors, 14 inch by 14 inch minimum size in usable opening. Where entrance of a serviceman may be required, provide 20 inch by 30 inch minimum usable opening. Locate access doors/panels for non-obstructed and easy reach.
   1. All access doors less than 7'-0" above floors and exposed to public access shall have keyed locks.

B. Access doors shall match those supplied in Division 08 in all respects, except as noted herein.

C. Provide stainless steel access doors for use in toilet rooms, shower rooms, kitchens and other damp areas. Provide steel access doors with prime coat of baked-on paint for all other areas.

D. Where panels are located on ducts or plenums, provide neoprene gaskets to prevent air leakage, and use frames to set door out to flush with insulation.

E. Provide insulated doors where located in internally insulated ducts or casings.

F. Do not locate access doors in highly visible public areas such as lobbies, waiting areas, and primary entrance areas. Coordinate with the Architect when access is required in these areas.

G. Where specific information or details relating to access panels different from the above is shown or given on the Drawings or other Divisions of work, then that information shall supersede this specification.

H. Manufacturers: Subject to compliance with requirements, available manufacturers offering products which may be incorporated into the Work include Milcor, Karp, Nystrom, or Cesco, equal to the following:
   1. Milcor
      a. Style K (plaster).
      b. Style DW (gypsum board).
      c. Style M (Masonry).
      d. Style "Fire Rated” where required.

2.11 FLEXIBLE JOINTS

A. Where indicated on Drawings, provide Metraflex Metrasphere, Style R, Mason Industries, or equal, Spherical Expansion Joints. Provide control units at each expansion joint, arranged to limit both expansion and compression.

2.12 EQUIPMENT IDENTIFICATION

A. Identify each piece of equipment with a permanently attached engraved bakelite plate, 1/2 inch high white letters on black background.

2.13 PIPE IDENTIFICATION

A. Identify each piping system and indicate the direction of flow by means of Seton, Inc., Marking Services Inc., Reef Industries, Inc., or equal, pre-tensioned, coiled semi-rigid plastic pipe labels formed to circumference of pipe, requiring no fasteners or adhesive for attachment to pipe.

B. The legend and flow arrow shall conform to ASME A13.1.

2.14 INSULATION WORK

A. General:
1. Insulation products, including insulation, insulation facings, jackets, adhesives, sealants and coatings shall not contain polybrominated diphenyl ethers (PBDEs) in penta, octa, or deca formulations in amounts greater than 0.1 percent (by mass).
2. Adhesives and sealants shall comply with testing and product requirements of South Coast Air Quality Management District, Rule 1168.
3. The term "piping" used herein includes pipe, air separators, valves, strainers and fittings.
4. Apply insulating cement to fittings, valves and strainers and trowel smooth to the thickness of adjacent covering. Cover with jacket to match piping. Extend covering on valves up to the bonnet. Leave strainer cleanout plugs accessible.
5. Provide pre-formed PVC valve and fitting covers for indoor piping.
6. Provide factory-fabricated aluminum valve and fitting covers for outdoor piping.
7. Provide Calcium Silicate rigid insulation and sheet metal sleeve, 18 inch minimum length at each pipe hanger. Seal ends of insulation to make vapor tight with jacket.
8. Test insulation, jackets, and lap-seal adhesives as a composite product and confirm flame spread of not more than 25 and a smoke developed rating of not more than 50 when tested in accordance with UL723, ASTM E84, or NFPA 255.
9. Clean thoroughly, test and have approved, all piping and equipment before installing insulation and/or covering.
10. Repair all damage to existing pipe and duct insulation whether or not caused during the work of this contract, to match existing adjacent insulation for thickness and finish, but conforming to flame spread and smoke ratings specified above.

B. Insulation of Piping:
1. Exposed insulated piping within the building shall have a Zeston 2000 25/50, Proto Lo-Smoke, or equal, PVC jacket and fitting cover installed over the insulation, applied per manufacturer's instructions. Insulation shall be vapor tight before applying PVC jacket and fitting covers. Verify suitability with manufacturer of insulation. Insulation with pre-applied polymer jacket may be substituted at Contractor’s option.
2. Insulate refrigerant suction piping and chilled water supply and return piping, including fittings, with minimum 3-1/2 pounds per cubic foot density fiberglass with factory-applied ASJ-SSL jacket. Insulate valves and irregular surfaces to match adjacent insulation and cover with two layers of Glasfab saturated in Foster's Sealfas 30-36, 3M, or equal, carried 3 inches over the adjoining pipe insulation. Finish with a coat of Foster's Sealfas 30-36,

3M, or equal. The 3 inch wide SSL end laps furnished with the insulation shall be adhered over the end joints. Seal entire surface of insulation vapor tight, including joints and ends of PVC or aluminum fitting covers. Insulation thicknesses per application follow:
   a. Indoor refrigerant suction piping 3/4 inch diameter and smaller: 1 inch thick.
   b. Outdoor refrigerant suction piping; all sizes: 2 inches thick.

3. In lieu of the above, refrigerant suction piping, including fittings, may be insulated with Armacell LLC; AP Armaflex, or equal. Seal all joints with Armaflex 520 BLV adhesive, or equal. Apply insulation in strict accordance with manufacturer's recommendations. Insulation thicknesses follow:
   a. Indoor refrigerant suction piping 3/4 inch diameter and smaller: 1/2 inch thick.
   b. Indoor refrigerant piping 1 inch diameter and larger: 1 inch thick.
   c. Outdoor refrigerant piping; all sizes: 2 inches thick.
4. When equipment manufacturers' instructions indicate that refrigerant liquid and hot-gas gas piping be insulated, insulation thickness shall be equal to, and applied as described herein for refrigerant suction piping.
5. Variable refrigerant flow (VRF) heat pump systems: Insulation for VRF system refrigerant piping shall be installed according to VRF unit manufacturer's instructions.
6. Where insulated piping is exposed to the weather apply aluminum jacket secured with 1/2 inch stainless-steel bands on 12 inch centers. Insulation shall be vapor tight before applying metal jacket, and aluminum fitting covers. Install jacketing with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Cover fittings with glass cloth, two coats of Foster Sealfas 30-36, and factory-fabricated aluminum fitting covers, of same material, finish, and thickness as jacket. Insulation shall be vapor tight before applying metal jacket and fitting covers.
   a. Preformed 2-piece or gore, 45- and 90-degree, short- and long-radius elbows.
   b. Tee covers.
   c. Flange and union covers.
   d. End caps.
   e. Beveled collars.
   f. Valve covers.
   g. Field fabricate fitting covers only if factory-fabricated fitting covers are not available.
7. Jacket thickness:
   a. Pipes 10 inches diameter and smaller: Minimum .016 inch thick jacket with smooth finish.
   b. Pipes 12 inches diameter and larger: Minimum .020 inch thick jacket with smooth finish.

C. Duct Insulation:
1. All duct insulation shall meet minimum R-value of R-8 at 3 inch thickness 3/4 pound per cubic foot density for ductwork installed outside the building insulation envelope. For ductwork installed within the building insulation envelope, duct insulation shall have a minimum R-value of R-4.2 at 2 inch thickness, 3/4 pound per cubic foot density.
2. General: Insulation applied to the exterior surface of ducts located in buildings shall have a flame spread of not more than 25 and a smoke-developed rating of not more than 50 when tested as a composite installation including insulation, facing materials, tapes and adhesives as normally applied. Material exposed within ducts or plenum shall have a flame-spread rating of not more than 25 and a smoke-developed rating of not more than 50.
3. Wrap all unlined concealed supply and return ducts with fiberglass duct wrap, manufactured as a blanket of glass fibers factory laminated to a reinforced foil/kraft vapor retarding facing. Provide 2 inch stapling and taping flange. Wrap insulation entirely around duct and secure with outward clinching staples on 6 inch centers. Provide mechanical fasteners at maximum 18 inch centers for all bottoms of duct which are greater than 24 inches. Lap all insulation joints 3" minimum. Insulate ducts installed tight against other work before hanging in place. Seal all seams, both longitudinal and transverse, and all

staple and mechanical fastener penetrations of facing with scrim backed foil tape or recommended sealant, to provide a vapor tight installation.

4. On all supply and return ductwork exposed to weather and not internally lined, field apply minimum 2” thick mineral-fiber board thermal insulation, glass fibers bonded with thermosetting resin. Comply with ASTM C612, type IB without facing and with all service jacket with factory applied FRK-25 foil reinforced kraft paper. Aluminum jacket, 0.024 inch thickness sheets manufactured from aluminum alloy complying with ASTM B209, stucco embossed finish and having an integrally bonded moisture barrier over entire surface in contract with insulation.
5. Provide internal duct lining in accordance with specification section 23 80 00.

PART 3 - EXECUTION

3.01 ELECTRICAL REQUIREMENTS

A. Provide adequate working space around electrical equipment in compliance with the California Electrical Code. Coordinate the Mechanical Work with the Electrical Work to comply.

B. Furnish necessary control diagrams and instructions for the controls. Before permitting operation of any equipment which is furnished, installed, or modified under this Section, review all associated electrical work, including overload protection devices, and assume complete responsibility for the correctness of the electrical connections and protective devices. Motors and control equipment shall conform to the Standards of the National Electrical Manufacturers' Association. All equipment and connections exposed to the weather shall be NEMA IIIR with factory-wired strip heaters in each starter enclosure and temperature control panel where required to inhibit condensation.

C. All line voltage and low voltage wiring and conduit associated with the Temperature Control System are included in this Section. Wiring and conduit shall comply with Division 26.

3.02 PIPING SYSTEM REQUIREMENTS

A. Drawing plans, schematic and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.

3.03 PRIMING AND PAINTING

A. Perform all priming and painting on the equipment and materials as specified herein.

B. Priming:
1. Exposed ferrous metals, including piping, which are not galvanized or factory-finished shall be primed. Black steel pipe exposed to the weather shall be painted one coat of Rust-Oleum #1069 primer for black steel piping or Rust-Oleum #5260, Kelly Moore, or equal, primer for galvanized piping.
2. Metal surfaces of items to be jacketed or insulated except ductwork and piping shall be given two coats of primer unless furnished with equivalent factory finish. Items to be primed shall be properly cleaned by effective means free of rust, dirt, scale, grease and other deleterious matter and then primed with the best available grade of zinc rich primer. After erection or installation, all primed surfaces shall be properly cleaned of any foreign or deleterious matter that might impair proper bonding of subsequent paint coatings. Any abrasion or other damage to the shop or field prime coat shall be properly repaired and touched up with the same material used for the original priming.

3. Where equipment is provided with nameplate data, the nameplate should be masked off prior to painting. When painting is completed, remove masking material.

C. See Painting Section for detailed requirements.

3.04 INSTALLATION OF VALVES

A. General:
1. Valves shall be full line size unless indicated otherwise on Drawings.
2. Install horizontal valves with valve stem above horizontal, except butterfly valves.
3. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.
4. Locate valves for easy access and provide separate support where necessary.
5. Install valves in position to allow full stem movement.
6. Install exposed polished or enameled connections with special care showing no tool marks or exposed threads.
7. Butterfly valves conforming to the paragraph “Butterfly Valves” may be used in lieu of gate or globe valves for locations above grade.
8. Ball valves conforming to the paragraph “Ball Valves” may be used in lieu of gate valves for locations above grade for services 2-1/2 inches and smaller.
9. Valves 2-1/2 inches and smaller (except ball valves) in nonferrous water piping systems may be solder joint type with bronze body and trim.
10. Provide gate or globe valves on inlet and outlet of each pump.

B. Swing Check Valves: Install in horizontal position with hinge pin level.

C. Silent Check Valves: Install in horizontal or vertical position between flanges.

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

3.05 INSTALLATION OF PIPING AND DUCT SYSTEMS

A. General:
1. All piping shall be concealed unless shown or otherwise directed. Allow sufficient space for ceiling panel removal.
2. Installation of piping shall be made with appropriate fittings. Bending of piping will not be accepted.
3. Install piping to permit application of insulation and to allow valve servicing.
4. Where piping, conduit, or ductwork is left exposed within a room, the same shall be run true to plumb, horizontal, or intended planes. Where possible, uniform margins are to be maintained between parallel lines and/or adjacent wall, floor, or ceiling surfaces.
5. Horizontal runs of pipes, conduits, or ductwork suspended from ceilings shall provide for a maximum headroom clearance. The clearance shall not be less than 6'-6" without written approval from the Architect.
6. Close ends of pipe immediately after installation. Leave closure in place until removal is necessary for completion of installation.
7. At the time of rough installation, or during storage on the construction site and until final startup of the heating and cooling equipment, all duct and other related air distribution component opening shall be covered with tape, plastic, sheet metal, or other methods acceptable to the enforcing agency.
8. Each piping system shall be thoroughly flushed and proved clean before connection to equipment.
9. Pipe the discharge of each relief valve, air vent, backflow preventer, and similar device to floor sink or drain.

10. Install exposed polished or enameled connections with special care showing no tool marks or threads at fittings.
11. Install horizontal valves with valve stem above horizontal.
12. Use reducing fittings; bushings shall not be allowed. Use eccentric reducing fittings wherever necessary to provide free drainage of lines and passage of air.
13. Verify final equipment locations for roughing-in.
14. Where piping is installed in walls within one inch of the face of stud, provide a 16 gauge sheet metal shield plate on the face of the stud. The shield plate shall extend a minimum of 1-1/2 inches beyond the outside diameter of the pipe.

B. Sleeves:
1. Install Adjus-to-Crete, Pipeline Seal and Insulator, or equal, pipe sleeves of sufficient size to allow for free motion of pipe, 24 gauge galvanized steel. The space between pipe and sleeves through floor slabs on ground, through outside walls above or below grade, through roof, and other locations as directed shall be caulked with oakum and mastic and made watertight. The space between pipe and sleeve and between sleeve and slab or wall shall be sealed watertight.
2. At Contractor's option, Link-Seal, Metraflex Metraseal, or equal, casing seals may be used in lieu of caulking. Wrap pipes through slabs on grade with 1 inch thick fiberglass insulation to completely isolate the pipe from the concrete.

C. Floor, Wall, and Ceiling Plates:
1. Fit all pipes with or without insulation passing through walls, floors, or ceilings, and all hanger rods penetrating finished ceilings with chrome-plated or stainless escutcheon plates.

D. Firestopping:
1. Pack the annular space between the pipe sleeves and the pipe and between duct openings and ducts through all floors and walls with UL listed fire stop, and sealed at the ends. All pipe penetrations shall be UL listed, Hilti, 3M Pro-Set, or equal.
    a. Install fire caulking behind mechanical services installed within fire rated walls, to maintain continuous rating of wall construction.
2. Provide SpecSeal Systems UL fire rated sleeve/coupling penetrators for each pipe penetration or fixture opening passing through floors, walls, partitions or floor/ceiling assemblies. All Penetrators shall comply with UL Fire Resistance Directory (Latest Edition), and in accordance with CBC requirements.
3. Sleeve penetrators shall have a built-in anchor ring for waterproofing and anchoring into concrete pours or use the special fit cored hole penetrator for cored holes.
4. Copper and steel piping shall have SpecSeal plugs on both sides of the penetrator to reduce noise and to provide waterproofing.
5. All above Firestopping systems to be installed in strict accordance with manufacturer's instructions.
6. Alternate firestopping systems are acceptable if approved equal. However, any deviation from the above specification requires the Contractor to be responsible for determining the suitability of the proposed products and their intended use, and the Contractor shall assume all risks and liabilities whatsoever in connection therewith.

E. Flashing:
1. Flashing for penetrations of metal or membrane roof for mechanical items such as flues, ducts, and pipes shall be coordinated with the roofing manufacturer and roofing installer for the specific roofing type. The work of this section shall include furnishing, layout, sizing, and coordination of penetrations required for the mechanical work.
    a. Furnish and install flashing and counterflashing in strict conformance with the requirements of the roofing manufacturer. Submit shop drawing details for review prior to installation.

b. Furnish and install counterflashing above each flashing required. Provide Stoneman, or equal, vandalproof top and flashing combination. Elmdor/Stoneman Model 1540.
c. Flues and ducts shall have 24 gauge galvanized sheet metal storm collar securely clamped to the flue above the flashing.

2. For all other types of roofing system, furnish and install around each pipe, where it passes through roof, a flashing and counterflashing. All flashing shall be made of four pound seamless sheet lead with 6 inch minimum skirt and steel reinforced boot. Counterflashing shall be cast iron. For vents, provide vandalproof top and flashing combination. Elmdor/Stoneman Model 1100-4.

F. Hangers and Supports:
1. General: Support ductwork, equipment and piping so that it is firmly held in place by approved iron hangers and supports, and special hangers. Hanger and support components shall support weight of ductwork, equipment and pipe, fluid, and pipe insulation based on spacing between supports with minimum factor of safety of five based on ultimate strength of material used. Do not exceed manufacturer's load rating. Pipe attachments or hangers, of same size as pipe or tubing on which used, or nearest available. Rigidly fasten hose faucets, fixture stops, compressed air outlets, and similar items to the building construction. The Architect shall approve hanger material before installation. Do not support piping or ductwork with plumbers' tape, wire rope, wood, or other makeshift devices. Where building structural members do not match piping and ductwork support spacing, provide “bridging” support members firmly attached to building structural members in a fashion approved by the structural engineer.
   a. Materials, design, and type numbers for support of piping per Manufacturers' Standardization Society (MSS), Standard Practice (SP)-58.
      1) Provide copper-plated or felt-lined hangers for use on copper tubing.
   b. Materials and design for ductwork support shall be per SMACNA “HVAC Duct Construction Standards, Metal and Flexible.”
2. Hanger components shall be provided by one manufacturer: B-Line, Grinnell, Unistrut, Badger, or equal.
3. Riser clamps: B-line model B3373, or equal.
4. Pipe Hanger and Support Placement and Spacing:
   a. Vertical piping support spacing: Provide riser clamps for piping, above each floor, in contact with the floor. Provide support at joints, branches, and horizontal offsets. Provide additional support for vertical piping, spaced at or within the following maximum limits:

Pipe Diameter	Steel Threaded or Welded (Note 3)	Copper Brazed or Soldered (Notes 3, 4)	CPVC & PVC (Note 2)
1/2 - 1”	12 ft.	Each Floor, Not to Exceed 10 ft.	Base and Each Floor (Note 1)
1-1/4 - 2”	12 ft.	Each Floor, Not to Exceed 10 ft.	Base and Each Floor (Note 1)
2-1/2 - 3”	12 ft.	Each Floor, Not to Exceed 10 ft.	Base and Each Floor (Note 1)
Over 4”	12 ft.	Each Floor, Not to Exceed 10 ft.	Base and Each Floor (Note 1)

1) Note 1: Provide mid-story guides.

2) Note 2: For PVC piping, provide for expansion every 30 feet per IAPMO installation standard. For CPVC piping, provide for expansion per IAPMO installation standard.
3) Note 3: Spacing of hangers and supports for piping assembled with mechanical joints shall be in accordance with standards acceptable to authorities having jurisdiction.
4) Note 4: Includes refrigerant piping, including vapor and hot gas pipes.

b. Horizontal piping, hanger and support spacing: Locate hangers and supports at each change of direction, within one foot of elbow, and spaced at or within following maximum limits:

Pipe Diameter	Steel Threaded or Welded (Note 2)	Copper Brazed or Soldered (Notes 2, 3)	CPVC & PVC (Note 1)
1/2 - 1"	6 ft.	5 ft.	3 ft.
1-1/4 - 2"	7 ft.	6 ft.	4 ft.
2-1/2 - 3"	10 ft.	10 ft.	4 ft.
Over 4"	10 ft.	10 ft.	4 ft.

1) Note 1: For PVC piping, provide for expansion every 30 feet per IAPMO installation standard. For CPVC piping, provide for expansion per IAPMO installation standard.
2) Note 2: Spacing of hangers and supports for piping assembled with mechanical joints shall be in accordance with standards acceptable to authorities having jurisdiction.
3) Note 3: Includes all refrigerant piping, including vapor and hot gas pipes.

5. Suspended Piping:
a. Individually suspended piping: B-Line B3690 J-Hanger or B3100 Clevis, complete with threaded rod, or equal. All hangers on supply and return piping handling heating hot water or steam shall have a swing connector at point of support.

Pipe Size	Rod Size Diameter
2" and Smaller	3/8"
2-1/2" to 3-1/2"	1/2"
4" to 5"	5/8"
6"	3/4"

b. Provide 3/8 inch rod for support of PVC and CPVC and provide continuous support.
c. Trapeze Suspension: B-Line 1-5/8 inch width channel in accordance with manufacturers' published load ratings. No deflection to exceed 1/180 of a span.
d. Trapeze Supporting Rods: Shall have a safety factor of five; securely anchor to building structure.
e. Pipe Clamps and Straps: B-Line B2000, B2400; isolate copper pipe with two thicknesses of 2 inches wide 10-mil polyvinyl tape. Where used for seismic support systems, provide B-Line B2400 series pipe straps.

f. Concrete Inserts: B-line B22-I continuous insert or B2500 spot insert. Do not use actuated fasteners for support of overhead piping unless approved by Architect.
g. Above Roof: H frame made from Uni-Strut hot-dipped galvanized 1-5/8 inch single or double channel with P-2072A or P-2073A foot secured to roof and surrounded with waterproof roofed-in sleeper. Secure to sleeper with lag screws, and secure sleeper to blocking under roof.
h. Steel Connectors: Beam clamps with retainers.

6. Duct Hanger and Support Spacing: Conform to Requirements of CMC and SMACNA "HVAC Duct Construction Standards, Metal and Flexible."
7. Support to Structure:
   a. Steel Structure: Provide and install additional steel bracing as required to suit structure. Provide through bolts with length to suit requirements of the structural components. Burning or welding on any structural member may only be done if approved by the Architect.
8. Rubber Neoprene Pipe Isolators:
   a. Pipe isolators shall comprise an internal rubber or neoprene material that isolates pipe from hanger and structure. Install at all piping located in acoustical walls. Refer to Architectural Drawings for location of acoustical walls.
   b. Isolation material shall be either a rubber or neoprene material that prevents contact between the pipe and the structure. The rubber shall have between a 45 to 55 durometer rating and a minimum thickness of 1/2 inch.
   c. Acceptable Suppliers:
      1) Vertical runs: Acousto-Plumb or equal.
      2) Horizontal runs: B-Line, Vibraclamp; Acousto-Plumb or equal.
9. Provide continuous V channel support for all horizontal plastic piping.
10. Provide support for piping through roof, arranged to anchor piping solidly in place at the roof penetration.
11. Provide rigid insulation and a 12 inch long, 18 gauge galvanized sheet iron shield between the covering and the hanger whenever hangers are installed on the outside of the pipe covering.
12. Insulate copper tubing from ferrous materials and hangers with two thicknesses of 3 inch wide, 10 mil polyvinyl tape wrapped around pipe.
13. Provide a support or hanger close to each change of direction of pipe either horizontal or vertical and as near as possible to concentrated loads.
14. Suspend rods from concrete inserts with removable nuts where suspended from concrete decks. Power actuated inserts will not be allowed.
15. On chilled or combination hot and chilled water or refrigerant pipes, install the hangers on the outside of the pipe covering and not in contact with the pipe. Provide rigid insulation and a 12 inch long, 18 gauge galvanized sheet iron shield between the covering and the hanger whenever hangers are installed on the outside of the pipe covering.

3.06 PIPE JOINTS AND CONNECTIONS

A. General:
   1. Cutting: Cut pipe and tubing square, remove rough edges or burrs. Bevel plain ends of steel pipe.
   2. Remove scale, slag, dirt and debris from inside and outside of pipe before assembly.
   3. Boss or saddle type fittings or mechanically extracted tube joints will not be allowed.

B. Threaded Pipe: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
   1. Apply thread compound to external pipe threads: Rectorseal No. 5, Permatex No. 1, or equal.
   2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.

C. Flanged Joints: Select appropriate asbestos-free, nonmetallic gasket material in size, type, and thickness suitable for type of water conveyed by pipe. Join flanges with gasket and bolts according to ASME B31.9.

D. Copper Pipe and Tubing: All joints shall be brazed according to ASME Section IX, Welding and Brazing Qualifications, except pneumatic control piping, and hydronic piping having grooved-end fittings and couplings.

E. Welded Pipe:
1. Make up with oxyacetylene or electric arc process.
2. All welding shall conform to the American Standard Code for Power Piping ASME B-31.1. When requested by the Architect, furnish certification from an approved testing agency or National Certified Pipe Welding Bureau that the welders performing the work are qualified.
3. All line welds shall be of the single "V" butt type. Welds for flanges shall be of the fillet type.
4. Where the branch is two pipe sizes smaller than the main or smaller, Bonney Weldolets, Threadolets, Nibco, or equal, may be used in lieu of welding tees.

F. Flexible Connections:
1. Furnish and install Thermo Tech., Inc. F/J/R, Metraflex, or equal, flexible couplings with limiter bolts on piping connections to all equipment mounted on anti-vibration bases, except fan coil units under 2000 cfm, on each connection to each base mounted pump and where shown. Couplings shall be suitable for pressure and type of service.
2. Flexible connections in refrigerant lines; Flexonic, Anaconda or equal, metal hose, full size.
3. Anchor piping securely on the system side of each flexible connection.

G. Grooved-End Fittings and Couplings: Assemble joints with coupling and gasket, lubricant, and bolts. Cut or roll grooves in ends of pipe based on pipe and coupling manufacturer’s written instructions for pipe wall thickness. Use grooved-end fittings and rigid, grooved-end couplings.

3.07 UNIONS AND FLANGES

A. Install Epco, Nibco, or equal, dielectric unions or flanges at points of connection between copper or brass piping or material and steel or cast iron pipe or material except in drain piping. Bushings or couplings shall not be used.

B. Install unions in piping NPS 2” and smaller 3 or flanges in piping NPS 2-1/2” and larger whether shown or not at each connection to all equipment and tanks, and at all connections to all automatic valves, such as temperature control valves.

C. Locate the unions for easy removal of the equipment, tank, or valve.

D. Do not install unions or flanges in refrigerant piping systems.

3.08 ACCESS DOOR

A. Furnish and install access doors wherever required whether shown or not for easy maintenance of mechanical systems; for example, at concealed valves, strainers, traps, cleanouts, dampers, motors, controls, operating equipment, etc. Access doors shall provide for complete removal and replacement of equipment.

3.09 CONCRETE WORK

A. Concrete work required for work of this Section shall be included under another section of the Specification, unless otherwise noted, including poured-in-place concrete work for installing

precast manholes, catch basins, etc., and shall include reinforced concrete bases for pumps, tanks, compressors, fan units, boilers, unless the work is specifically indicated on the Drawings to be furnished under this Section.

B. Underground anchors, and pads for valve access boxes are included under this Section of the Specification. Concrete shall be 3000 psi test minimum. Refer to Division 03 for concrete types.

3.10 PIPE PROTECTION

A. Wrap bare galvanized and black steel pipe buried in the ground and to 6" above grade, including piping in conduit, with one of the following, or equal:
   1. Polyethylene Coating: Pressure sensitive polyethylene coating, "X-Tru-Coat" as manufactured by Pipe Line Service Corporation or "Green Line" wrap as manufactured by Roystron Products, or equal.
      a. Field Joints and Fittings: Protecto Wrap #1170 tape as manufactured by Pipe Line Service Corporation, or Primer #200 tape by Roystron Products, or equal. Installation shall be as per manufacturer's recommendation and instructions.
   2. Tape Wrap: Pressure-sensitive polyvinyl chloride tape, "Transtex #V-l0 or V-20", "Scotchwrap 50", Slipknot l00, PASCO Specialty & Mfg., Inc., or equal, with continuous identification. Tape shall be a minimum of 20 mils thick for fittings and irregular surfaces, two wraps, 50 percent overlap, 40 mils total thickness. Tape shall be laminated with a suitable adhesive; widths as recommended by the manufacturer for the pipe size. Wrap straight lengths of piping with an approved wrapping machine.

B. Field Joints: Valves and Fittings: double wrap polyvinyl chloride tape as above. Provide at least two thicknesses of tape over the joint and extend a minimum of 4 inches over adjacent pipe covering. Build up with primer to match adjacent covering thickness. Width of tape of fittings shall not exceed 3 inches. Tape shall adhere tightly to all surfaces of the fittings without air pockets.

C. Testing: Test completed wrap of piping, including all epoxy painted piping with Tinker and Rasor Co. holiday detector, or equal.

D. Cleaning: Clean all piping thoroughly before wrapping.
   1. Inspection: Damaged or defective wraps shall be repaired as directed. No wrapped pipe shall be covered until approved by Architect.

E. Covering: No rocks or sharp edges shall be backfilled against the wrap. When backfilling with other than sand, protect wrap with an outer wrapping of Kraft paper; leave in place during backfill.

3.11 PIPE IDENTIFICATION

A. Provide temporary identification of each pipe installed, at the time of installation. Temporary identification shall be removed and replaced with permanent identification as part of the work.

B. Apply the legend and flow arrow at all valve locations; at all points where the piping enters or leaves a wall, partition, cluster of piping or similar obstruction, at each change of direction, and at approximately 20'-0" intervals on pipe runs. Variations or changes in locations and spacing may be made with the approval of the Architect. There shall be at least one marking in each room. Markings shall be located for maximum visibility from expected personnel approach.

C. Wherever two or more pipes run parallel, the markings shall be supplied in the same relative location on each.

D. Apply the markings after painting and cleaning of piping and insulation is completed.

3.12 EXPANSION ANCHORS IN HARDENED CONCRETE

A. Refer to Structural Drawings.

B. Qualification Tests: The specific anchor shall have a current ICC-ES report and evaluated in cracked concrete in accordance with Acceptance Criteria AC193. If the specific anchor satisfies cyclic testing requirements per Acceptance Criteria AC01, Section 5.6, the full allowable shear and tension loads listed in the current ICC-ES report and manufacturer's recommendations for the specific anchor may be used. Otherwise, the design shear and tension loads shall not be more than 80% of the listed allowable shear and tension loads for the specific anchor.

C. Installation: The anchors must be installed in accordance with the requirements given in ICC Research Committee Recommendations for the specific anchor.

D. Testing: Fifty percent of the anchors shall be load-tested on each job to twice the allowable capacity in tension, except that if the design load is less than 75 pounds; only one anchor in ten need be tested. If any anchor fails, all anchors must be tested. The load test shall be performed in the presence of a special inspector.

E. The load may be applied by any method that will effectively measure the tension in the anchor, such as direct pull with a hydraulic jack, a torque wrench calibrated using the specific anchor or calibrated spring-loading devices. Anchors in which the torque is used to expand the anchor without applying tension to the bolt may not be verified with a torque wrench.

3.13 PIPING SYSTEM PRESSURE TESTING

A. General:
1. Perform operational tests under simulated or actual service conditions.
2. Repair leaks and defects with new materials, and retest piping or portion thereof until satisfactory results are obtained.

B. Piping Systems: Test the installations in accordance with the following requirements and applicable codes:
1. Notify the Architect at least seven days in advance of testing.
2. Authority having jurisdiction shall witness tests of piping systems.
3. Piping shall be tested at completion of roughing-in, or at other times as directed by the Architect.
4. Furnish necessary materials, test pumps, gases, instruments and labor required for testing.
5. Isolate from system equipment that may be damaged by test pressure.
6. Test Schedule: No loss in pressure or visible leaks shall show after four hours at the pressures indicated.

System Tested	Test Pressure PSI	Test With
All Hot, Chilled, Combination, Condenser Water Piping	Greater of 1-1/2 x WP or 100 psi	Water

C. Testing, Evacuating, Charging and Lubrication of Refrigeration Systems:
1. Pressurize with dry nitrogen and/or refrigerant to 300 psig and test all joints with an electronic detector or halide torch. Release the pressure and attach a high vacuum pump. Evacuate to 4 mm (4000 microns) and hold for 30 minutes. Break to 5 psig with dry nitrogen and allow to remain in the system for ten minutes. Evacuate to 2 mm (2000 microns) and hold for 30 minutes. Use a mercury manometer or electronic vacuum gauge. Do not start timing until recommended vacuum range is reached.

2. At the end of the evacuation, if the system has been proved leak-free, charge with refrigerant and fill the crankcase to the oil level specified by the manufacturer. All refrigerant oil shall be delivered to the location in sealed containers.
3. Replenish for a period of one year without cost to the Owner all refrigerant and oil required to maintain the proper levels.

3.14 TRACER WIRES

A. Provide tracer wire for non-metallic water pipe in ground outside of buildings. Use AWG #12 tracer wire with blue colored low density high molecular weight polyethylene insulation, and lay continuously on pipe so that it is not broken or stressed by backfilling operations. Secure wire to the piping with tape at 18 inch intervals. Solder all joints.

B. Terminals: Precast concrete box and cast iron locking traffic cover, Brooks 3TL, or equal; cover marked with name of service; 6 inches of loose gravel below box. Plastic terminal board with brass bolts; identify line direction with plastic tags. Test for continuity between terminals, after backfilling, in presence of Inspector.

C. Alternate: Use electronically detectable plastic tape with metallic core, Terra Tape D, manufactured by Reef Industries, Inc., Seton, Inc., Marking Services, Inc., or equal; tape 2 inches wide, continuously imprinted "CAUTION WATER (GAS, etc.) LINE BELOW". Install, with printed side up, directly over pipe, 18 inches below finish grade. Backfill material shall be as previously specified for the particular condition where pipe is installed, but avoid use of crushed rock or of earth with particles larger than l/2 inch within the top 12 inches of backfill. Take precautions to insure that tape is not damaged or misplaced during backfill operations. Terminal boxes not required.

3.15 OPERATION OF SYSTEMS

A. Do not operate any mechanical equipment for any purpose, temporary or permanent, until all of the following has been completed:
1. Complete all requirements listed under “Check, Test and Start Requirements.”
2. Ductwork and piping has been properly cleaned. Piping systems shall be flushed and treated prior to operation.
3. Filters, strainers etc. are in place.
4. Bearings have been lubricated, and alignment of rotating equipment has been checked.
5. Equipment has been run under observation, and is operating in a satisfactory manner.

B. Provide test and balance agency with one set of Contract Drawings, Specifications, Addenda, Change orders issued, applicable shop drawings and submittals and temperature control drawings.

C. Operate every fire damper, smoke damper, combination smoke and fire damper under normal operating conditions. Activate smoke detectors as required to operate the damper, stage fan, etc. Provide written confirmation that all systems operate in a satisfactory manner.

3.16 CHECK, TEST AND START REQUIREMENTS

A. An authorized representative of the equipment manufacturer shall perform check, test and start of each piece of mechanical equipment. The representative may be an employee of the equipment manufacturer, or a manufacturer-certified contractor. Submit written certification from the manufacturer stating that the representative is qualified to perform the check test and start of the equipment.
1. As part of the submittal process, provide a copy of each manufacturer’s printed startup form to be used.

2. Some items of specified equipment may require that check, test and start of equipment must be performed by the manufacturer, using manufacturer's employees. See specific equipment Articles in these Specifications for this requirement.
3. Provide all personnel, test instruments, and equipment to properly perform the check, test and start work.
4. When work has been completed, provide copies of reports for review, prior to final observation of work.

B. Provide copies of the completed check, test and start report of each item of equipment, bound with the Operation and Maintenance Manual.

C. Upon completion of the work, provide a schedule of planned maintenance for each piece of equipment. Indicate frequency of service, recommended spare parts (including filters and lubricants), and methods for adjustment and alignment of all equipment components. Provide a copy of the schedule with each Operation and Maintenance Manual. Provide a copy of certification from the Owner's representative indicating that they have been properly instructed in maintenance requirements for the equipment installed.

3.17 PRELIMINARY OPERATIONAL REQUIREMENTS AND TESTS

A. Prior to observation to determine final acceptance, put HVAC, plumbing, and fire protection systems into service and check that work required for that purpose has been done, including but not limited to the following condensed check list. Provide indexed report to tabulating the results of all work.
1. All equipment has been started, checked, lubricated and adjusted in accordance with the manufacturer's recommendations, including modulating power exhausts if present.
2. Correct rotation of motors and ratings of overload heaters are verified.
3. Specified filters are installed and spare filters have been turned over to Owner.
4. All manufacturers' certificates of start-up specified have been delivered to the Owner.
5. All equipment has been cleaned, and damaged painted finishes touched up.
6. Damaged fins on heat exchangers have been combed out.
7. Missing or damaged parts have been replaced.
8. Flushing and chemical treatment of piping systems has been completed and water treatment equipment, where specified, is in operation.
9. Equipment labels, pipe marker labels, ceiling markers and valve tags are installed.
10. Valve tag schedules, corrected control diagrams, sequence of operation lists and start-stop instructions have been posted.
11. Preliminary test and balance work is complete, and reports have been forwarded for review.
12. Automatic control set points are as designated and performance of controls checks out to agree with the sequence of operation.
13. Operation and Maintenance Manuals have been delivered and instructions to the operating personnel have been made.

B. Prior to the observation to determine final acceptance, operate all mechanical systems as required to demonstrate that the installation and performance of these systems conform to the requirements of these specifications.
1. Operate and test all mechanical equipment and systems for a period of at least five consecutive 8 hour days to demonstrate the satisfactory overall operation of the project as a complete unit.
2. Include operation of heating and air conditioning equipment and systems for a period of not less than two 8 hour days at not less than 90 percent of full specified heating and cooling capacities in tests.
3. Commence tests after preliminary balancing and adjustments to equipment have been checked. Immediately before starting tests, install air filters and lubricate all running

equipment. Notify the Architect at least seven calendar days in advance of starting the above tests.

4. During the test period, make final adjustments and balancing of equipment, systems controls, and circuits so that all are placed in first class operating condition.
5. Where Utility District rebates are applicable, demonstrate that the systems meet the rebate program requirements.

C. Before handing over the system to Owner replace all filters with complete new set of filters.

D. Review of Contractor's Tests:
1. All tests made by the Contractor or manufacturers' representatives are subject to observation and review by the Owner. Provide timely notice prior to start of each test, in order to allow for observation of testing. Upon the completion of all tests, provide a letter to confirm that all testing has been successful.

E. Test Logs:
1. Maintain test logs listing the tests on all mechanical systems showing dates, items tested, inspectors' names, remarks on success or failure of the tests.

F. Preliminary Operation:
1. The Owner reserves the right to operate portions of the mechanical system on a preliminary basis without voiding the guarantee.

G. Operational Tests:
1. Before operational tests are performed, demonstrate that all systems and components are complete and fully charged with operating fluid and lubricants.
2. Systems shall be operable and capable of maintaining continuous uninterrupted operation during the operating and demonstration period. After all systems have been completely installed, connections made, and tests completed, operate the systems continuously for a period of five working days during the hours of a normal working day.
3. This period of continuous systems operation may be coordinated with the removal of Volatile Organic Compounds (VOCs) from the building prior to occupancy should the Owner decide to implement such a program.
4. Control systems shall be completely operable with settings properly calibrated and adjusted.
5. Rotating equipment shall be in dynamic balance and alignment.
6. If the system fails to operate continuously during the test period, the deficiencies shall be corrected and the entire test repeated.

H. Pre-Occupancy Building Purge:
1. Prior to occupancy, ventilate the building on 100 percent outside air, 100 percent exhaust for a continuous period determined by a qualified industrial hygienist (engaged by the Contractor) to reduce V.O.C’s prior to occupancy.
2. Submit report by the industrial hygienist verifying satisfactory completion of the pre-occupancy purge.

3.18 DEMONSTRATION AND TRAINING

A. An authorized representative of the equipment manufacturer shall train Owner-designated personnel in maintenance and adjustment of equipment. The representative may be an employee of the equipment manufacturer, or a manufacturer-certified contractor. Submit written certification from the manufacturer stating that the representative is qualified to perform the Owner training for the equipment installed.
1. As part of the submittal process, provide a training agenda outlining major topics and time allowed for each topic.

2. Some items of specified equipment require that training must be performed by the manufacturer, using manufacturer's employees. See specific equipment Articles in these Specifications for this requirement.
3. Contractor shall provide three copies of certification by Contractor that training has been completed, signed by Owner's representative, for inclusion in Operation and Maintenance Manual. Certificates shall include:
   a. Listing of Owner-designated personnel completing training, by name and title.
   b. Name and title of training instructor.
   c. Date(s) of training.
   d. List of topics covered in training sessions.
4. Refer to specific equipment Articles for minimum training period duration for each piece of equipment.

END OF SECTION

SECTION 23 05 93 - TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section Includes:
   1. Balancing Air Systems:
      a. Constant-volume air systems.
   2. Balancing Domestic Water Piping Systems.

1.03 REFERENCES

A. Associated Air Balance Council (AABC)
   1. National Standards for Total System Balance, latest edition.

B. National Environmental Balancing Bureau (NEBB)
   1. Procedural Standards for Testing and Balancing of Environmental Systems, latest edition.

1.04 DEFINITIONS

A. The intent of this Section is to use the standards pertaining to the TAB specialist engaged to perform the Work of this Contract, with additional requirements specified in this Section. Contract requirements take precedence over corresponding AABC or NEBB standards requirements. Differences in terminology between the Specifications and the specified TAB organization standards do not relieve the TAB entity engaged to perform the Work of this Contract of responsibility from completing the Work as described in the Specifications.

B. Similar Terms: The following table is provided for clarification only:

Similar Terms		
Contract Term	AABC Term	NEBB Term
TAB Specialist	TAB Agency	NEBB Certified Firm
TAB Standard	National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems	Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems
TAB Field Supervisor	Test and Balance Engineer	Test and Balance Supervisor

C. AABC: Associated Air Balance Council.

D. NEBB: National Environmental Balancing Bureau.

E. TAB: Testing, adjusting, and balancing.

F. TAB Organization: Body governing practices of TAB Specialists.

G. TAB Specialist: An entity engaged to perform TAB Work.

1.05 ACTION SUBMITTALS

A. LEED Submittals:
   1. Air-Balance Report for Prerequisite IEQ 1: Documentation of work performed for ASHRAE 62.1, Section 7.2.2 - "Air Balancing."
   2. TAB Report for Prerequisite EA 2: Documentation of work performed for ASHRAE/IESNA 90.1, Section 6.7.2.3 - "System Balancing."

1.06 INFORMATIONAL SUBMITTALS

A. Qualification Data: Within 30 days of Contractor's Notice to Proceed, submit documentation that the TAB specialist and this Project's TAB team members meet the qualifications specified in "Quality Assurance" Article.
   1. Provide list of similar projects completed by proposed TAB field supervisor.
   2. Provide copy of completed TAB report, approved by mechanical engineer of record for a completed project with similar system types and of similar complexity.

B. Contract Documents Examination Report: Within 30 days of Contractor's Notice to Proceed, submit the Contract Documents review report as specified in Part 3.
   1. Submit examinations report with qualifications data.

C. Strategies and Procedures Plan: Within 60 days of Contractor's Notice to Proceed, submit TAB strategies and step-by-step procedures as specified in "Preparation" Article.

D. Interim Reports. Submit interim reports as specified in Part 3. Include list of system conditions requiring correction and problems not identified in Contract Documents examination report.

E. Certified TAB reports.
   1. Provide three printed copies of final TAB report. Provide one electronic file copy in PDF format.

F. Sample report forms.

G. Instrument calibration reports, to include the following:
   1. Instrument type and make.
   2. Serial number.
   3. Application.
   4. Dates of use.
   5. Dates of calibration.
      a. Instruments to be used for testing and balancing shall have been calibrated within a period of one year, or less if so recommended by instrument manufacturer and be checked for accuracy prior to start of work.

1.07 QUALITY ASSURANCE

A. Independent TAB Specialist Qualifications: Engage a TAB entity certified by AABC or NEBB.
   1. The certification shall be maintained for the entire duration of TAB work for this Project. If TAB specialist loses certification during this period, the Contractor shall immediately notify the Architect and submit another TAB specialist for approval. All work specified in this

Section and in other related Sections performed by the TAB specialist shall be invalidated if the TAB specialist loses certification, and shall be performed by an approved successor.

B. To secure approval for the proposed TAB specialist, submit information certifying that the TAB specialist is either a first tier subcontractor engaged and paid by the Contractor, or is engaged and paid directly by the Owner. TAB specialist shall not be affiliated with any other entity participating in Work of this Contract, including design, furnishing equipment, or construction. In addition, submit evidence of the following:
   1. TAB Field Supervisor: Full-time employee of the TAB specialist and certified by AABC or NEBB.
      a. TAB field supervisor shall have minimum 10 years supervisory experience in TAB work.
   2. TAB Technician: Full-time employee of the TAB specialist and who is certified by AABC or NEBB as a TAB technician.
      a. TAB technician shall have minimum 4 years TAB field experience.

C. TAB Specialist engaged to perform TAB work in this Project shall be a business limited to and specializing in TAB work, or in TAB work and Commissioning.

D. TAB specialist engaged to perform TAB work shall not also perform commissioning activities on this Project.

E. Certified TAB field supervisor or certified TAB technician shall be present at the Project site at all times when TAB work is performed.
   1. TAB specialist shall maintain at the Project site a minimum ratio of one certified field supervisor or technician for each non-certified employee at times when TAB work is being performed.

F. Contractor shall notify Architect in writing within three days of receiving direction resulting in reduction of test and balance scope or other deviations from Contract Documents. Deviations from the TAB plan shall be approved in writing by the mechanical engineer of record for the Project.

G. TAB Standard:
   1. Perform TAB work in accordance with the requirements of the standard under which the TAB agencies' qualifications are approved unless Specifications contain different or more stringent requirements:
      a. AABC National Standards for Total System Balance, or
      b. NEBB Procedural Standards for Testing, Adjusting, Balancing of Environmental Systems.
   2. All recommendations and suggested practices contained in the TAB standard are mandatory. Use provisions of the TAB standard, including checklists and report forms, to the extent to which they are applicable to this Project.
   3. Testing, adjusting, balancing procedures, and reporting required for this Project, and not covered by the TAB standard applicable to the TAB specialist engaged to perform the Work of this Contract, shall be submitted for approval by the design engineer.

H. Certify TAB field data reports and perform the following:
   1. Review field data reports to validate accuracy of data and to prepare certified TAB reports.
   2. Certify that the TAB team complied with the approved TAB plan and the procedures specified and referenced in this Specification.

I. TAB Report Forms: Use standard TAB specialist's forms approved by Architect.

J. Instrumentation Type, Quantity, Accuracy, and Calibration: As described in ASHRAE 111, Section 5, "Instrumentation."

K. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 7.2.2 - "Air Balancing."

L. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6.7.2.3 - "System Balancing."

1.08 PROJECT CONDITIONS

1.09 WARRANTY

A. Provide workmanship and performance warranty applicable to TAB specialist engaged to perform Work of this Contract:
1. AABC Performance Guarantee.
2. NEBB Quality Assurance Program.

B. Refer to Division 01 Specifications for additional requirements.

1.10 COORDINATION

A. Notice: Provide seven days' advance notice for each test. Include scheduled test dates and times.

B. Perform TAB after leakage and pressure tests on air and water distribution systems have been satisfactorily completed.

C. Coordinate TAB work with work of other trades.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.01 EXAMINATION

A. Contract Documents Examination Report:
1. TAB specialist shall review Contract Documents, including plans and specifications. Provide report listing conditions that would prevent the system(s) from operating in accordance with the sequence of operations specified, or would prevent accurate testing and balancing:
a. Identify each condition requiring correction using equipment designation shown on Drawings. Provide room number, nearest building grid line intersection, or other information necessary to identify location of condition requiring correction.
b. Proposed corrective action necessary for proper system operation.

B. Examine systems for installed balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers. Verify that locations of these balancing devices are accessible.

C. Examine the approved submittals for HVAC systems and equipment.

D. Examine design data including HVAC system descriptions, statements of design assumptions for environmental conditions and systems' output, and statements of philosophies and assumptions about HVAC system and equipment controls.

E. Examine equipment performance data including fan and pump curves.
   1. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.

F. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.

G. Examine test reports specified in individual system and equipment Sections.

H. Examine HVAC equipment and filters and verify that bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.

I. Examine terminal units, such as variable-air-volume boxes, and verify that they are accessible and their controls are connected and functioning.

J. Examine strainers. Verify that startup screens are replaced by permanent screens with indicated perforations.

K. Examine heat-transfer coils for correct piping connections and for clean and straight fins.

L. Examine system pumps to ensure absence of entrained air in the suction piping.

M. Examine operating safety interlocks and controls on HVAC equipment.

N. Report conditions requiring correction discovered before and during performance of TAB procedures.

O. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

3.02 PREPARATION

A. Prepare a TAB plan that includes strategies and step-by-step procedures. TAB plan shall be specific to Project and include the following:
   1. General description of each air system and sequence(s) of operation.
   2. Complete list of measurements to be performed.
   3. Complete list of measurement procedures. Specify types of instruments to be utilized and method of instrument application.
   4. Qualifications of personnel assigned to Project.
   5. Single-line CAD drawings reflecting all test locations (terminal units, grilles, diffusers, traverse locations, etc.
   6. Air terminal correction factors for the following:
      a. Air terminal configuration.
      b. Flow direction (supply or return/exhaust).
      c. Effective area of each size and type of air terminal.
      d. Air density.

B. Complete system-readiness checks and prepare reports. Verify the following:
   1. Permanent electrical-power wiring is complete.
   2. Automatic temperature-control systems are operational.
   3. Equipment and duct access doors are securely closed.
   4. Balance, smoke, and fire dampers are open.
   5. Isolating and balancing valves are open and control valves are operational.

6. Ceilings are installed in critical areas where air-pattern adjustments are required and access to balancing devices is provided.
7. Windows and doors can be closed so indicated conditions for system operations can be met.

3.03 GENERAL PROCEDURES FOR TESTING AND BALANCING

A. Perform testing and balancing procedures on each system according to the procedures contained in AABC's "National Standards for Total System Balance" or NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems" and in this Section.
   1. Comply with requirements in ASHRAE 62.1, Section 7.2.2 - "Air Balancing."

B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary for TAB procedures.
   1. After testing and balancing, patch probe holes in ducts with same material and thickness as used to construct ducts.
   2. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish according to Section 23 07 13 "Duct Insulation," Section 23 07 16 "HVAC Equipment Insulation," Section 23 80 00 Heating, Ventilating, and Air Conditioning."

C. Mark equipment and balancing devices, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.

D. Take and report testing and balancing measurements in inch-pound (IP) units.

3.04 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Crosscheck the summation of required outlet volumes with required fan volumes.

B. Test each system to verify building or space operating pressure, including all stages of economizer cycle. Maximum building pressure shall not exceed 0.03 inches of pressure.

C. Except as specifically indicated in this Specification, Pitot tube traverses shall be made of each duct to measure airflow. Pitot tubes, associated instruments, traverses, and techniques shall conform to ASHRAE Handbook, HVAC Applications, and ASHRAE Handbook, HVAC Systems and Equipment.
   1. Use state-of-the-art instrumentation approved by TAB specialists governing agency..
   2. Where ducts' design velocity and air quantity are both less than 1000 fpm/CFM, air quantity may be determined by measurements at terminals served.

D. Test holes shall be placed in straight duct, as far as possible downstream from elbow, bends, take-offs, and other turbulence-generating devices.

E. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.

F. Check airflow patterns from the outdoor-air louvers and dampers and the return- and exhaust-air dampers through the supply-fan discharge and mixing dampers.

G. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.

H. Verify that motor starters are equipped with properly sized thermal protection.

I. Check dampers for proper position to achieve desired airflow path.

J. Check for airflow blockages.

K. Check condensate drains for proper connections and functioning.

L. Check for proper sealing of air-handling-unit components.

M. Verify that air duct system is sealed as specified in Section 23 31 13 "Metal Ducts." Section 23 80 00 “Heating, Ventilating, and Air Conditioning.”

N. Provide for adjustments or modifications to fan and motor sheaves, belts, damper linkages, and other components as required to achieve specified air balance at no additional cost to Owner.

O. Automatically operated dampers shall be adjusted to operate as indicated in Contract Documents. Controls shall be checked for proper calibration.

3.05 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS

A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.
   1. Measure total airflow.
      a. Where sufficient space in ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow. Alternative methods shall be examined for determining total CFM, i.e., Pitot-tube traversing of branch ducts, coil or filter velocity profiles, prior to utilizing airflow values at terminal outlets and inlets.
   2. Measure fan static pressures as follows to determine actual static pressure:
      a. Measure outlet static pressure as far downstream from the fan as practical and upstream from restrictions in ducts such as elbows and transitions.
      b. Measure static pressure directly at the fan outlet.
      c. Measure inlet static pressure of single-inlet fans in the inlet duct as near the fan as possible, upstream from the flexible connection, and downstream from duct restrictions.
      d. Measure inlet static pressure of double-inlet fans through the wall of the plenum that houses the fan.
   3. Measure static pressure across each component that makes up an air-handling unit, rooftop unit, and other air-handling and -treating equipment.
      a. Report the cleanliness status of filters and the time static pressures are measured.
   4. Measure static pressures entering and leaving other devices, such as sound traps, heat-recovery equipment, and air washers, under final balanced conditions.
   5. Review Record Documents to determine variations in design static pressures versus actual static pressures. Calculate actual system-effect factors. Recommend adjustments to accommodate actual conditions.
   6. Obtain approval from Architect for adjustment of fan speed higher or lower than indicated speed. Comply with requirements in HVAC Sections for air-handling units for adjustment of fans, belts, and pulley sizes to achieve indicated air-handling-unit performance.
   7. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload will occur. Measure amperage in full-cooling, full-heating, economizer, and any other operating mode to determine the maximum required brake horsepower.

B. Check operation of relief air dampers. Measure total relief air quantity at each stage of normal, economizer, power exhaust, or power exhaust economizer operation, as applicable to installed

equipment. Adjust relief air dampers to provide 100 percent relief in economizer mode. Ensure that relief dampers close completely upon unit shutdown.

C. Check operation of outside air dampers. Measure total outside air quantity at each stage of normal, economizer, power exhaust, or power exhaust economizer operation, as applicable to installed equipment. Adjust outside air dampers to provide 100 percent outside air in economizer mode. Ensure that outside air dampers close completely upon unit shutdown.

D. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows within specified tolerances.
   1. Measure airflow of submain and branch ducts.
      a. Where sufficient space in submain and branch ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow for that zone.
   2. Measure static pressure at a point downstream from the balancing damper, and adjust volume dampers until the proper static pressure is achieved.
   3. Remeasure each submain and branch duct after all have been adjusted. Continue to adjust submain and branch ducts to indicated airflows within specified tolerances.

E. Measure air outlets and inlets without making adjustments.
   1. Measure terminal outlets using a direct-reading digital backflow compensating hood. Use outlet manufacturer's written instructions and calculating factors only when direct-reading hood cannot be used due to physical obstruction or other limiting factors. Final report shall indicate where values listed have not been obtained by direct measurement.

F. Adjust air outlets and inlets for each space to indicated airflows within specified tolerances of indicated values. Make adjustments using branch volume dampers rather than extractors and the dampers at air terminals.
   1. Adjust each outlet in same room or space to within specified tolerances of indicated quantities without generating noise levels above the limitations prescribed by the Contract Documents, if included.
   2. Adjust patterns of adjustable outlets for proper distribution without drafts. Terminal air velocity at five feet above finished floor shall not exceed 50 feet per minute in occupied air-conditioned spaces.

G. Do not overpressurize ducts.

3.06 PROCEDURES FOR MOTORS

A. Motors, 1/2 HP and Larger: Test at final balanced conditions and record the following data:
   1. Manufacturer's name, model number, and serial number.
   2. Motor horsepower rating.
   3. Motor rpm.
   4. Efficiency rating.
   5. Nameplate and measured voltage, each phase.
   6. Nameplate and measured amperage, each phase.
   7. Starter manufacturer’s name, model number, size, type, and thermal-protection-element rating.
      a. Starter strip heater size, type, and rating.

B. Motors Driven by Variable-Frequency Controllers: Test for proper operation at speeds varying from minimum to maximum. Test the manual bypass of the controller to prove proper operation. Record observations including name of controller manufacturer, model number, serial number, and nameplate data.

3.07 PROCEDURES FOR CONDENSING UNITS

A. Verify proper rotation of fans.

B. Measure entering- and leaving-air temperatures.

C. Record compressor data.

3.08 PROCEDURES FOR HEAT-TRANSFER COILS

A. Measure, adjust, and record the following data for each electric heating coil:
1. Nameplate data.
2. Airflow.
3. Entering- and leaving-air temperature at full load.
4. Voltage and amperage input of each phase at full load and at each incremental stage.
5. Calculated kilowatt at full load.
6. Fuse or circuit-breaker rating for overload protection.

B. Measure, adjust, and record the following data for each refrigerant coil:
1. Dry-bulb temperature of entering and leaving air.
2. Wet-bulb temperature of entering and leaving air.
3. Airflow.
4. Air pressure drop.

3.09 GENERAL PROCEDURES FOR PLUMBING SYSTEMS

A. Measure pressure drop across each backflow preventer assembly at design flows.

B. Measure water flow at pumps. Use the following procedures except for positive-displacement pumps:
1. Verify impeller size by operating the pump with the discharge valve closed. Read pressure differential across the pump. Convert pressure to head and correct for differences in gage heights. Note the point on manufacturer's pump curve at zero flow and verify that the pump has the intended impeller size.
   a. If impeller sizes must be adjusted to achieve pump performance, obtain approval from Architect Owner Construction Manager Commissioning Authority and comply with requirements in Section 22 50 00 “Plumbing Equipment Section 22 11 23 "Domestic Water Pumps."
2. Check system resistance. With all valves open, read pressure differential across the pump and mark pump manufacturer's head-capacity curve. Adjust pump discharge valve until indicated water flow is achieved.
   a. Monitor motor performance during procedures and do not operate motors in overload conditions.
3. Verify pump-motor brake horsepower. Calculate the intended brake horsepower for the system based on pump manufacturer's performance data. Compare calculated brake horsepower with nameplate data on the pump motor. Report conditions where actual amperage exceeds motor nameplate amperage.
4. Report flow rates that are not within range given in article, Tolerances.

C. Set calibrated balancing valves, if installed, at calculated presettings.

D. Measure flow at all stations and adjust, where necessary, to obtain first balance.
1. System components that have Cv rating or an accurately cataloged flow-pressure-drop relationship may be used as a flow-indicating device.

E. Measure flow at main balancing station and set main balancing device to achieve flow that is 5 percent greater than indicated flow.

F. Adjust balancing stations to within specified tolerances of indicated flow rate as follows:
   1. Determine the balancing station with the highest percentage over indicated flow.
   2. Adjust each station in turn, beginning with the station with the highest percentage over indicated flow and proceeding to the station with the lowest percentage over indicated flow.
   3. Record settings and mark balancing devices.

G. Measure pump flow rate and make final measurements of pump amperage, voltage, rpm, pump heads, and systems' pressures and temperatures including outdoor-air temperature.

H. Measure the differential-pressure-control-valve settings existing at the conclusion of balancing.

I. Check settings and operation of each safety valve. Record settings.

3.10 TOLERANCES

A. Set HVAC system's air flow rates and water flow rates within the following tolerances:
   1. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus 10 percent and minus 0 percent.
   2. Air Outlets and Inlets: Plus 5 percent and minus 5 percent.
   3. Multiple outlets within single room: Plus 5 percent and minus 0 percent for total airflow within room. Tolerance for individual outlets within a single room having multiple outlets shall be as for “Air Outlets and Inlets”.
      a. Room shall be balanced to create pressure relationship (positive, negative, or neutral) with adjacent spaces as indicated on Drawings. Maintain airflow differentials between supply, return, and exhaust indicated on Drawings.
   4. Heating-Water Flow Rate.
   5. Cooling-Water Flow Rate.

B. Set plumbing systems water flow rates within plus or minus 10 percent.

3.11 REPORTING

A. Initial Construction-Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article, prepare a report on the adequacy of design for systems' balancing devices. Recommend changes and additions to systems' balancing devices to facilitate proper performance measuring and balancing. Recommend changes and additions to HVAC systems and general construction to allow access for performance measuring and balancing devices.

B. Interim Reports: Prepare periodic lists of conditions requiring correction and problems found in systems being tested and balanced. Prepare a separate report for each system and each building floor for systems serving multiple floors.

3.12 FINAL REPORT

A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.
   1. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing field supervisor. Report shall be co-signed by the Contractor, attesting that he has reviewed the report, and the report has been found to be complete and accurate.

2. The certification sheet shall be followed by sheet(s) listing items for which balancing objectives could not be achieved. Provide explanation for failure to achieve balancing objectives for each item listed.
3. Include a list of instruments used for procedures, along with proof of calibration.

B. Final Report Contents: In addition to certified field-report data, include the following:
1. Pump curves.
2. Fan curves.
3. Manufacturers' test data.
4. Field test reports prepared by system and equipment installers.
5. Other information relative to equipment performance; do not include Shop Drawings and product data.

C. General Report Data: In addition to form titles and entries, include the following data:
1. Title page.
2. Name and address of the TAB specialist.
3. Project name.
4. Project location.
5. Project Performance Guaranty
6. Architect's name and address.
7. Engineer's name and address.
8. Contractor's name and address.
9. Report date.
10. Signature of TAB supervisor who certifies the report.
11. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
12. Summary of contents including the following:
    a. Indicated versus final performance.
    b. Notable characteristics of systems.
    c. Description of system operation sequence if it varies from the Contract Documents.
13. Nomenclature sheets for each item of equipment.
14. Test conditions for fans and pump performance forms including the following:
    a. Settings for outdoor-, return-, and exhaust-air dampers.
    b. Conditions of filters.
    c. Cooling coil, wet- and dry-bulb conditions.
    d. Face and bypass damper settings at coils.
    e. Fan drive settings including settings and percentage of maximum pitch diameter.
    f. Settings for supply-air, static-pressure controller.
    g. Other system operating conditions that affect performance.

D. System Diagrams: Include schematic layouts of air and hydronic distribution systems. Present each system with single-line diagram and include the following:
1. Quantities of outdoor, supply, return, and exhaust airflows.
2. Duct, outlet, and inlet sizes.

E. Air distribution outlets and inlets shall be shown on keyed plans with designation for each outlet and inlet matching designation used in Contract Documents and TAB test reports. Room numbers shall be included in keyed plans and test reports. Where multiple outlets and inlets are installed within a single room, a designation shall be assigned and listed for each outlet and inlet in addition to room number.

F. Test Reports – General:
1. All test reports containing air or liquid flow data shall record flow values prior to system adjustment in addition to required data listed for each test report.

G. Apparatus-Coil Test Reports:

1. Coil Data:
   a. System identification.
   b. Location.
   c. Coil type.
   d. Number of rows.
   e. Fin spacing in fins per inch o.c.
   f. Make and model number.
   g. Face area in sq. ft.
   h. Tube size in NPS.
   i. Tube and fin materials.
   j. Circuiting arrangement.
2. Test Data (Indicated and Actual Values):
   a. Air flow rate in cfm.
   b. Average face velocity in fpm.
   c. Air pressure drop in inches wg.
   d. Outdoor-air, wet- and dry-bulb temperatures in deg F.
   e. Return-air, wet- and dry-bulb temperatures in deg F.
   f. Entering-air, wet- and dry-bulb temperatures in deg F.
   g. Leaving-air, wet- and dry-bulb temperatures in deg F.
   h. Refrigerant expansion valve and refrigerant types.

H. Gas- and Oil-Fired Heat Apparatus Test Reports: In addition to manufacturer's factory startup equipment reports, include the following:
1. Unit Data:
   a. System identification.
   b. Location.
   c. Make and type.
   d. Model number and unit size.
   e. Manufacturer's serial number.
   f. Fuel type in input data.
   g. Output capacity in Btu/h.
   h. Ignition type.
   i. Burner-control types.
   j. Motor horsepower and rpm.
   k. Motor volts, phase, and hertz.
   l. Motor full-load amperage and service factor.
   m. Sheave make, size in inches, and bore.
   n. Center-to-center dimensions of sheave, and amount of adjustments in inches.
2. Test Data (Indicated and Actual Values):
   a. Total air flow rate in cfm.
   b. Entering-air temperature in deg F.
   c. Leaving-air temperature in deg F.
   d. Air temperature differential in deg F.
   e. Entering-air static pressure in inches wg.
   f. Leaving-air static pressure in inches wg.
   g. Air static-pressure differential in inches wg.
   h. Low-fire fuel input in Btu/h.
   i. High-fire fuel input in Btu/h.
   j. Manifold pressure in psig.
   k. High-temperature-limit setting in deg F.
   l. Operating set point in Btu/h.
   m. Motor voltage at each connection.
   n. Motor amperage for each phase.
   o. Heating value of fuel in Btu/h.

I. Fan Test Reports: For supply, return, and exhaust fans, include the following:

1. Fan Data:
    a. System identification.
    b. Location.
    c. Make and type.
    d. Model number and size.
    e. Manufacturer's serial number.
    f. Arrangement and class.
    g. Sheave make, size in inches, and bore.
    h. Center-to-center dimensions of sheave, and amount of adjustments in inches.
2. Motor Data:
    a. Motor make, and frame type and size.
    b. Horsepower and rpm.
    c. Volts, phase, and hertz.
    d. Full-load amperage and service factor.
    e. Sheave make, size in inches, and bore.
    f. Center-to-center dimensions of sheave, and amount of adjustments in inches.
    g. Number, make, and size of belts.
3. Test Data (Indicated and Actual Values):
    a. Total airflow rate in cfm.
    b. Total system static pressure in inches wg.
    c. Fan rpm.
    d. Discharge static pressure in inches wg.
    e. Suction static pressure in inches wg.

J. Round, Flat-Oval, and Rectangular Duct Traverse Reports: Include a diagram with a grid representing the duct cross-section and record the following:
1. Report Data:
    a. System and air-handling-unit number.
    b. Location and zone.
    c. Traverse air temperature in deg F.
    d. Duct static pressure in inches wg.
    e. Duct size in inches.
    f. Duct area in sq. ft..
    g. Indicated air flow rate in cfm.
    h. Indicated velocity in fpm.
    i. Actual air flow rate in cfm.
    j. Actual average velocity in fpm.
    k. Barometric pressure in psig.

K. Air-Terminal-Device Reports:
1. Unit Data:
    a. System and air-handling unit identification.
    b. Location and zone.
    c. Apparatus used for test.
    d. Area served.
    e. Make.
    f. Number from system diagram.
    g. Type and model number.
    h. Size.
    i. Effective area in sq. ft.
2. Test Data (Indicated and Actual Values):
    a. Air flow rate in cfm.
    b. Air velocity in fpm.
    c. Preliminary air flow rate as needed in cfm.
    d. Preliminary velocity as needed in fpm.
    e. Final air flow rate in cfm.

f. Final velocity in fpm.
g. Space temperature in deg F.

L. Instrument Calibration Reports:
1. Report Data:
a. Instrument type and make.
b. Serial number.
c. Application.
d. Dates of use.
e. Dates of calibration.

3.13 INSPECTIONS

A. Initial Inspection:
1. After testing and balancing are complete, operate each system and randomly check measurements to verify that the system is operating according to the final test and balance readings documented in the final report.
2. Check the following for each system:
a. Measure airflow of at least 10 percent of air outlets.
b. Measure water flow of at least percent of terminals.
c. Measure room temperature at each thermostat/temperature sensor. Compare the reading to the set point.
d. Verify that balancing devices are marked with final balance position.
e. Note deviations from the Contract Documents in the final report.

B. Final Inspection:
1. After initial inspection is complete and documentation by random checks verifies that testing and balancing are complete and accurately documented in the final report, request that a final inspection be made by Architect.
2. The TAB specialist's test and balance engineer shall conduct the inspection in the presence of Architect.
3. Architect shall randomly select measurements, documented in the final report, to be rechecked. Rechecking shall be limited to either 10 percent of the total measurements recorded or the extent of measurements that can be accomplished in a normal 8-hour business day.
4. If rechecks yield measurements that differ from the measurements documented in the final report by more than 10 percent, the measurements shall be noted as "FAILED."
5. If the number of "FAILED" measurements is greater than 10 percent of the total measurements checked during the final inspection, the testing and balancing shall be considered incomplete and shall be rejected.

C. TAB Work will be considered defective if it does not pass final inspections. If TAB Work fails, proceed as follows:
1. Recheck all measurements and make adjustments. Revise the final report and balancing device settings to include all changes; resubmit the final report and request a second final inspection.
2. If the second final inspection also fails, Owner may contact the TAB specialists' governing organization for remedial action by the governing organization under the workmanship and performance warranty. See article, Warranty.
3. If remedial action is not provided by the TAB specialists' governing organization in a timely manner, Owner may contract the services of another TAB specialist to complete the TAB Work according to the Contract Documents and deduct the cost of the services from the original TAB specialists' final payment.

D. Prepare test and inspection reports.

3.14 ADDITIONAL TESTS

A. Seasonal Periods: If initial TAB procedures were not performed during near-peak summer and winter conditions, perform additional TAB during near-peak summer and winter conditions.

END OF SECTION

SECTION 23 08 00.13 – TITLE 24 COMMISSIONING OF HVAC

PART 1 - GENERAL

1.01 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. In the event of conflict between requirements of Division 01 Title 24 commissioning specifications and this Section, Division 01 requirements shall prevail.

1.02 SUMMARY

A. Section Includes: Requirements for commissioning of HVAC systems for Title 24 (T-24) compliance.

B. The requirements of this Section apply to all Sections of Division 23.

C. Scope: Commissioning Coordinator shall complete the building systems commissioning requirements of the California Energy Code, as applicable to Project. It is not the intention of Project specifications to require duplication in testing.
   1. T-24 commissioning activities may be coordinated with Contractor tests and TAB work specified in technical Sections.
   2. T-24 commissioning activities may be coordinated with LEED and CHPS program commissioning activities, as applicable to Project.

1.03 REFERENCES

A. 2016 California Energy Code.

B. 2016 California Energy Code and Building Energy Efficiency Standards Reference Appendices.

C. 2016 Building Energy Efficiency Standards Nonresidential Compliance Manual.

1.04 DEFINITIONS

A. Commissioning Coordinator: General Contractor, or an entity engaged by the General Contractor to perform T-24 commissioning.

B. Covered Processes: Process equipment for which there are listed requirements in the California Energy Code.

C. OPR: Owner’s Project Requirements.

D. TAB: Testing, Adjusting, and Balancing.

1.05 SUBMITTALS (FOR RECORD ONLY)

A. Submit the following:
   1. Commissioning Plan.
   2. Systems Manual.
   3. Commissioning Report.
   4. Certificates of Installation.

5. Certificates of Acceptance.

B. Above items for inclusion in closeout documents submitted to authorities having jurisdiction.

PART 2 - PRODUCTS

2.01 TEST INSTRUMENTS

A. Commissioning Coordinator shall supply test instruments. Instruments to be used for testing and balancing shall have been calibrated within a period of one year, or less if recommended by instrument manufacturer, and be checked for accuracy prior to start of work.

PART 3 - EXECUTION

3.01 COMMISSIONING PROCESS ROLES AND RESPONSIBILITIES

A. Architect/Engineer:
1. Performs construction observation. Provides construction observation reports.
2. Reviews and approves Commissioning Plan, Systems Manual, and Commissioning Report.
3. Assists in problem resolution.

B. Commissioning Coordinator:
1. Coordinates commissioning process.
2. Develops Commissioning Plan.
3. Schedules and conducts functional testing. Completes Certificates of Acceptance.
4. Assembles Systems Manual.
5. Schedules and conducts systems operations training. Verifies systems operations training completion.

C. HVAC Subcontractor: Assists in functional testing.

D. Electrical Subcontractor: Assists in functional testing.

E. Controls Subcontractor: Assists in functional testing.

F. TAB Subcontractor: Assists in functional testing.

G. Equipment Manufacturers/Vendors:
1. Performs Check, Test, and Start of equipment and systems, as required by Project technical Sections.
2. Provides systems and equipment documentation required to complete functional testing and assemble Systems Manual.

3.02 COMMISSIONING PLAN

A. Commissioning Coordinator shall author the code-required Commissioning Plan. The Commissioning Plan shall address HVAC systems for which commissioning is required. The Commissioning Plan shall be updated by Commissioning Coordinator throughout the construction process. The Commissioning Plan shall contain the following:
1. General Project Information: Commissioning Coordinator shall obtain general Project information from Project architectural Drawings.
2. Commissioning Goals:
a. Verify that the applicable equipment and systems are installed in accordance with the contract documents and according to the manufacturer's recommendations.

b. Verify and document proper integrated performance of equipment and systems utilizing functional testing for mechanical system acceptance, as required by the California Energy Code.
c. Verify that Systems Manual documentation is complete.
d. Verify that operating personnel are trained to enable them to operate, monitor, adjust, and maintain HVAC systems in an effective and energy-efficient manner.

3. Commissioning Coordinator shall compile the following information and include in Commissioning Plan:
   a. An explanation of original design intent: Commissioning Coordinator shall obtain copies of the OPR and BOD for the Project.
   b. Equipment and systems to be tested, including the extent of tests: Test 100 percent of a given type of installed equipment having associated Acceptance Requirements.
      1) Refer to forms MCH-01-E on Drawings for systems to be commissioned.
      2) Covered Processes: In addition to systems listed in MCH-01-E on Drawings, complete Acceptance Requirements for the following systems, if applicable to Project:
         a) Parking garage ventilation systems.
         b) Compressed air systems.
         c) Type 1 Kitchen exhaust systems.
   c. Functions to be tested: Refer to 2016 Building Energy Efficiency Standards for Residential and Nonresidential Buildings, Nonresidential Appendix NA7.
   d. Conditions under which the test shall be performed.
   e. Measureable criteria for acceptable performance: Refer to 2016 Building Energy Efficiency Standards for Residential and Nonresidential Buildings, Nonresidential Appendix NA7.
   f. Commissioning team information:
      1) Refer to Project information on architectural Drawings for design team participants. Commissioning Coordinator shall add subcontractor information to provided design team information and include in Commissioning Plan.
   g. Commissioning process activities, schedules, and responsibilities. Plans for the completion of functional performance testing, systems operations training, and commissioning report.

3.03 CERTIFICATES OF INSTALLATION

A. Commissioning Coordinator shall complete applicable Certificates of Installation forms.

3.04 FUNCTIONAL TESTING REQUIREMENTS

A. Contractor shall complete the applicable Acceptance Requirements for Code Compliance contained in the California Building Energy Efficiency Standards. Refer to T-24 compliance forms on Drawings for systems having Acceptance testing requirements. Contractor shall perform Acceptance tests and complete the appropriate “Certificates of Acceptance.” Contractor shall engage certified HERS Rater to verify duct leakage rate for duct systems indicated on T-24 compliance forms on Drawings as requiring duct leakage rate testing. For additional duct leak testing requirements, refer to Section 23 80 00, “Heating, Ventilating, and Air Conditioning,” Article, “Ductwork Sealing and Leak Testing.”

1. Covered Processes: In addition to systems listed on T-24 compliance forms on Drawings, complete Acceptance Requirements for the following systems, if applicable to Project:
   a. Parking garage ventilation systems.
   b. Compressed air systems.
   c. Type 1 Kitchen exhaust systems.

3.05 SYSTEMS MANUAL

A. Commissioning Coordinator shall assemble Systems Manual in accordance with the requirements of the California Energy Code, HVAC and Plumbing specifications, and Division 01 specifications, including Section 01 79 00, Demonstration and Training, and commissioning specifications.

3.06 SYSTEMS OPERATIONS TRAINING

A. Commissioning Coordinator shall provide systems operations training in accordance with the requirements of the California Energy Code, HVAC and Plumbing specifications, and Division 01 specifications, including Section 01 79 00, Demonstration and Training, and commissioning specifications.

3.07 COMMISSIONING REPORT

A. Commissioning Coordinator shall complete Commissioning Report in accordance with the requirements of the California Energy Code and Division 01 commissioning specifications.

END OF SECTION

SECTION 23 80 00 – HEATING, VENTILATING AND AIR CONDITIONING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Roof mounted air conditioning units.

B. Heating and ventilating units.

C. Split system air conditioning units.

D. Air cooled condensing units.

E. Cooling coils.

F. Refrigeration piping and fittings.

G. Fans.

H. Relief and intake vents.

I. Louvers.

J. Air inlets and outlets.

K. Filters.

L. Dampers.

M. Ductwork.

1.02 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. Section 23 00 50, Basic HVAC Materials and Methods.

C. 23 05 93, Testing, Adjusting, and Balancing for HVAC.

D. Section 25 50 00, Automation Facility Controls.

E. Section 23 09 00, Instrumentation and Controls for HVAC.

1.03 ADDITIONAL REQUIREMENTS

A. Furnish and install any incidental work not shown or specified which is necessary to provide a complete and workable system.

B. Coordinate all of work in this Section with all of the Trades covered in other Sections of the Specifications to provide a complete, operable and sanitary installation of the highest quality workmanship.

1.04 DESCRIPTION OF WORK

A. Work of this section includes, but is not necessarily limited to Heating, Ventilating and Air Conditioning work indicated on the drawings and described herein.

1.05 QUALITY ASSURANCE

A. Design Criteria:
   1. All equipment and accessories to be the product of a manufacturer regularly engaged in its manufacture. All gas-fired equipment shall be UL, ETL or CSA listed.
   2. Supply all equipment and accessories in accordance with requirements of applicable national, state and local codes.
   3. All items of a given type shall be products of the same manufacturer.
   4. Scheduled equipment performance is minimum capacity required.
   5. Scheduled electrical capacity shall be considered as maximum available.
   6. Scheduled gas BTU input shall be considered as maximum available.

1.06 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data, including rated capacities of selected model clearly indicated, dimensions, weight, corner or mounting point weights, furnished specialties and accessories; and installation and start-up instructions. Product data shall include applicable product listings and standards. Refer to Section 23 00 50, Basic HVAC Material and Methods for additional requirements.
   1. Upon approval of submittal, provide manufacturer’s installation and operating instructions to the Project inspector for the following:
      a. Fire dampers, smoke dampers, and combination smoke-fire dampers.

B. Roof Curb Data: For roof mounted equipment where combined weight of equipment unit and roof curb or rail exceeds 400 pounds, submit calculations from manufacturer for roof curbs proving compliance with the seismic requirements of the California Building Code, and ASCE 7-10. Manufacturer shall certify that roof curbs are suitable for use indicated on Drawings and in Specifications for the seismic design category indicated in structural Contract Documents. Calculations shall be stamped and signed by a State of California registered structural engineer.

C. Economizer Fault Detection and Diagnostics (FDD) System Data: For all air-cooled unitary direct-expansion units equipped with an economizer, provide data for third-party supplied California Energy Commission certified FDD controller, documenting compliance with the requirements of California Building Energy Efficiency Standards. Provide evidence of certification.

D. Engineering Data: Submit fan curves and sound power level data for each fan unit. Data shall be at the scheduled capacity. Data shall include the name of the rating agency or independent laboratory.

E. Maintenance Data: Submit maintenance data and parts list for each piece of equipment, control, and accessory; including "trouble-shooting guide," in Operation and Maintenance Manual.

F. Record Drawings: At project close-out, submit Record Drawings of installed ductwork, duct accessories, and outlets and inlets in accordance with requirements of Division 01.

G. Coordinated Layouts: Submit coordinated layouts. For requirements refer to article, Coordinated Layouts, in this Section.

1.07 COORDINATED LAYOUT

A. Coordinated layouts are required to amplify, expand and coordinate the information contained in the Contract Documents.

B. Provide minimum 1/4 inch equals one foot scaled coordinated layout drawings showing plan and pertinent section or elevation views of piping, ductwork, equipment, accessories, and electrical systems. Drawings shall be reproducible and work of each trade represented shall be fully coordinated with structure, other disciplines, and finished surfaces. Drawings shall be presented on a single size sheet. Coordinated layout drawings shall have title block, key plan, north arrow and sufficient grid lines to provide cross-reference to design Drawings.
   1. Provide a stamp or title block on each drawing with locations for signatures from all contractors involved, including but not limited to the General, HVAC, Plumbing, Fire Protection, and Electrical contractors. Include statement for signature that the contractor has reviewed the coordinated layout drawings in detail and has coordinated the work of his trade.
   2. Show on drawings the intended elevation of all ductwork in accordance with the following example:

      B.O.D. = 9'-0"
      OFFSET UP 6"
      B.O.D. = 9'-6"

   3. Highlight, encircle or otherwise indicate deviations from the Contract Documents on the coordinated layouts. Architect will not be responsible for identifying deviations from the original Contract Documents.

C. Since scale of contract drawings is small and all offsets and fittings are not shown, contractor shall make allowances in bid for additional coordination time, detailing, fittings, offsets, hangers and the like to achieve a fully coordinated installation. If changes in duct size are required, equivalent area shall be maintained and the aspect ratio shall not be in excess of 2 to 1 unless approved by the Engineer. Drawings shall be submitted for review prior to fabrication and installation. Drawings may be submitted in packages representing at least one quarter of the building ductwork.

D. Check routing on all ductwork before fabricating. Report any discrepancies to Architect. No extra cost will be allowed for failure to conform to above.

1.08 REFERENCES

A. AABC - Associated Air Balance Council

B. AFBMA - Anti Friction Bearing Manufacturer's Association

C. CSA – Canadian Standards Association International

D. AMCA - Air Moving and Control Association Inc.
   1. Standard 210 - Laboratory Methods of Testing Fans

E. ANSI - American National Standards Institute

F. ARI - Air-Conditioning and Refrigeration Institute

G. ASHRAE - American Society of Heating, Refrigerating and Air Conditioning Engineers

H. ASME - American Society of Mechanical Engineers

I. ASTM - American Society of Testing and Materials

J. CCR - California Code of Regulations

K. CSFM - California State Fire Marshal

L. NIST - National Institute of Standards and Technology

M. NEMA - National Electrical Manufacturer's Association

N. NFPA - National Fire Protection Association

O. OSHA - Occupational Safety and Health Act

P. SMACNA - Duct Manuals

Q. CBC - California Building Code

R. UL - Underwriters' Laboratories, Inc.

S. CMC - California Mechanical Code

T. CPC - California Plumbing Code

U. CEC - California Electrical Code

PART 2 - PRODUCTS

2.01 MATERIALS

A. Insulation products, including insulation, insulation facings, jackets, adhesives, sealants and coatings shall not contain polybrominated diphenyl ethers (PBDEs) in penta, octa, or deca formulations in amounts greater than 0.1 percent (by mass).

2.02 GAS FIRED EQUIPMENT

A. All gas-fired equipment shall be listed for use as a gas appliance.

B. All units shall comply with the emissions requirements of the Air Quality Management District (AQMD) in which they are to be installed.

2.03 AIR CONDITIONING UNIT, ROOF-MOUNTED

A. Provide factory assembled single packaged outdoor rooftop mounted, electrically controlled gas heating and electric cooling unit, rated in accordance with ARI Standards 210/240 or 340/360, and ETL or UL listed and labeled, classified in accordance with UL 1995. Provide refrigerant charge R-410A, all internal wiring, piping, controls, and special features required prior to field startup. Design unit to conform to the following:
   1. California NOx emission requirements.
   2. ASHRAE 15.
   3. ASHRAE 90.1.
   4. Insulation, adhesive, and all materials exposed to air stream shall meet NFPA 90A requirements for flame spread and smoke generation.
   5. Unit casing shall be capable of withstanding 500-hour salt spray exposure per ASTM B117 (scribed specimen).

B. Unit shall be rated in accordance with ARI sound standards 270 or 370.

C. Unit shall be ETL or UL tested and certified in accordance with ANSI Z21.47 Standards as a total package.

D. Roof curb shall be designed to conform to NRCA Standards.

E. Unit shall be designed and manufactured in accordance with ISO 9001.

F. For unit sizes applicable to Energy Star program, units shall be Energy Star qualified.

G. Cabinet:
1. Provide galvanized steel unit cabinet, bonderized and coated with a baked enamel finish.
2. All airstream interior surfaces shall be insulated with a minimum 1/2 inch thick, 1.5 lb. density cleanable insulation. Insulation shall be encapsulated with panel design or have sealed edges.
3. Cabinet panels shall be hinged with integrated non-corrosive hinges. Provide hinged access panels for the filter, compressors, evaporator fan, and control box/ heat section areas. Each panel shall have multiple latches and handles. Each external hinged access panel shall be double-wall construction and permanently attached to the rooftop unit.
4. Return air filters shall be accessible through a dedicated hinged access panel.
5. Fork lift slots and rigging holes shall be provided in unit base rails. Base rails shall be minimum 16 gauge.
6. Unit shall have an integral sloped condensate drain pan, providing minimum 3/4 in.-14 NPT connections for horizontal drain configuration. Provide unit with alternate vertical thru-the-bottom drain connection when furnished as standard for units sizes scheduled on Drawings. See Drawings for drain configuration. Pan shall be removable for cleaning and maintenance. All drain pans shall conform to ASHRAE 62.1 self-draining provisions.
7. Unit shall have standard side and alternate field or factory installed thru-the-bottom power and control wiring connection capability. Thru-the-bottom electrical connections shall use manufacturer's approved water-tight connection method.
8. Unit shall be field convertible to, or factory furnished with, horizontal air discharge, as applicable for unit sizes as scheduled on Drawings.

H. Fans:
1. Centrifugal supply air blower (evaporator fan) shall have sealed, permanently lubricated ball bearings, or rigid pillow block bearings, as supplied as standard equipment for unit sizes scheduled on Drawings. Units supplied with pillow block bearings shall be furnished with accessible lubricant fittings. Provide belt-driven double inlet fan wheel, centrifugal type with forward curved blades and adjustable sheaves. Multiple speed direct drive motors may be utilized when supplied as standard equipment for efficiency and electrical requirements as scheduled on the Drawings. Fan wheel shall be steel, with corrosion resistant finish, dynamically balanced.
2. Condenser fans shall be of the direct-driven propeller type, with corrosion-resistant aluminum blades. Fans shall be dynamically balanced and discharge air upwards. Induced-draft blower shall be of the direct-driven, single inlet, forward-curved, centrifugal type, made from aluminized steel with a corrosion-resistant finish and shall be dynamically balanced.
3. Induced draft fan shall be of the direct driven, single inlet, forward-curved centrifugal type. Fan wheel shall be steel, with corrosion resistant finish, dynamically balanced.

I. Motors:
1. Compressor motors shall be cooled by refrigerant gas passing through motor windings and shall have line break thermal and current overload protection.
2. Evaporator fan motor shall have permanently lubricated, sealed bearings and inherent automatic-reset thermal overload protection or manual reset calibrated circuit breakers.

3. Totally enclosed condenser-fan motor shall have permanently lubricated, sealed bearings, and inherent automatic-reset thermal overload protection.
4. Induced-draft motor shall have permanently lubricated sealed bearings and inherent automatic-reset thermal overload protection.
5. For single-phase fan motors sized larger than 1/12 hp and smaller than 1 hp, refer to Article, Electric Motors, in Section 23 00 50, Basic HVAC Materials and Methods.

J. Compressor:
1. Fully hermetic, scroll type with internal high-pressure and temperature protection.
2. Factory installed rubber shock mounted and internally spring mounted for vibration isolation.
3. Compressor Anti-Recycle Timer: Compressor shall be prevented from restarting for a minimum of five minutes after shutdown, with manufacturers installed compressor cycle delay.
4. Compressor shall have a five year warranty.

K. Coils:
1. Standard evaporator and condenser coils shall have aluminum plate fins mechanically bonded to seamless internally finned copper tubes with all joints brazed.
2. Units shall have face-split type evaporator coils.
3. For units with single compressor, condenser coils shall be single slab, single pass design. For dual compressor units, condenser coils shall be single slab, 2 pass design.
4. Evaporator coils shall be leak tested at minimum 150 psig, and pressure tested at minimum 450 psig.
5. Condenser coils shall be leak tested at minimum 150 psig, and pressure tested at minimum 650 psig.

L. Heating Section:
1. Induced-draft combustion type with direct-spark ignition system and redundant main gas valve with 2-stage capability on all 3-phase units.
2. Heat Exchanger:
   a. The standard aluminized heat exchanger shall be of the tubular-section type constructed of minimum 20-gage aluminized steel. Standard heat exchanger shall have a ten year warranty.
3. Burners shall be of the in-shot type constructed of aluminum-coated steel.
4. All gas piping shall enter the unit at a single location. Gas entry shall be through side or bottom of unit. See Drawings for gas entry location. When bottom gas entry is utilized, unit shall be furnished with field installed conversion kit, arranged so that gas shut-off valve is accessible from the roof.
5. All factory-installed orifices are for operation up to 2,000 feet of altitude. For altitudes between 2,000 feet and 7,000 feet, a factory certified kit shall be furnished for field installation.
6. Units shall be suitable for use with natural gas or propane. Provide field-installed propane conversion kit as required, see schedule on Drawings.
7. The integrated gas controller board shall include gas heat operation fault notification using an LED (light-emitting diode).
8. Unit shall be equipped with anti-cycle protection with one short cycle on unit flame rollout switch or 4 continuous short cycles on the high-temperature limit switch. Fault indication shall be made using an LED.
9. The integrated gas controller board shall contain algorithms that modify evaporator-fan operation to prevent future cycling on high-temperature limit switch.
10. The LED shall be visible without removal of control box access panel.
11. Gas burner tray shall be removable for maintenance.
12. Heating section shall be insulated with foil-faced fiberglass insulation.

M. Refrigerant Components:

1. Each refrigerant circuit shall include:
    a. Balanced port thermostatic expansion valve (TXV) with removable power element.
    b. Solid core refrigerant filter driers with pressure ports.
    c. Refrigerant pressure gage ports and connections on suction, discharge, and liquid lines.

N. Filter Section:
1. Standard filter section shall accommodate 2 inch deep filters. Filters shall conform to the "Air Filters" Article in this Specification Section.
2. Filter section shall use standard size filters.

O. Controls:
1. Unit shall be complete with self-contained low voltage fuse protected control circuit. Refer to Section 25 50 00, if included, and equipment schedule, sequence of operation and control diagram on Drawings for additional requirements.
2. When third party direct digital controls with an Energy Management System will be utilized, provide electro-mechanical controls with 24V thermostat interface.
3. When stand-alone thermostat operation is utilized, provide electro-mechanical controls with 24V thermostat interface or provide microprocessor controls.
4. When stand-alone thermostat operation is utilized for single-zone VAV units, provide microprocessor controls. Units shall have factory mounted supply fan variable frequency drives.
5. When third party direct digital controls with an Energy Management System will be utilized for single zone VAV units, provide microprocessor controls with BACnet or LON interface. Units shall have factory mounted supply fan variable frequency drives.
6. Electro-mechanical controls shall include the following, as a minimum:
    a. Service run test capability.
    b. Provide compressor minimum run time (3 minutes) and minimum off time (5 minutes).
    c. Economizer control.
    d. Unit shall have 35° F low ambient cooling operation.
    e. Time delay relay.
7. Microprocessor controls shall include the following, as a minimum:
    a. User diagnostic interface.
    b. Unit control with standard suction pressure transducers and condensing temperature thermistors.
    c. Shall provide a 5° F temperature difference between cooling and heating set points to meet ASHRAE 90.1 energy standard.
    d. Service run test capability.
    e. Shall accept input from a CO2 sensor (indoor).
    f. Configurable alarm light shall be provided which activates when certain types of alarms occur.
    g. Provide compressor minimum run time (3 minutes) and minimum off time (5 minutes).
    h. Service diagnostic mode.
    i. Economizer control.
    j. Unit shall have 0° F low ambient cooling operation.
    k. Time delay relay.

P. Safeties:
1. Unit shall incorporate a solid-state compressor lockout that provides optional reset capability at the space thermostat, should any of the following safety devices trip and shut off compressor:
    a. Compressor lockout protection provided for either internal or external overload.
    b. Low-pressure protection.
    c. Freeze protection (evaporator coil).

d. High-pressure protection (high pressure switch or internal).
e. Compressor reverse rotation protection.
f. Loss of charge protection.
g. Start assist on singe-phase units.

2. Supply-air sensor shall be located in the unit and detect both heating and cooling operation.
3. Induced draft heating section shall be provided with the following minimum protections:
   a. High-temperature limit switch.
   b. Induced-draft motor speed sensor.
   c. Flame rollout switch.
   d. Flame proving controls.
   e. Redundant gas valve.
4. Phase Protection: Provide unit-mounted “SymCom,” or equal, Motor Saver three phase voltage monitor, model 201A or equal, adjustable voltage range for each unit, install per manufacturer's recommendations, mount in NEMA 3R enclosure if exposed to the weather.
   a. Units shall provide the following features:
      1) Low voltage fault trip and reset.
      2) Voltage unbalance/phasing fault trip and reset.
      3) High voltage fault trip and reset.
      4) Transient Protection (Internal).
      5) Automatic restart.
   b. Provide each unit with 600V socket, “SymCom” model OT08, or equal.

Q. Operating Characteristics:
1. Unit shall be capable of starting and running at 125° F ambient outdoor temperature per maximum load criteria of ARI Standards 210 or 360.
2. Unit will operate in cooling down to an outdoor ambient temperature of 35° F.
3. Unit shall be provided with fan time delay to prevent cold air delivery in heating mode.

R. Electrical Requirements:
1. All unit power wiring shall enter unit cabinet at a single location. Both unit side and bottom power entry provisions shall be provided. Refer to Drawings schedule for thru-the-bottom power wiring requirement.

S. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:
1. Carrier Corporation.
2. Trane Inc.
3. Johnson Controls, Inc.

T. Provide the following additional features and equipment:
1. Roof Curb: Formed galvanized steel with wood nailer strip capable of supporting entire unit weight. Provide 3 inch wide bottom flange.
2. Modulating Power Exhaust Economizer: Micrometl, Canfab, or equal. Integrated type capable of simultaneous economizer and compressor operation.
   a. Provide self-contained outdoor rooftop system, mounted directly to the return air compartment of the HVAC packaged equipment. Provide differential dry bulb economizer control system and a factory programmed, fully programmable variable frequency drive package controlled by a differential pressure transmitter, mounted directly to the return air compartment of the HVAC packaged equipment. Design the system to continuously maintain space pressure, and provide capability of introducing up to 100 percent outdoor air.
      1) Economizer control system shall be certified as meeting the requirements for Fault Detection and Diagnostics (FDD) in the California Building Energy and Efficiency Standards.

b. Provide outside differential pressure tubing termination with hex style pneumatic filter-muffler, minimum filtration 40 microns, 53 SCFM maximum at 100 psi, as manufactured by McMaster-Carr, or equal.
c. Provide hinged cabinet access doors and include latches to provide a tool-less entry for servicing.
d. Provide door lock on the power exhaust cabinet to meet ETL safety requirements.
e. Outdoor air intake dampers shall be low leak not to exceed 3 percent at 1 inch wg pressure differential and include stainless steel side seal and neoprene edge seal. Arrange dampers to close upon loss of power.
f. Provide belt driven exhaust blowers, double inlet, forward-curved centrifugal type. Provide gravity backdraft damper at fan outlet.
g. Provide fully programmable factory programmed variable frequency drive (VFD) package for each fan, driven by 4 to 20 mA signal from a differential pressure transmitter. Pressure transmitters shall measure 0 - 0.1 in wg. Install room sensor tubing with sensor tube termination installed within the room.
    1) Where direct digital controls are utilized, provide Belimo, or equal, damper actuator, complete with spring return and all controls required to make the system fully operational.
    2) Where stand-alone controls are utilized, provide Belimo, or equal, damper actuator, complete with spring return and all controls, including logic module, required to make the system fully operational.

3. Gas Flue Extensions:
    a. Provide at all locations where gas flue outlet will be within 10 feet of an adjacent building forced air inlet, or mechanical unit air intake, and where indicated on Drawings.
4. Other features, accessories, and equipment scheduled on Drawings.

U. Replenish for a period of one year without cost to the Owner all refrigerant and oil required to maintain the proper levels.

V. Owner Training: Manufacturer shall provide two initial on-site 4-hour training sessions for Owners' maintenance personnel. Manufacturer shall provide one 4-hour follow-up training session to be scheduled by Owner within one year of the date of the final initial training session. Training session agenda shall be as follows:
1. First session: Equipment.
2. Second session: Controls.
3. Follow-up session: Agenda by Owner.

2.04 HEATING AND VENTILATING UNIT

A. Provide factory assembled packaged rooftop mounted, electrically controlled heating and make-up air unit, ETL or UL listed and labeled, consisting of cabinet, supply fan, filters, and indirect-fired gas furnace. Provide all internal wiring, piping, controls and special features required prior to field startup. Design unit to conform to the following:
1. ANSI Z83.8/CSA 2.6.
2. NFPA 54.
3. ASHRAE 90.1.
4. Insulation, adhesive, and all materials exposed to airstream shall meet NFPA 90A requirements for flame spread and smoke generation.
5. Unit casing shall be capable of withstanding 1000-hour salt spray exposure per ASTM B117 (scribed specimen).
6. Roof curb shall be designed to conform to NRCA Standards.

B. Cabinet: Double-wall G90 galvanized steel panels, minimum 18 gauge, rigidly formed and supported by minimum 16 gauge galvanized steel channel base with rigging holes. Cabinet shall be fully weatherized for outdoor installation, and provided with the following:

1. Finish: Air-dried enamel.
2. Cabinet insulation: Minimum 1" thick fiberglass duct liner, complying with ASTM C 1071, Type II, applied on all unit sections.
3. Access Panels: Hinged, double-wall with cam-lock fasteners. Insulate access panels exposed to airstream equal to unit cabinet insulation. Provide access panels at furnace, fan motor, filter and control areas.
4. Provide with integral curb cap and matching roof curb. Roof curb shall be formed galvanized steel with wood nailer strip, capable of supporting entire unit weight. Provide 3 inch wide bottom flange.

C. Blower: Double width, double inlet centrifugal type fan, statically and dynamically balanced. Blower motor shall be single speed, open drip proof, and energy efficient. Motor bearings shall be permanently lubricated ball bearing or pillow block type. Blower and motor shall be vibration isolated.
1. For single-phase fan motors sized larger than 1/12 hp and smaller than 1 hp, refer to Article, Electric Motors, in Section 23 00 50, Basic HVAC Materials and Methods.
2. Drive: V-belt drive with matching fan pulley and adjustable motor sheaves and belt assembly. Linked blower belts will not be accepted.

D. Heating Section: CSA certified for use with natural gas, 80 percent minimum thermal efficiency. Heating section may be integral to blower cabinet or be provided as separate section. Provide with the following features:
1. Modulating gas valve, capable of turndown to minimum 25 percent of gas input value scheduled on Drawings.
2. Stainless steel burner assembly.
3. Combustion air vent fan: Direct drive centrifugal type.
4. Electronic discharge temperature controller. Control interface shall be LCD screen with indicating lights. Default display shall be actual discharge temperature.
5. Direct spark ignition with non-standing pilot.
6. 409 Stainless steel tubular heat exchanger with minimum 10 year warranty.
    a. Controls and Safeties: All burner controls factory wired to terminal blocks, complete with 24 V transformer. Provide the following:
        1) High temperature limit control with automatic reset.
        2) Ignition with 100 percent timed lockout.
        3) Pressure switch to lock out gas valve on failure of combustion air blower.
        4) Gas Train: Regulated, redundant, 24 V AC gas valve assembly containing pilot solenoid valve, pilot filter, pressure regulator, pilot shut off, and manual shut off.
        5) Purge-period timer shall automatically delay burner ignition and bypass low-limit control, and provide pre-purge and post-purge cycle.

E. Filter Section
1. Standard filter section shall accommodate 2 inch deep filters. Filters shall conform to the "Air Filters" Article in this Specification Section.
2. Filter section shall use standard size filters.
3. Velocity shall not exceed 550 FPM.

F. Mixing Box: Inlet air control shall allow for 100 percent OA and 100 percent return air with mixed air controller and warm-up (ASHRAE Cycle III). Standard configuration shall be bottom return with rear outside air intake. Provide galvanized outside air hood with bird screen and rain baffles. Omit outside air hood when evaporative cooling module is utilized. When economizer operation is indicated in the sequence of operations, provide dry bulb economizer controller.

G. Dampers:
1. Outdoor-Air and Return Air Damper: Galvanized steel, opposed-blade dampers with vinyl blade seals and stainless steel jamb seals.

2. Damper Operator: Direct coupled, multi-position electronic type with spring return or fully modulating electronic type as required by control sequence indicated on Drawings.

H. Downturn Plenum: Provide downturn plenum if required for vertical supply air discharge. See Drawings for unit air discharge configuration. Plenum shall be of materials, construction and finish equal to that described for unit cabinet.

I. Controls:
1. Factory-wired, fuse protected control transformer, connection for power supply and field-wired unit to remote control panel. Refer to Section 25 50 00, if included, and equipment schedule, sequence of operation and control diagram on Drawings for additional requirements.
2. When utilizing stand-alone thermostat controls: Manufacturer provided remote surface-mounted or recessed control panel shall contain potentiometer for setting minimum outside air quantity. Refer to Drawings for location and type of control panel. Remote control panel and potentiometer not required for direct digital control. Remote control panel shall have the following additional features:
   a. Switches:
      1) On-off-auto fan switch.
      2) Heat-vent-cool switch.
   b. Status lights:
      1) Supply fan operation indicating light.
      2) Blower on.
      3) Heat/main valve on.
   c. Thermostat with over-ride.
3. When utilizing direct digital control: Provide factory installed application-specific controller and damper actuators compatible with the direct digital control system. Unit manufacturer shall coordinate with controls contractor to ensure compatibility. Controller shall have the following functions:
   a. Provide start and stop interface relay, and relay to notify DDC system of alarm condition. Provide the following alarms, as a minimum:
      1) Supply fan status.
      2) Heat status.
      3) Freeze alarm.
   b. Provide hardware interface or additional sensors as follows:
      1) Room temperature.
      2) Discharge air temperature.
      3) Furnace operating.
      4) Return air temperature.
      5) Outdoor air temperature.
      6) Heater output (0-100 percent).
      7) Modulating damper output or VFD control (0-100 percent).

2.05 SPLIT SYSTEM AC UNIT

A. General: Furnish and install split system air conditioner, with R410A refrigerant, and complete with automatic controls. Equipment shall be shipped factory assembled, wired, tested, and ready for field connections.

B. Quality Assurance:
1. Unit shall be ETL or UL listed and labeled.
2. Unit shall be manufactured in a facility registered to ISO 9001:2000.
3. Unit shall be rated in accordance with ARI standard 210.

C. Delivery, Storage and Handling: Follow manufacturer’s recommendations.

D. Cooling System: The total certified cooling capacity shall not be less than scheduled. The compressor power input shall not exceed that of the unit specified.

E. Indoor Section: Wall mounted, ceiling surface mounted, or ceiling recessed mounted, as indicated on Drawings.
   1. Cabinet:
      a. Wall mounted: Molded white high strength plastic.
         1) Provide wall mounted unit with factory mounting plate.
      b. Ceiling surface mounted: Molded white high strength plastic with provision for outside air duct connection.
      c. Ceiling recessed mounted: galvanized steel with provision for outside air duct connection.
   2. Fans: Double inlet, forward curved, statically and dynamically balanced.
   3. Fan Motor: Direct drive, permanently lubricated, with two or 4 speed operation for unit size scheduled on Drawings.
      a. For single-phase fan motors sized larger than 1/12 hp and smaller than 1 hp, refer to Article, Electric Motors, in Section 23 00 50, Basic HVAC Materials and Methods.
   4. Air Outlet: With motorized horizontal and vertical vanes.
      a. Wall and ceiling surface mounted units: Horizontal vane shall close air outlet upon unit shut-down.
   5. Evaporator Coil: Aluminum fins mechanically bonded to copper tubes. Coils shall be pressure leak tested.
   6. Insulation: Interior surfaces exposed to the airstream shall be fully insulated.

F. Outdoor Section:
   1. Casing: Galvanized steel plate, powder coated with acrylic or polyester.
   2. Condenser Fan Grille: ABS plastic.
   3. Fan and fan motor: Direct drive, totally enclosed, propeller type, permanently lubricated, horizontal discharge.
   4. Compressor: Variable speed rotary type, with crankcase heater and accumulator. Compressor shall be capable of operating at 0 degrees F. Compressor mounted on vibration isolator pads.
   5. Coil: Aluminum fins mechanically bonded to copper tubes. Coils shall be pressure leak tested. Provide coil with integral metal guard.

G. Controls: Hard wired, microprocessor based, wall mounted controller with LCD display shall provide the following functions, as a minimum:
   1. 7-day programmable timer.
   2. Test and check functions.
   3. Diagnostic functions.
   4. Vane position control.
   5. Fan speed adjustment.
   6. Temperature adjustment.
   7. Automatic restart.
   8. Mode selection, including cool/dry/fan.
      a. Provide lockable enclosure for wall mounted controller.

H. Safeties: Shall include the following, as a minimum:
   1. Five minute compressor anti-recycle timer.
   2. High pressure protection.
   3. Current and temperature sensing motor overload protection.

I. Filters: Provide 1 inch thick fiberglass throwaway filters with cardboard holding frames for indoor unit. Provide sufficient filters for four complete changes for each unit.

J. Service Access: All components, wiring, and inspection areas shall be completely accessible through removable panels.

K. Refrigerant Piping:
1. Provide factory pre-charged and sealed line set piping, length to suit the location of equipment. Tubing sizes shall be in accordance with manufacturers written instructions.
2. Provide refrigeration piping in accordance with Article, Refrigerant Piping, in this Section.

L. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:
1. Mitsubishi Electric Corporation.
2. Carrier Corporation.
3. Sanyo Electric Co., Ltd.

M. Owner Training: Manufacturer shall provide one on-site 2-hour training session for Owners' maintenance personnel.

2.06 AIR COOLED CONDENSING UNIT

A. Provide outdoor-mounted, factory assembled, single piece, air-cooled, split-system air conditioner unit suitable for ground or rooftop installation, rated in accordance with ARI Standard 210, and UL or ETL listed and labeled. Provide refrigerant charge R-410A, all internal wiring, piping, controls, compressor, and special features required prior to field start-up. Design unit to conform to the following:
1. ANSI/ASHRAE latest edition.
2. NEC latest edition.
3. Unit cabinet to be capable of withstanding Federal Test Method Standard No. 141 (Method 6061) 500-hr salt spray test.
4. Unit shall be constructed in accordance with UL standards.

B. Unit shall be certified for capacity and efficiency, and listed in the latest ARI directory.

C. Unit shall be manufactured in a facility registered to ISO 9001:2000.

D. Unit shall be Energy Star Qualified.

E. Provide unit with 5 year limited parts warranty.

F. Cabinet:
1. Unit cabinet constructed of galvanized steel, bonderized, and coated with powder coat paint.

G. Fans:
1. Direct-drive propeller type condenser fan, discharging air vertically.
2. Totally enclosed condenser fan motors, 1-phase type with Class B insulation and permanently lubricated bearings, and corrosion resistant shafts.
3. Condenser fan openings equipped with PVC-coated steel wire safety guards.
4. Statically and dynamically balanced fan blades.

H. Compressor:
1. Hermetically sealed compressor mounted on rubber vibration isolators.
2. Compressor with sound insulator.
3. Provide unit with 5 year limited compressor warranty.

I. Refrigeration Components:

1. Refrigerant circuit to include liquid and vapor line shut-off valves with sweat connections.
2. System charge of R-410A refrigerant and compressor oil.
3. Unit to be equipped with factory-supplied high-pressure switch, low pressure switch, and filter drier.
4. Provide unit with manufacturer's refrigerant line set.
5. Provide refrigeration piping in accordance with Article, Refrigerant Piping, in this Section.

J. Condenser Coil:
1. Air-cooled condenser coil constructed of aluminum fins mechanically bonded to copper tubes.
2. Coils shall be leak and pressure tested.

K. Electrical Requirements:
1. Unit shall have single point power connection.
2. Provide unit with 24V control circuit.

L. Operating Characteristics:
1. Unit shall be capable of starting and running a 115 degrees F ambient outdoor temperature per maximum load criteria of ARI Standard 210.
2. Compressor with standard controls shall be capable of operation down to 55 degrees F ambient outdoor temperature.

M. Provide the following additional components and features:
1. Provide evaporator freeze thermostat, winter start control, compressor start assist capacitor and relay, low ambient controller, and ball bearing fan motor.
2. Provide expanded metal coil guard for all sides of the air cooled condensing unit. Coil guard shall be as manufactured by MicroMetl, Can-Fab, or equal.

N. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:
1. Carrier Corporation.
2. Trane Inc.

O. Owner Training: Manufacturer shall provide one on-site 1-hour training sessions for Owners' maintenance personnel.

2.07 COOLING COIL

A. Provide direct expansion encased cooling coil.
1. Install encased coil to operate properly in vertical or horizontal position as required. Construct coil with aluminum plate fins mechanically bonded in non-ferrous tubing with all joints brazed ultrasonically. Coil shall have factory-installed refrigerant metering device, refrigerant line fittings which permit mechanical connections, and condensate pan with primary and auxiliary drain connections.
2. Construct casings of galvanneal steel, bonderize, insulate, and finish with baked enamel.

2.08 REFRIGERATION PIPE AND FITTINGS

A. Refrigeration gas and liquid piping shall be type ACR hard drawn copper tubing, cleaned and capped in accordance with ASTM B280, with wrought copper fittings. All joints shall be brazed with Sil-fos under nitrogen purge. Relief valve discharge piping shall be full size of relief discharge port.
1. Manufactured, pre-charged and pre-insulated refrigerant line-set refrigerant piping may be utilized at Contractor's discretion.

a. VRF Systems: Use of manufactured, pre-charged and pre-insulated refrigerant line-set refrigerant piping between outdoor condensing units and indoor heat recovery controllers, or distribution headers and tees is not allowed. When system manufacturer's installation instructions allow use of refrigerant line-set piping between indoor heat recovery controllers, or distribution headers and tees, and air terminal devices, follow instructions for allowable pipe size range and support to avoid forming traps in the piping.

B. Refrigeration Piping Specialties: Furnish and install Superior, Sporlan, Alco, Henry, or equal, stop valves, solenoid valves, adjustable thermal expansion valves, sight glass, flexible connection, charging valve, and drier with valve bypass in the liquid lines and Superior DFN shell and cartridge suction line filter sized 2-1/2 times tonnage.
1. Install only those refrigeration piping specialties recommended by manufacturer of specific installed equipment.

2.09 REFRIGERANT ACCESS VALVE LOCKING CAPS

A. Each refrigerant circuit access valve located outside buildings, including valves located on roofs, shall be provided with a locking cap. Caps shall be of metal construction, with threaded brass inserts. Caps shall be color-coded according to ASHRAE standards for R22 and R410A refrigerant gasses, universal color for other refrigerant gasses. Caps shall be removable only with cap manufacturer's handheld tool.
1. Provide minimum of two (2) cap removal tools for every ten (10) air conditioning units or other systems containing refrigerant installed under this Project.

2.10 FANS

A. All fans shall be Air Moving and Control Association Inc. (AMCA) labeled.

B. Provide self-aligning, enclosed ball bearings, accessible for lubrication unless specified otherwise.

C. Provide variable speed switch for all direct drive fans.

D. Roof Mounted:
1. Direct or V-belt Drive: Provide one-piece heavy-duty ventilator housings, one piece heavy gauge spun aluminum construction, with weatherproof assembly and integral weather shield. Mount ventilators on curbs furnished by the fan manufacturer. Install with fan assembly level.
2. Fan wheels shall be centrifugal design, statically and dynamically balanced. Tip speed, rpm and motor horsepower shall not exceed listing in manufacturer's catalog for unit specified.
3. Fans shall have integral factory formed base and one piece spinning without welding. Housings shall be provided with wiring channel and are to be of the direct discharge design. Motor and fan assembly shall be on vibration isolating mounts. Fans shall have capacity, speeds and motor sizes as shown.
4. Provide the following accessories:
a. Gravity backdraft dampers.
b. Aluminum bird screen with a minimum of 85 percent free area.
c. Adjustable motor pulley.

E. In-Line Centrifugal Fans:
1. Centrifugal fan with airfoil blades, aluminum or steel housing, externally mounted belt-drive motor, external lube tubes, integral support brackets.

2. Provide sloped roof or flat roof type roof cap, or wall cap to suit the location indicated on the Drawings.

F. Ceiling Mounted Fans:
1. Acoustic lined cabinet, built-in back draft damper, vibration isolated fan and motor, variable speed switch.
2. Provide sloped roof or flat roof type roof cap, or wall cap to suit the location indicated on the Drawings.

G. Fan Drives:
1. Drive Design: The design horsepower rating of each drive shall be at least 1.5 times, single belt drives 2 times, the nameplate rating of the motor with proper allowances for sheave diameters, speed ratio, arcs of contact and belt length.
2. Provide variable speed drives, Dayco, Browning, Woods, or equal. Allow for replacement of fan and motor drives and belts as required to suit the balance requirements of the project.
3. Select variable speed drives to allow an increase or decrease of minimum of ten percent of design fan speed.

H. Motors:
1. Motors of 25 HP and less shall have adjustable pitch sheaves; sheaves on motors above 25 HP may be non-adjustable. Change, at no extra cost to Owner, the non-adjustable sheaves to obtain desired air quantities.
2. For single-phase fan motors sized larger than 1/12 hp and smaller than 1 hp, refer to Article, Electric Motors, in Section 23 00 50, Basic HVAC Materials and Methods.

I. Sheaves: Sheaves shall be cast or fabricated, bored to size or bushed with fully split tapered bushings to fit properly on the shafts. All sheaves shall be secured with keys and set screws.

J. Belts:
1. All belts shall be furnished in matched sets.
2. Provide a minimum of two belts for all drives with motors 5 horsepower motors and larger.
3. Belts shall be within 1 degree 30 minutes of true alignment in all cases.

K. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:
1. Greenheck Fan Corporation.
2. Loren Cook Company.
3. PennBarry.
4. American Coolair Corporation.

L. Owner Training: Manufacturer shall provide one on-site 1-hour training session for Owners' maintenance personnel.

2.11 RELIEF AND INTAKE VENTS

A. Galvanized steel housing with 1/2 inch mesh screen, counterbalanced backdraft damper and matching prefabricated curb. Omit backdraft damper on intake vents. Provide pitched roof curb for relief vents, and install with backdraft damper level.

B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:
1. Greenheck Fan Corporation.
2. Lauren Cook Company.
3. PennBarry.
4. American Coolair Corporation.

2.12 LOUVERS

A. Louvers shall be minimum 16 gauge steel with Bonderite and Epon gray primer and 1/2 inch square mesh, 16 gauge galvanized steel screen on the inside. Louvers shall be Airolite #609, Arrow United Industries, or equal, with 4 inch louver depth.

2.13 AIR INLETS AND OUTLETS

A. Except as otherwise indicated, provide manufacturer's standard outlets and inlets where shown; of size, shape, capacity and type indicated; constructed of materials and components as indicated, and as required for complete installation.

B. Ceiling, wall or floor Compatibility: Provide outlets with border styles that are compatible with adjacent ceiling, wall or floor systems, and that are specifically manufactured to fit into ceiling, wall or floor module with accurate fit and adequate support. Refer to general construction drawings and specifications for types of ceiling systems that will contain each type of air outlet and inlet.

C. Refer to Schedule on Mechanical Drawings for details of inlets and outlets to be used.

2.14 AIR FILTERS

A. Provide MERV 8 disposable pleated media type. Refer to specific equipment Articles for filter depth and for exceptions to this specification. Filters shall conform to the following:
   1. Standards:
      a. ASHRAE Standard 52.2-2007.
      b. Underwriters Laboratories: U.L. 900, Class 2.
   2. Construction:
      a. Media: Synthetic or cotton-synthetic blend with radial pleats.
      b. Media Frame: High wet-strength beverage board.
      c. Media Support: Welded wire or expanded metal grid bonded to air leaving side of the media.
   3. Performance: 2” deep filter shall have a maximum initial air resistance of 0.31 inches w.g.

B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:
   1. Camfil Farr, Inc., model 30/30.
   2. Flanders Corporation, model 40 LPD.

C. Temporary (Construction Period) Filters:
   1. Install new temporary filters in all units that have filter systems installed. Temporary filters shall match the permanent filters that are specified for the units. Replace filters as needed, in accordance with manufacturer’s directions, in order to provide protection for the unit prior to occupancy by the Owner.
   2. If air handling units are operated during construction of the project, install temporary filters directly over each return air inlet. Filters shall match the permanent filters that are specified for the units. Select size of filter to completely cover the frame of the return air inlet, and tape filters firmly in place to eliminate any construction debris from entering the duct system or unit. Remove the temporary filters upon completion of the work, and repair all damaged paintwork.

D. Spare Filters:
   1. Furnish two new, complete sets of filter cartridges for each filter bank on completion and acceptance of the work. Install one set of filters in units (prior to final air balance) and leave

the remaining filters in location designated by the Owner. Provide units designed to accommodate washable, permanent filters with one washable, permanent filter.

2.15 DAMPERS

A. Backdraft Dampers: Ruskin CBD2, counterbalanced, Nailer Industries, or equal.

B. Manual Air and Balance Dampers: Provide dampers of single blade type or multi-blade type constructed in accordance with SMACNA, "HVAC Duct Construction Standards," except as noted herein.
   1. Rectangular Ductwork:
      a. Single damper blades may be used in ducts up to 10 inches in height. Dampers shall be 16 gauge minimum. Provide self-locking regulators, equal to Ventlok 641. Provide end bearings equal to Ventlok 607 at each damper. Provide continuous solid 3/8 inch square shafts.
      b. Multiple blade dampers shall be equal to Ruskin CD35 Standard Control Damper. Maximum width for multiple damper blades for use in rectangular duct shall not exceed 6 inches.
      c. Where duct velocity may be expected to exceed 1500 fpm, provide Ruskin CD-50, or equal, low leakage dampers with airfoil blades.
   2. Round Ductwork:
      a. Single damper blades may be used in ducts up to 12 inches in diameter. Provide multiple blade opposed blade dampers, with connected linkage, for ductwork larger than 12 inches in diameter.
      b. Damper blades for round ductwork shall be 20 gauge steel for ducts up to 12 inches diameter and 16 gauge steel for dampers larger than 12 inches damper. Provide self-locking regulators, equal to Ventlok 641, Durodyne, or equal for operation of dampers. Provide end bearings equal to Ventlok 607 and provide continuous solid 3/8 inch square shafts.
   3. Where ductwork is externally insulated, provide self-locking regulators equal to Ventlok 644, Durodyne, or equal for rectangular ductwork, and Ventlok 637, Durodyne, or equal for round ducts.

C. Fire Dampers and Combination Fire/Smoke Dampers:
   1. Fire dampers and combination fire/smoke dampers shall be listed and approved by the California State Fire Marshal. Installation shall conform to the manufacturer’s UL approved installation instructions.
      a. Combination fire/smoke dampers. Dampers shall be UL classified and labeled as Leakage Class I Smoke Dampers in accordance with the latest version of UL 555S. Dampers shall be warranted to be free from defects in material and workmanship for a period of 5 years after date of shipment. Damper/actuator assembly shall be tested to full open and full close at minimum 2000 fpm 250° F heated air and 4” w.g. with airflow in both directions. (Specified select: 250° / 350°, 2000 fpm/3000 fpm). Each damper shall be equipped with “controlled closure” quick detect heat actuated release device to prevent duct and HVAC component damage resulting from instantaneous damper closure. Release device shall be EFL type and shall allow reset from outside the sleeve after moderate temperature exposure. (Replacement type fusible links not acceptable.)
      b. Two position combination fire smoke dampers shall be equipped with one or more factory installed, direct coupled, 120 volt, single phase, electric actuator for energize open – fail close operation. Dampers with multiple actuators shall be factory wired with single point connection at the EFL heat release devise for connection to poser. Damper actuator shall include minimum one-year energized hold open (no cycles) and spring return (fail) close reliability. Damper/actuator shall include minimum 20,000 full open-full close cycle performances.

c. Modulating combination fire smoke dampers shall be equipped with one or more factory installed contact for modulating signal connection. Damper/actuator shall include minimum 100,000 full open-full close cycle performances with spring return (fail) close on loss of power.

d. Round combination fire smoke dampers up to 24" diameter shall be true round type with minimum 20 gauge galvanized steel designed for lowest pressure drop and noise performance. Bearings shall be stainless steel sleeve turning in an extruded hole in the frame. Blade seals shall be silicone edge designed to withstand 450° F and galvanized steel mechanically locked in to the blade edge (adhesive type seals are not acceptable). Each damper shall be equipped with a factory-installed sleeve of 17 inches minimum length and factory "roll formed" one-piece angles with pre-punched holes. Dampers shall be Ruskin FSDR25, Pottorff, or equal.

e. Round (larger than 24" diameter) or rectangular combination fire smoke dampers shall include roll-formed structural hat channel frame, reinforced at the corners, formed from a single piece of minimum 16 gauge equivalent thickness formed from single piece galvanized steel. Bearings shall be stainless steel turning in an extruded hole in the frame. Blade edge seals shall be silicone rubber designed to withstand 450° F and galvanized steel mechanically locked in to the blade edge (adhesive type seals are not acceptable). Each damper shall be equipped with a factory-installed sleeve of 17" minimum length and factory "roll formed" one-piece angles with pre-punched holes for easy installation. Dampers shall be Ruskin FSD60, Pottorff, or equal.

f. All FSD60 type dampers shall be AMCA licensed and shall bear the AMCA Seal for Air Performance. AMCA certified testing shall verify pressure drop does not exceed .03" w.g. at a face velocity of 1,000 fpm on a 24" x 24" damper.

g. Wall type fire/smoke damper:
   1) Combination fire/smoke dampers for use in the wall of exit corridors shall be classified and labeled as Leakage Class II Smoke Dampers in accordance with the latest version of UL 555S. Dampers shall meet the requirements for combination fire/smoke dampers in paragraph 3 above except AMCA certified testing shall verify pressure drop does not exceed .07" w.g. at a face velocity of 1,000 fpm on a 24" x 24" damper and blades shall be single skin galvanized steel 10 gauge minimum with 3 longitudinal grooves for reinforcement. Dampers shall be Ruskin FSD36, Pottorff, or equal.
   2) Front access combination fire/smoke dampers shall meet all the requirements for combination fire/smoke dampers in paragraph 3 above except pressure drop requirement. In addition, the dampers shall be constructed so that actuators and all accessories are accessible from the grille side. Actuators and accessories shall be housed within an integral cabinet on the side of the damper frame and shall not be installed in the air stream in front of the damper. The damper sleeve shall be minimum 14" and flanged to accept a steel framed grille. The sleeve shall be covered with fire resistant material. Dampers shall be Ruskin FSD60FA, Pottorff, or equal.

h. Fusible links shall have temperature rating approximately 50° F above normal maximum operating temperature of the heat producing appliance.
   1) If project requires re-openable fire/smoke dampers, provide Ruskin 165 ° F / 350° F TS150, NCA or equal. The TS150 firestat replaces the EFL and allows the damper to be re-opened from remote location up to 350 ° F. TS150 shall include full open and full closed damper position contacts for interface with remote position indication panel.
   2) Each fire/smoke damper shall be equipped with "controlled closure" quick detect heat actuated release device to prevent duct and HVAC component damage. Release device shall allow easy reset after moderate temperature rise outside the sleeve. Heat release device shall be the Ruskin EFL, NCA or equal.

3) Unless the system is using a validation control system, each fire/smoke damper shall be equipped with a control panel including blade position indicator lights and a key operated switch. The panel cover shall be oversized for flush mount into the wall or ceiling and shall have a brushed look. Control panel shall be Ruskin MCP2, Pottorff, or equal.

2. All actuators used for smoke dampers or combination fire/smoke dampers shall have a cycle time requirement of not more than every twelve months and shall be rated for continuous "0n" duty and shall be provided with internal spring return. Actuators shall be equipped with pilot light, remote key test switch, end switch and circuitry to activate pilot light on remote key (test) switch located in corridor ceiling adjacent to damper. Electric motors shall be Invensys MA-250, MA-253, Honeywell H2000, or equal.

2.16 DUCTWORK

A. Construct and install all sheet metal ductwork in accordance with the California Mechanical Code for 2 inches static pressure for supply air, and 2 inches minimum for return and exhaust air unless otherwise noted on Drawings.
1. Where not in conflict with the California Mechanical Code, construct and install all sheet metal ductwork in accordance with SMACNA HVAC Duct Construction Standards (Metal and Flexible). Where applicable for HVAC work, construct and install sheet metal work in accordance with SMACNA Architectural Sheet Metal Manual.
2. Provide variations in duct size, and additional duct fittings as required to clear obstructions and maintain clearances as approved by the Architect at no extra cost to the Owner.
3. Gauges, joints and bracing shall be in accordance with the California Mechanical Code.
4. Provide beading or cross breaking for all ductwork inside building. Provide cross breaking for ductwork exposed to weather.
5. At the contractor's option, ductwork may be fabricated using the Ductmate, Nexus, Quickduct, Transverse Duct Connection (TDC), Pyramid-Loc duct connection systems, or equal. Fabricate in strict conformance with manufacturer's written installation instructions and in accordance with California Mechanical Code.
   a. Seal flanged ends with pressure sensitive high density, closed cell neoprene or polyethylene tape gasket, Thermo 440, or equal.
   b. Provide metal clips for duct connections, except at breakaway connections for fire dampers and fire smoke dampers. Provide corner clips at each corner of duct, through bolted, at all locations except at breakaway connections for fire dampers and fire smoke dampers. Where used on locations exposed to weather, provide continuous metal clip at top and sides of duct, with 1 inch overhang for top side.

B. Design and installation standards:
1. SMACNA Compliance: Comply with applicable portions of Sheet Metal and Air Conditioning Contractor's National Association (SMACNA) for all work in this section.
2. NFPA Compliance: Comply with ANSI/NFPA 90A, "Standard for the Installation of Air Conditioning and Ventilating Systems," and ANSI/NFPA 90B, "Standard for the Installation of Warm Air Heating and Air Conditioning Systems."
3. California Mechanical Code.

C. Fabricate all ductwork with sheet metal. Fiberglass ductwork will not be accepted for use on this project.

D. Duct sizes indicated are external sizes.

E. Galvanized Sheet Steel: Lock-forming quality, ASTM A924 and ASTM A653, Coating Designation G 90. Provide mill phosphatized finish for exposed surfaces of ducts exposed to view.
1. Provide mill certification for galvanized material at request of the Project Inspector.

F. Duct Sealants:
1. Sealant shall have a VOC content of 250 g/L or less.
2. Sealant shall comply with testing and product requirements of South Coast Air Quality Management District, Rule 1168.
3. Provide one part, non-sag, synthetic latex sealant, formulated with a minimum of 68 percent solids. Sealant shall comply with ASTM E84, Surface Burning Characteristics.
   a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:
      1) Design Polymerics, model DP1010.
      2) Polymer Adhesive Sealant Systems Inc, model Airseal #11.
      3) McGill Airseal, LLC.
4. Seal airtight and watertight joints and seams of ductwork exposed to weather with 6 ounce canvas bonded to ductwork with Foster 30-36 adhesive; cover canvas with heavy coat of Foster 56-10 coating, no dilution. Provide basis of design product or equal by Mon-Eco Industries, Inc., or McGill Airseal, LLC.
   a. Pressure-sensitive tapes or single part sealant not acceptable.
   b. Where seams are exposed to weather, paint seams with aluminum paint. Provide cross broken ductwork, and ensure that the ductwork will shed water. Beading of duct work exposed to weather will not be considered acceptable.

G. Provide sheet metal angle frame at all duct penetrations to wall, floor, roof, or ceiling.

H. Duct Support Materials: Except as otherwise indicated, provide hot-dipped galvanized steel fasteners, anchors, straps, trim, and angles for support of ductwork.

I. Rectangular Duct Fabrication:
1. Shop fabricate ductwork of gauges and reinforcement complying with the more stringent of the following standards, except as noted herein.
   a. SMACNA HVAC Duct Construction Standards
   b. California Mechanical Code
2. Fabricate ducts for 2 inch pressure class with minimum duct gauges and reinforcement as follows, except as otherwise noted:

Duct Dimension	Minimum Gauge	Joint Reinforcement Per CMC
Through 12"	26	Not Required
13" through 18"	24	Not Required
19" through 30"	24	C/4
31" through 42"	22	E/4
43" through 54"	22	F/2
55" through 60"	20	G/4
61" through 84"	20	I/2
85" through 96"	20	J/2
Over 96"	18	K/2

3. Fabricate duct fittings to match adjoining ducts and to comply with duct requirements as applicable to fittings. Except as otherwise indicated, fabricate elbows with center-line radius equal to 1.5 times associated duct width. Fabricate to include single thickness turning vane in elbows where space does not permit the above radius or where square elbows are shown. Limit angular tapers to 30 degrees for contracting tapers and 20 degrees for expanding tapers. Turning vanes shall be E-Z Rail II, Durodyne, or equal.
4. Fabricate round supply connections at rectangular, plenum type fittings using spin-in type fittings, complete with extractor and volume control damper. Refer to Paragraph "DAMPERS" for damper requirements.
5. Provide drive slip or equivalent flat seams for ducts exposed in the conditioned space or where necessary due to space limitations. On ducts with flat seams, provide standard reinforcing on inside of duct. Duct connection to outlet on exposed duct shall be full size of outer perimeter of outlet flange.
6. Ducts exposed in the conditioned space shall be free of dents and blemishes and be mounted tight against adjacent surface with flat hangers. Remove all fabrication labels from ductwork.
7. Provide 20 gauge minimum for ductwork exposed within occupied spaces.

J. Rectangular Internally Insulated Duct Fabrication:
1. Provide internal duct lining where indicated on the Drawings, with a minimum of 10'-0" length in each direction from the fan, fan casing, or unit casing. Line all transfer ducts.
   a. Where ductwork is exposed to weather or outside the building insulation envelope, provide 2 inch thick, 1-1/2 pound density internal lining with matte facing, with an R-Value of 8.0 minimum.
   b. Where ductwork is within the building insulation envelope, lining shall be 1" thick, 1-1/2 pound density, with R-value of 4.2 minimum.
   c. Ducts exposed in the conditioned space shall be free of dents and blemishes and be mounted tight against adjacent surface with flat hangers. Remove all fabrication labels from ductwork.
   d. Where installed exposed in the conditioned space, duct shall be minimum 20 gauge with 1 inch insulation layer (minimum R-value – R-4.2).
   e. Cement duct liner in place with nonflammable, non-hardening duct adhesive. Seal all raw edges of insulation inside ductwork with adhesive, including longitudinal liner edges.
   f. Provide metal nosing at all locations where liner is preceded by unlined metal.
   g. Provide sheet metal weld pins and washers or clinch pins and washers on all ductwork on 12 inch intervals with the first row within 3 inches of the leading edge of each piece of insulation and within 4 inches of corners. No use of adhesive mounted pins will be considered.
      1) Install clinched pin fasteners with properly adjusted automatic fastening equipment. Manual installation will not be considered.
      2) Install weld pins with properly adjusted automatic fastening equipment. Installation shall not damage the galvanized coating on the outside of the duct.
   h. All ductwork, adhesives, lining, sealant, flex duct and the like shall have a flame spread of 25 or less and developed smoke rating of 50 or less when tested in accordance with one of the following test methods: NFPA 255, ASTM E84, or UL 723.
   i. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

Manufacturer:	Product:
Johns Manville	Duct Liner PM

Manufacturer:	Product:
CertainTeed Corporation	ToughGard
Fosters Adhesive	85-62
Swifts Adhesive	7336

K. Round and Oval Ductwork Fabrication:
1. Round and oval duct and fittings shall be spiral lockseam or longitudinal seam as indicated in table below. Provide couplings to join each length of duct.
   a. At contractors' option, round or oval ductwork may be utilized in place of rectangular ductwork shown on Drawings, provided available space allows installation of round or oval ductwork without compromising space required for installation of products and systems of other trades.
      1) Round or oval ductwork utilized in place of rectangular ductwork shown on Drawings shall be sized to have a static pressure loss equivalent to rectangular duct shown on Drawings.
      2) Unlined round or oval duct shall not be utilized in place of rectangular internally lined ductwork shown on Drawings.
2. Fabricate duct fittings to match adjoining ducts and to comply with duct requirements as applicable to fittings. Except as otherwise indicated, fabricate elbows with center-line radius equal to 1.5 times associated duct width. Provide two-piece, die-stamped, 45-degree to 90-degree elbows for sizes up to 12 inches; five-piece, 90-degree elbows for sizes 12 inches and above; conical tees; and conical laterals. All reducers shall be placed after a tap has been made on the duct main. Reducers shall be long-taper style.
3. Round Ductwork: Construct of galvanized sheet steel complying with ANSI/ASTM A 653 by the following methods and in minimum gauges listed.

Diameter	Minimum Gauge	Method of Manufacture
Up to 14"	26	Spiral Lockseam
15" to 23"	24	Spiral Lockseam
24" to 36"	22	Spiral Lockseam
37" to 50"	20	Spiral Lockseam
51" to 60"	18	Spiral Lockseam
Over 60"	14	Longitudinal Seam

4. Provide locked seams for spiral duct; fusion welded butt seam for longitudinal seam duct.
5. Fittings and Couplings: Construct of minimum gauges listed. Provide continuous welds along seams at exposed ducts. Provide spot weld bonded seams at concealed ducts.

Diameter	Minimum Gauge
3" to 36"	20
38" to 50"	18

Diameter	Minimum Gauge
Over 50"	16

6. Ducts exposed in the conditioned space shall be free of dents and blemishes and be mounted tight against adjacent surface with flat hangers. Remove all fabrication labels from ductwork.
7. Provide 20 gauge minimum for ductwork exposed within occupied spaces.

L. Round Internally Insulated Duct and Fittings: Where ductwork is exposed to weather or outside the building insulation envelope, construct with outer pressure shell, 2 inch thick (Minimum R-value = R-8) insulation layer, and perforated inner liner. Where ductwork is within the building insulation envelope, construct with outer pressure shell, 1 inch thick (minimum R-value = R4.2) insulation layer, and perforated inner liner. Construct shell and liner of galvanized sheet steel complying with ANSI/ASTM A 653, of spiral lockseam construction (use longitudinal seam for over 59 inches), in minimum gauges listed in table below. Where installed exposed in the conditioned space: duct and fitting outer pressure shell shall be minimum 20 gauge with 1 inch insulation layer (minimum R-value = R-4.2), and perforated inner liner.

Nominal Duct Diameter	Outer Shell	Inner Liner
3" TO 12"	26 gauge	24 gauge
13" TO 24"	24 gauge	24 gauge
25" to 34"	22 gauge	24 gauge
35" to 48"	20 gauge	24 gauge
49" to 58"	18 gauge	24 gauge
Over 59"	16 gauge	20 gauge

1. Fittings and Couplings: Construct of minimum gauges listed. Provide continuous weld along seams of outer shell at exposed ducts. Provide spot weld bonded seams at concealed ducts.

Nominal Duct Diameter	Outer Shell	Inner Liner
3" to 34"	20 gauge	24 gauge
36" to 48"	18 gauge	24 gauge
Over 48"	16 gauge	24 gauge

2. Inner Liner: Perforate with 3/32 inch holes for 22 percent open area. Provide metal spacers welded in position to maintain spacing and concentricity.
3. Ducts exposed in the conditioned space shall be free of dents and blemishes and be mounted tight against adjacent surface with flat hangers. Remove all fabrication labels from ductwork.
4. Where installed exposed in the conditioned space, duct shall be minimum 20 gauge with 1 inch insulation layer (minimum R-value – R-4.2).

5. All ductwork, adhesives, lining, sealant, flex duct and the like shall have a flame spread of 25 or less and developed smoke rating of 50 or less when tested in accordance with one of the following test methods: NFPA 255, ASTM E84, or UL 723.
6. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:
   a. Sheet Metal Div., McGill AirFlow, LLC., Acousti-k27
   b. Semco Duct and Acoustical Products, Inc.
   c. Air Systems Manufacturing, Inc. - Las Vegas

M. Duct Access Doors:
1. Duct Access: Provide hinged access door in rectangular ducts for access to fire dampers, control equipment, etc. Access door size shall be duct diameter wide by duct diameter high for all ducts under 24 inches. Ducts over 24 inches in diameter shall have 24-inch by 18-inch access doors. Minimum size access doors shall be 6 inches by 6 inches.
2. Provide hinged style access doors for round ductwork, NCA Manufacturing, Inc., Model AD-RD-87, Pottorff Series 60, or equal. Access doors shall be 16 gauge galvanized steel with continuous piano hinge. Locks shall be plated steel strike and catch. Provide 1" x 3/8" Polyethylene "Perma Stik" gasket all around door.

N. Flexible Air Ducts:
1. Provide exterior reinforced laminated vapor barrier, fiberglass insulation, encapsulated spring steel wire Helix, and impervious, smooth, non-perforated interior vinyl liner. Individual lengths of flexible ducts shall contain factory fabricated steel connection collars.
   a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:
      1) C.A. Schroeder, Inc., Cal Flex model 2PMJ.
      2) ThermaFlex model M KC.
2. Factory made air ducts shall be approved for the use intended and shall conform to the requirements of UL 181 and NFPA 90A. Each portion of a factory-made air duct system shall be identified by the manufacturer with a label or other suitable identification indicating compliance with UL 181, Class 1. Ducts shall be UL listed Class 1, maximum 25/50 smoke and flame spread and shall be installed in accordance with the terms of their listing and the requirements of SMACNA HVAC Duct Construction Standards (Metal and Flexible). Factory-made air ducts shall have the following minimum R-values: R-6.0 for ductwork installed within the building insulation envelope, R-8.0 for ductwork installed outside the building insulation envelope.
3. Flexible ductwork shall be maximum of 5 feet long, and shall be extended to the fullest possible length, in order to minimize pressure drop in the duct.
4. Flexible ducts shall be selected for minimum of 6 inch positive static pressure and minimum of 1 inch negative static pressure.
5. Duct Access Panels:
   a. Provide duct access panel assembly of the same material and gauge used for the duct. Duct access panels shall conform to the following:
      1) Fasteners: Black steel or stainless steel to match material used for the duct. Panel fasteners shall not penetrate duct wall.
      2) Gasket: Comply with NFPA 96, grease-tight, high temperature ceramic fiber, rated for minimum 1500 °F.

O. Type 1 Clothes Dryer Exhaust Ducts: Provide aluminum duct and fittings in wall and ceiling as indicated on Drawings.

P. Type 2 Clothes Dryer Exhaust Ducts:
1. Fabricate ducts and supports of 18 gauge minimum, Type 304, stainless steel. All duct seams and joints shall be welded. Finish exposed stainless steel with Number 4 finish.

Q. Shower exhaust ducts: Provide ducts and supports from stainless steel for a length of 20 feet from exhaust grille or register.

R. Provide Ventlon, or equal, flexible connections on inlet and outlet of AC Unit, air handler and exhaust fans. Provide galvanized weather hood over flexible connections exposed to the weather.

2.17 TEMPERATURE CONTROL SYSTEM

A. Refer to Section 25 50 00, Automation Facility Controls

PART 3 - EXECUTION

3.01 ROOF MOUNTED EQUIPMENT

A. Mount and anchor equipment in strict compliance with Drawings details. Alternate anchorage methods will not be considered for roof mounted equipment.

B. Examine rough-in for roof mounted equipment to verify actual locations of piping and duct connections prior to final equipment installation.

C. Verify that piping to be installed adjacent to roof mounted equipment allows service and maintenance.

D. Verify that gas piping will be installed with sufficient clearance for burner removal and service.

E. Install gas flue extensions. Attach gas flue extensions to unit according to unit manufacturers' installation instructions. Terminate gas flue extensions with lowest discharge opening at height compliant with requirements of California Mechanical Code, based on final unit location.

F. Install ducts to termination at top of roof curb and install heavy duty rubber gaskets on supply and return openings and on full perimeter of curb, or as required for an airtight installation, prior to setting unit on curb.

G. Cover roof inside each roof mounted air conditioning unit, heat pump unit, and heating and ventilating unit roof curb with 2 inch thick, 3 pound density fiberglass insulation board.

H. Connect supply and return air ducts to horizontal discharge roof mounted equipment with flexible duct connectors specified elsewhere in these Specifications.

I. Remove roof decking only as required for passage of ducts. Do not cut out decking under entire roof curb.

3.02 INSTALLATION OF SPLIT SYSTEM AC, HEAT PUMP, AND VRF SYSTEMS

A. General:
1. Install units level and plumb.
2. Install evaporator-fan components as detailed on Drawings.
3. Install ground or roof- mounted condensing units as detailed on Drawings.
4. Install seismic restraints as required by applicable codes. Refer to Article, Submittals, in Section 23 00 50, Basic HVAC Materials and Methods, for delegated design requirements for seismic restraints.
5. Install and connect refrigerant piping as detailed in unit manufacturers' literature. Install piping to allow access to unit.

6. Install cooling coil condensate primary drain pan piping, and overflow, if provided, and run to nearest code-compliant receptacle, or as indicated on Drawings. Install secondary drain pan for units installed over permanent and suspended-tile ceilings. Install secondary drain pan piping and terminate 1/2 inch below ceiling, with escutcheon, in a readily visible location or as shown on Drawings.
7. Install air filters at each indoor unit. Install washable, permanent filters at indoor units designed to accept washable, permanent filters. Refer to Drawings schedule, and Article, Air Filters, in this Section, for filter requirements for ducted, above-ceiling units incorporating mixing boxes.
8. Duct Connections: Duct installation requirements are specified in Article, Ductwork, in this Section. Drawings indicate the general arrangement of ducts. Connect supply and return ducts to split-system air-conditioning units with flexible duct connectors. Flexible duct connectors are specified in Article, Ductwork, in this Section.

3.03 REFRIGERANT PIPING INSTALLATION

A. General:
1. Install refrigerant piping according to ASHRAE 15. Install and connect refrigerant piping as detailed in unit manufacturers' literature. Install piping to allow access to unit.
2. Install piping straight and free of kinks, restrictions or traps.
3. Install piping as short and direct as possible, with a minimum number of joints, elbows, and fittings.
4. Slope horizontal suction piping 1 inch/10 feet towards compressor.
5. Install fittings for changes in direction and branch connections.
6. Piping under raised floors shall be kept 6 inches minimum above ground; excavate as necessary.
7. Install locking caps on refrigerant access valves located outside building, including valves located on roofs.
8. Insulate refrigerant piping, including liquid and hot gas pipes when required by system manufacturer, and including headers, branches, and other components as detailed in unit manufacturers' literature. Refer to Article, Insulation Work, in Section 23 00 50, Basic HVAC Materials and Methods.

B. Factory Pre-charged and sealed line set piping:
1. Keep the entire system clean and dry during installation.
2. All tubing shall be evacuated and sealed at the factory. The seal must not be broken until ready for assembly.
3. If there is any evidence of dust, moisture, or corrosion, the tubing must be cleaned out by drawing a swab soaked with methyl alcohol through the tubing as many times as necessary to thoroughly clean the tubing.
4. Where line set piping is used, enclose in iron or steel piping and fittings or in EMT conduit.

C. Field Assembled Refrigerant Piping:
1. Select system components with pressure rating equal to or greater than system operating pressure.
2. Where subject to mechanical injury, enclose refrigerant piping in EMT conduit.
3. When brazing, remove solenoid valve coils and sight glasses, also remove valve stems, seats, and packing, and accessible internal parts of refrigerant specialties. Do not apply heat near expansion-valve bulb.

3.04 INSTALLATION OF FANS

A. Ceiling Mounted Fans: Mount variable speed switch within fan housing. Mark final balance point on variable speed switch.

B. Provide access doors for fans or motors mounted in ductwork.

C. Mount all fans as detailed on Drawings and in compliance with CBC standards.

D. Fan motors mounted in air-stream to be totally enclosed.

E. Completely line supply, return or exhaust fan cabinets with 1 inch thick, 3/4 pound density acoustic insulation securely cemented in place.

F. Roof fans shall be mounted level.

G. Provide heavy-duty rubber gasket between exhaust fan mounting flange and roof curb, or as required for an airtight installation.

3.05 RELIEF VENTS

A. Install relief vents to provide a level mounting for backdraft damper.

3.06 AIR INLETS AND OUTLETS

A. Provide all air inlets and outlets with gaskets and install so that there will be no streaking of the walls or ceilings due to leakage. Duct connection to outlet on exposed duct shall be full size of outer perimeter of outlet flange.

B. Unless otherwise indicated on Drawings, provide rectangular plenum on top of each diffuser and ceiling return for connection to ductwork. Line plenum with internal insulation as indicated for lined ductwork. Size plenum to allow full opening into air terminal.

C. Ceiling-mounted air terminals or services installed in T-Bar type ceiling systems shall be positively attached to the ceiling suspension main runners or to cross runners with the same carrying capacity as the main runners.
   1. Terminals or services weighing not more than 56 pounds shall have two No. 12 gauge hangers connected from the terminal or service to the structure above. These wires may be slack.
   2. Support terminals or services weighing more than 56 pounds directly from the structure above by approved hangers. Provide 4 taut 12 gauge wires each, attached to the fixture and to the structure above. The 4 taut 12 gauge wires, including their attachment to the structure above must be capable of supporting 4 times the weight of the unit.
   3. Secure air inlets and outlets to main runners of ceiling suspension system with two #8 sheet metal screws at opposing corners.

D. Furnish all air inlets and outlets with a baked prime coat unless otherwise noted. Provide off-white baked enamel finish on ceiling-mounted air inlets and outlets. Paint exposed mounting screws to match the material being secured.

E. Air inlets and outlets shall match all qualities of these specified including appearance, throw, noise level, adjustability, etc.

3.07 FILTERS

A. Mount filters in airtight frames furnished by the filter manufacturer, and install in accordance with manufacturer's recommendations.

B. Air filters shall be accessible for cleaning or replacement.

C. Identify each filter access door with 1/2 inch high minimum stenciled letters.

D. Provide temporary filters for all fans that are operated during construction; after all construction dirt has been removed from the building install new filters at no additional cost to the Owner. In addition to temporary filters at filter location, provide temporary filters on all duct openings which will operate under a negative pressure.
   1. Filters used for temporary operation shall be the same as permanent filters for the application. Filters used for duct openings may be 1 inch thick pleated media disposable type.

3.08 DAMPERS

A. All dampers automatically controlled by damper motors are specified under "Temperature Control System" except those specified with items of equipment.

B. Provide opposed blade manual air dampers at each branch duct connection and at locations indicated on the drawings and where necessary to control air flow for balancing system. Provide an opposed blade balancing damper in each zone supply duct. Provide an access panel or Ventlok flush type damper regulator on ceiling or wall for each concealed damper.

C. Install fusible link fire dampers full size of duct at points where shown or required.

D. Provide 18 inch x 12 inch minimum hinged access doors in ductwork and furring for easy access to each fire damper; insulated access doors in insulated ducts. Label access doors with 1/2 inch high red letters.
   1. Provide Ventlok Series 100, Durodyne, or equal access doors with hardware for convenient access to all automatic dampers and other components of the system, insulated type in insulated ducts. Provide Ventlok #202 for light duty up to 2 inch thick doors, #260 heavy-duty up to 2 inch thick doors and #310 heavy-duty for greater than 2 inch thick doors. Provide #260 hinges on all hinged and personnel access doors; include gasketing.

3.09 INSTALLATION OF DUCTWORK

A. Assemble and install ductwork in accordance with recognized industry practices which will achieve air tight and noiseless (no objectionable noise) systems capable of performing each indicated service. Install each run with minimum of joints. Align ductwork accurately at connections within 1/8 inch misalignment tolerance and with internal surfaces smooth. Support ducts rigidly with suitable ties, braces, hangers, and anchors of type which will hold ducts true to shape and to prevent buckling. Where possible, install ductwork to clear construction by 1/4 inch minimum, except at air inlets and outlets. Where ductwork will not clear construction, secure duct firmly to eliminate noise in the system.

B. Duct Joints: Install duct sealers, pop rivets or sheet metal screws at each fitting and joint. Duct sealer shall be fire retardant. Sheet metal screw for joints shall be minimum #10 size galvanized.

C. Upper connection of support to wood structure shall be with wood screws or lag screws in shear fastened in the upper one half of the wood structural member. Fasteners shall conform to the following schedule:

For ducts with P/2=30"	#10 x 1-1/2" wood screw
For ducts with P/2=72"	1/4"x 1-1/2" lag screw
For ducts with P/2 over 73"	3/8"x 1-1/2" lag screw

D. Upper connection in tension to wood shall not be used unless absolutely necessary. Where deemed necessary the contractor shall submit calculations to show the size fastener and

penetration required to support loads in tension from wood in accordance with the following schedule:

For ducts with P/2=30"	260 pounds per hanger
For ducts with P/2=72"	320 pounds per hanger
For ducts with P/2=96"	460 pounds per hanger
For duct with P/2 larger than 120"	NOT ALLOWED

E. Install concrete inserts for support of ductwork in coordination with formwork as required to avoid delays in work.

F. Upper connection to manufactured truss construction must comply with truss manufacturers published requirements and Structural Engineers requirements.

G. Where ducts pass through interior partitions and exterior walls, conceal space between construction opening and duct or duct plus insulation with sheet metal flanges of same gauge as duct. Overlap opening on four sides by at least 1-1/2 inches.

H. Support ductwork in manner complying with SMACNA "HVAC Duct Construction Standards," hangers and supports sections. Where special hanging of ductwork is detailed or shown on Drawings, Drawings shall be followed. Angles shall be attached to overhead construction in a manner so as to allow a minimum of 2 inches of movement in all directions with no bending or sagging of the angle.
1. Except where modified in individual paragraphs of this Section, provide hanger support with minimum 18 gauge straps, 1 inch wide. Fold duct strap over at bottom of duct.
2. Install duct supports to rectangular ducts with sheet metal screws. Provide one screw at top of duct and one screw into strap at bottom of duct.

I. Installation of Flexible Ductwork:
1. Provide flexible ducts with supports at 30 inch centers with 2 inch wide, 26 gauge steel hanger collar attached to the structure with an approved duct hanger. Installation shall minimize sharp radius turns or offsets.
   a. Supports shall be in accordance with SMACNA HVAC Duct Construction Standards (Metal and Flexible).
   b. Make bends to maintain R/W-1.5.
2. Make connections to rigid duct and units with Panduit style draw band at inner liner material, and a second draw band over the outer vapor barrier material.
3. Make connection to duct with spin-in fittings, with air scoop and balance damper.

J. Installation of Shower Exhaust Ducts:
1. Slope duct a minimum of 1 percent to drain back to the exhaust grille.

K. Paint inside of ducts, visible through grille, dull black.

L. Where ductwork is installed in finished areas of buildings that do not have ceilings, paint ductwork, support hangers, and air inlets and outlets to match adjacent architectural surfaces, or as directed by Architect.

3.10 DUCTWORK SEALING AND LEAK TESTING

A. All ductwork shall receive a Class A seal.

B. Seal airtight all joints and seams, including standing seams and manufactured joints and seams, of all supply, return and exhaust ducts except those exposed in conditioned space.

C. Leakage Classes:

Pressure Class	Leakage Class	
	Round Duct	Rectangular Duct
2"W.G. or less	8	16
4"W.G. or greater	2	4

D. All duct systems (supply, return, outside air intake, and exhaust), except those identified on compliance forms on Drawings as requiring Acceptance Testing per the requirements of the California Energy Code, shall be tested in accordance with the requirements of SMACNA's "HVAC Air Duct Leakage Test Manual." Test pressure shall be equal to the pressure class of the duct. For additional duct leak testing requirements, refer to Section 23 08 00.13, "Title 24 Commissioning of HVAC."

3.11 TEMPERATURE CONTROL SYSTEM

A. Provide thermostats where indicated on drawings. All wiring shall be in conduit. Provide all relays, transformers and the like to render the control system complete and fully operable. All control conduit to be rigid steel type.

3.12 EQUIPMENT START-UP

A. Initial start-up of the systems and pumps shall be under the direct supervision of the Contractor.

B. Equipment start-up shall not be performed until the piping systems have been flushed and treated and the initial water flow balance has been completed.

C. It shall be the responsibility of the Contractor to assemble and supervise a start-up team consisting of controls contractor, start-up technician, and test and balance contractor; all to work in concert to assure that the systems are started, balanced, and operate in accordance with the design.

D. After start-up is complete, instruct the Owner's personnel in the operation and maintenance of the systems. Obtain from the Owner's representative a signed memo certifying that instruction has been received.

E. For additional requirements, refer to article, Check, Test and Start Requirements, in Section 23 00 50, Basic HVAC Materials and Methods.

3.13 TESTING AND BALANCING

A. For testing and balancing requirements, refer to Section 23 05 93, Testing and Balancing for HVAC.

3.14 CLEANING AND PROTECTION

A. As each duct section is installed, clean interior of ductwork of dust and debris. Clean external surfaces of foreign substances that might cause corrosive deterioration of metal or where ductwork is to be painted.

B. Strip protective paper from stainless steel ductwork surfaces, and repair finish wherever it has been damaged.

C. Temporary Closure: At ends of ducts that are not connected to equipment or air distribution devices at time of ductwork installation, provide temporary closure of polyethylene film or other covering that will prevent entrance of dust and debris until connections are to be completed.

D. As each internally lined duct section is installed, check internal lining for small cuts, tears, or abrasions. Repair all damage with fire retardant adhesive.

3.15 EQUIPMENT MOUNTING

A. Mount and anchor equipment in strict compliance with Drawings details. Alternate anchorage methods will not be considered for roof mounted equipment.

3.16 MODULATING POWER EXHAUST START UP

A. Pre-Start Up:
1. Once the power exhaust economizer is installed, remove the access doors on the exhaust cabinet.
    a. Route the 1/8” pressure tubing (provided with the economizer) from the high-pressure port on the transmitter to the occupied building space. Terminate the pressure tubing in the conditioned space at a port (field provided) shielded from drafts.
    b. Route line voltage cable from the VFD to the disconnect or unit power distribution point as required.
2. Note:
    a. Check local code requirements prior to installing the line voltage through ac package unit. A separate disconnect may be required. See power exhaust name plate for electrical ratings.

B. Start Up:
1. Use the MODULATION POWER EXHAUST START-UP REPORT (included at the end of this section) to record unit information and verification of start up checks.
    a. The power exhaust will be energized when the exhaust control contacts are closed. The contacts will not be closed until the outside air dampers start to open. Once the contacts are closed the run signal at the VFD will be enabled. Motor speed will be dependent upon the building pressure signal from the pressure transmitter.
2. Check the power exhaust installation is complete, power exhaust is level and all seams are tight.
3. Check the set screws on the blower wheel hub. Be sure they are tight and the wheel does not rub the housing.
4. Check the motor and blower pulleys. Be sure they are tight and aligned.
5. Check the belt tension. Assure there is not more than 1/2” of belt deflection.
6. Check all line and low voltage connections for loose or un-connected wires.
    a. WARNING: Hazard of Electrical Shock! Capacitors in the VFD retain their charge after the power is removed. Disconnect incoming power and wait until the voltage between terminals b+ & b- is 0 vdc before servicing the drive.
7. Verify correct voltage to the disconnect before turning on power to the power exhaust.
    a. To check out the blower, temporarily disconnect the jumper from terminals 13a to 2 on the VFD terminal strip.
    b. This will place the VFD in keypad/frequency operation.
    c. Use the arrow keys on the keypad to increase the speed to 60 Hz.
    d. If the blower is rotating the wrong direction, switch the t1 & t2 motor leads at the VFD to t2 & t1.
    e. Adjust the motor sheave for the desired blower CFM output at full speed.

f. When the blower check-out is complete, run the speed back down to 20 Hz and re-connect the jumper between terminals 13a and 2.

8. Adjust the setpoint per job requirements. The VFD will display the pressure control set point in hundredths of an inch w.g. (Example: 3.0 = .03" w.g.)
   a. Note: The initial setting at first power up will be 3.0. To adjust the set point, press the up or down arrow, pic will flash in the display then the set point will display with a dot in the upper left corner of the window. Use the up or down arrow to adjust the set point now. After 5 seconds of inactivity the VFD will revert to display mode. Use the following chart for reference.

DISPLAY	INCHES WATER GAGE
10.0	0.10"
9.0	0.09"
8.0	0.08"
7.0	0.07"
6.0	0.06"
5.0	0.05"
4.0	0.04"
3.0	0.03"
2.0	0.02"
1.0	0.01"
0.0	0.00"

   b. To see the frequency output: press mode twice, p50 will display, press the up arrow until p71 is displayed, press mode. The display now shows the frequency output. Press mode to return to the set point display.
   c. To see the transmitter output: press mode twice, p50 will display, press the up arrow until p69 is displayed, press mode. The display now shows the transmitter output signal level. 0.0=0vdc, 10.0=10vdc. Press mode to return to the set point display.
   d. For more advanced features and settings, refer to the VFD manual.
   e. Note: to change the OEM settings, parameter p48 must be set to 01 (user settings). The VFD must be in a stopped state with "---"in the display to change this parameter.

9. Notes:
   a. Power supply, provide disconnect means and circuit protection as required. See power exhaust name plate for electrical ratings. If local codes allow connecting to the HVAC unit power make sure the disconnect and incoming wiring are sized to handle the load of both the HVAC unit and the power exhaust.
   b. The exhaust contacts (ec) initiate the run/stop signal for the VFD. When the outside air dampers are fully closed the VFD is in stop mode. When the dampers start to open the VFD will go into run mode. The exhaust contacts will be either integral to the economizer controller or actuator or be a separate end switch mounted on the damper frame.

c. The VFD is factory pre-programmed to accept the 0-10 vdc signal from the differential pressure transmitter. For custom programming, first change parameter 48 to user settings. See instructions in the VFD hand book to set parameters.

d. MODULATION POWER EXHAUST START-UP REPORT

PROJECT _____
AC UNIT MODEL _____ UNIT TAG _____
POWER EXHAUST MODEL _____
POWER EXHAUST SERIAL NUMBER _____
DATE _____ TECHNICIAN _____

____ POWER EXHAUST CABINET IS INSTALLED IN AC UNIT (SEAMS ARE TIGHT, POWER EXHAUST IS LEVEL, NO GAPS)
____ ELECTRICAL CONNECTIONS ARE TIGHT
____ VERIFY BLOWER ROTATES FREELY AND WHEEL DOES NOT RUB
____ MOTOR SHEAVE, BLOWER SHEAVE AND BLOWER WHEEL SET SCREWS ARE TIGHT.
____ VERIFY PRESSURE TUBING IS RUN TO OCCUPIED SPACE
____ LOW VOLTAGE WIRING IS CONNECTED
____ LINE VOLTAGE WIRING IS CONNECTED
____ VERIFY VOLTAGE _____ L1-L2 _____ L2- L3 _____ L1-L3
_____ L1-N _____ L2-N _____ L3-N
____ VERIFY BLOWER ROTATION
____ BLOWER & VFD DATA AT 60HZ _____ CFM _____ RPM
VFD _____ L1 AMPS _____ L2 AMPS _____ L3 AMPS
MOTOR _____ T1 AMPS _____ T2 AMPS _____ T3 AMPS
MOTOR _____ BHP
____ VERIFY VFD IS OPERATING IN PI MODE
____ PRESSURE SET POINT FOR OCCUPIED SPACE

SAMPLE BLOWER SET UP LABEL TO BE PLACED ON DRIVE SIDE OF BLOWER

MOTOR SHEAVE: 1VL34X.625 BLOWER SHEAVE: AK41H BLOWER BUSHING: HX.75 BELT: A37 MOTOR SHEAVE ADJUSTMENT 2 TURNS OPEN BLOWER RPM=1167 4 TURNS OPEN BLOWER RPM=987

END OF SECTION

Section 25 05 36 – CABLE TRAY

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes steel cable trays and accessories.

1.2 SUBMITTALS

A. Product Data: Include data indicating dimensions and finishes for each type of cable tray indicated.

B. Shop Drawings: Show fabrication and installation details of cable trays, including plans, elevations, and sections of components and attachments to other construction elements. Designate components and accessories, including clamps, brackets, hanger rods, splice-plate connectors, expansion-joint assemblies, straight lengths, and fittings.

1. Seismic-Restraint Details: Signed and sealed by a qualified professional engineer, licensed in the state where Project is located, who is responsible for their preparation.

a. Design Calculations: Calculate requirements for selecting seismic restraints.
b. Detail fabrication, including anchorages and attachments to structure and to supported cable trays.

C. Field quality-control reports.

D. Operation and maintenance data.

1.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Cooper B-Line, Inc.
2. Legrand.
3. or Equal

2.2 MATERIALS AND FINISHES

A. Cable Trays, Fittings, and Accessories: Steel tray and fittings complying with NEMA 20A, Pre-galvanized zinc ASTM A653SS. Hardware and accessories electrogalvanized zinc ASTM B633.

B. Sizes and Configurations: Refer to the Cable Tray Schedule on Drawings for specific requirements for types, materials, sizes, and configurations.

1. Center-hanger supports may not be used.

2.3 CABLE TRAY ACCESSORIES

A. Fittings: Tees, crosses, risers, elbows, and other fittings as indicated, of same materials and finishes as cable tray.

B. Cable tray supports and connectors, including bonding jumpers, as recommended by cable tray manufacturer.

2.4 WARNING SIGNS

A. Lettering: 1-1/2-inch- high, black letters on yellow background with legend "WARNING! NOT TO BE USED AS WALKWAY, LADDER, OR SUPPORT FOR LADDERS OR PERSONNEL."

B. Materials and fastening are specified in Division 16 Section "Electrical Identification."

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with recommendations in NEMA 20A

B. Install as a complete system, including all necessary fasteners, hold-down clips, splice-plate support systems, barrier strips, hinged horizontal and vertical splice plates, elbows, reducers, tees, and crosses.

C. Remove burrs and sharp edges from cable trays.

D. Fasten cable tray supports to building structure and install seismic restraints.

1. Design each fastener and support to carry load indicated by seismic requirements

2. Place supports so that spans do not exceed maximum spans on schedules.
3. Construct supports from channel members, threaded rods, and other appurtenances furnished by cable tray manufacturer. Arrange supports in trapeze or wall-bracket form as required by application.
4. Support bus assembly to prevent twisting from eccentric loading.
5. Manufacture center-hung support, designed for 60 percent versus 40 percent eccentric loading condition, with a safety factor of 3.
6. Locate and install supports according to NEMA 20A.

E. Install expansion connectors where cable tray crosses building expansion joint and in cable tray runs that exceed dimensions recommended in NEMA 20A. Space connectors and set gaps according to applicable standard.

F. Make changes in direction and elevation using standard fittings.

G. Make cable tray connections using standard fittings.

H. Seal penetrations through fire and smoke barriers according to "Through-Penetration Firestop Systems."

I. Sleeves for Future Cables: Install capped sleeves for future cables through firestop-sealed cable tray penetrations of fire and smoke barriers.

J. Workspace: Install cable trays with enough space to permit access for installing cables.

K. After installation of cable trays is completed, install warning signs in visible locations on or near cable trays.

L. Install cables only when cable tray installation has been completed and inspected.

M. Fasten cables on horizontal runs with cable clamps or cable ties as recommended by NEMA 20A. Tighten clamps only enough to secure the cable, without indenting the cable jacket. Install cable ties with a tool that includes an automatic pressure-limiting device.

N. On vertical runs, fasten cables to tray every 18 inches. Install intermediate supports when cable weight exceeds the load-carrying capacity of the tray rungs.

O. Ground cable trays according to manufacturer's written instructions.

P. Install an insulated equipment grounding conductor with cable tray, in addition to those required by NFPA 70.

3.2 FIELD QUALITY CONTROL

A. After installing cable trays and after electrical circuitry has been energized, survey for compliance with requirements. Perform the following field quality-control survey:

1. Visually inspect cable insulation for damage. Correct sharp corners, protuberances in cable tray, vibration, and thermal expansion and contraction conditions, which may cause or have caused damage.
2. Verify that the number, size, and voltage of cables in cable tray do not exceed that permitted by NFPA 70. Verify that communication or data-processing circuits are separated from power circuits by barriers.
3. Verify that there is no intrusion of such items as pipe, hangers, or other equipment that could damage cables.
4. Remove deposits of dust, industrial process materials, trash of any description, and any blockage of tray ventilation.
5. Visually inspect each cable tray joint and each ground connection for mechanical continuity. Check bolted connections between sections for corrosion. Clean and re-torque in suspect areas.
6. Check for missing or damaged bolts, bolt heads, or nuts. When found, replace with specified hardware.
7. Perform visual and mechanical checks for adequacy of cable tray grounding; verify that all takeoff raceways are bonded to cable tray.

B. Report results in writing.

END OF SECTION 16139

SECTION 26 01 20 - SITE ELECTRICAL WORK, GENERAL REQUIREMENTS

PART 1 - GENERAL

1.1 CONDITIONS:

A. The Requirements of General Conditions and Special Conditions apply to Work of this Section as if fully repeated herein.

B. The Requirements of this Section apply to all Work of Division 16.

C. Where items specified in other Sections of Division 16, conflict with requirements of this Section, the most stringent requirements shall govern.

1.2 WORK INCLUDED:

A. Provide a complete working installation with all material and equipment as shown and specified. The Contract Documents do not undertake to show or specify every item to be provided. When an item not shown or specified is necessary for proper operation of equipment shown or specified, provide the item, which will allow the system to function properly, at no increase in Contract Price.

B. Make electrical connections for equipment furnished as part of Work of other Sections.

1. Wherever term “electrical connections” is used, it shall be taken to include all operations and materials associated with completing electrical connection starting with pulled-in wire or cable including, but not limited to, the following:

a. Stripping of jacket(s).
b. Checking for continuity.
c. Meggering.
d. Tracing or wire and cables.
e. Fanning.
f. Measuring and cutting to final termination lengths.
g. Permanent identification of conductors in manner specified.
h. Stripping of insulation.
i. Installation of lugs, connectors or terminals.
j. Fastening wire or cable to designated terminal point, motor leads, or other designated points.
k. Taping as required.
l. Installing wire markers.

C. Seismic Requirements: Provide all equipment to resist forces produced by lateral loads specified for Seismic zone No. 3 in the 2013 California Building Code. For all seismic bracing systems, submit structural calculations and details prepared and signed by the Contractors licensed structural engineer which include all resultant forces applied to the building structure. Do not overstress building structure. Calculations will be reviewed for compliance with design criteria, not for arithmetic.

1.3 DEFINITIONS:

A. “Listed”: Equipment is “listed” if it is of a kind which is mentioned in a list which:

1. Is published by a nationally recognized laboratory which makes periodic inspection of production of such equipment.

2. States that such equipment meets nationally recognized standards or has been tested and found safe for use in a specific manner.

B. “Labeled”: Equipment is labeled if:

1. It embodies a valid label, symbol, or other identifying mark of a nationally recognized testing laboratory such as Underwriters Laboratories, Inc.
2. The laboratory makes periodic inspection of the production of such equipment.
3. The labeling indicates compliance with nationally recognized standards or tests to determine safe use in a specific manner.

C. “Certified”: Equipment is “certified” if:

1. Equipment has been tested and found by a nationally recognized testing laboratory to meet nationally recognized standards or to be safe for use in a specific manner.
2. Production periodically inspected by a nationally recognized testing laboratory.
3. It bears a label, tag or other record of certification.

D. “Nationally Recognized Testing Laboratory”: A testing laboratory which is approved, in accordance with OSHA regulation, by the Secretary of Labor.

E. “The Contractor”: Refers to the prime contractors.

F. “The Architect”: Refers to the Professional Architect.

G. “The Owner”: Refers to the legally registered owner of the project or their authorized representative.

H. “The Engineer”: Refers to the Professional Electrical Engineer.

I. “Provide”: Construed to mean furnish (supply), install and connect complete and ready for safe and regular operation of particular work referred to unless otherwise noted.

J. “Furnish”: Construed to mean purchase, procure, acquire and deliver complete with related accessories to project site.

K. “Install”: Construed to mean to physically erect and mount the item(s) complete with related accessories in-place.

L. “Connect”: Construed to mean make final electrical connections for a complete operating piece of equipment with related accessories.

M. “As directed”: As told by the Owner or their authorized representative in written directives.

N. “Work”: Labor, materials, equipment, apparatus, controls, accessories and other items required for proper and complete installation.

O. “Wiring”: Raceway, fittings, wire, boxes and related items.

P. “Concealed”: Embedded in or below masonry or other construction, installed in furred spaces, within partitions, above suspended ceilings, in trenches, or in enclosures.

Q. “Exposed”: Not installed underground or “concealed” as defined above.

R. “Indicated”, “shown” or “noted”: As indicated, shown or noted on drawings or specifications.

S. “Utility Companies”: Construed to mean either the electric utility or the telephone utility company or the cable television utility company.

1.4 QUALITY ASSURANCE:

A. Requirements of Regulatory Agencies:

1. As specified in Division 1 - General Requirements.
2. Nothing in the Contract Documents shall be construed to permit Work not conforming to applicable laws, ordinances, rules or regulations.
3. When the Contract Documents exceed requirements of applicable laws, ordinances, rules or regulations, Contract Documents shall take precedence.
4. It is not the intent of the Contract Documents to repeat requirements of Codes except where necessary for completeness or clarity.

B. Reference Standards:

1. All materials and equipment shall comply with all applicable standards and requirements of the following:

a.	ADA	Americans with Disabilities Act
b.	ANSI	American National Standards Institute.
c.	CBC	California Building Code, 2013.
d.	CEC	California Electrical Code, 2013.
e.	CMC	California Mechanical Code, 2013.
f.	CCR	California Code of Regulations, Title 8 and Title 17 Public Health, Title 19, and Title 24.
g.	CAL/OSHA	State of California Low-Voltage Electrical Safety Orders.
h.	CPUC	California Public Utilities Commission, General Order 128.
i.	EIA	Electronic Industries Association.
j.	ETL	Electrical Testing Laboratories.
k.	FS	Federal Specifications.
l.	IEEE	Institute of Electrical and Electronic Engineers.
m.	ICEA	Institute of Power Cable Engineers Association.
n.	NIST	National Institute of Standards and Technology.
o.	NESC	National Electrical Safety Code (ANSI-C2)
p.	NEMA	National Electrical Manufacturers' Association.
q.	NFPA	National Fire Protection Association.
r.	SFM	California State Fire Marshal.
s.	UL	Underwriter's Laboratories, Inc.
t.	WUESSC	Western Utilities Electric Service Standardization Committee.
u.	Codes and regulations noted in other SECTIONS in DIVISION 16.	
v.	Applicable State Codes and Ordinances.	

2. If any of the requirements of the above are in conflict with one another, or with the requirements of these Specifications, the most stringent requirement shall govern.

1.5 FEES, PERMITS AND UTILITY SERVICES:

A. Refer to supplementary conditions.

B. Arrange for required inspections and secure approvals from authorities having jurisdiction.

C. Arrange for utility connections.

1.6 SUBMITTALS:

A. General:

1. Submit shop drawings and supplemental data for all materials and equipment specified in all Sections of this Division, in accordance with the requirements of section on submittals, and as specified hereinafter.
2. All submittals shall be reviewed by the Contractor and stamped with his approval prior to submitting to the Architect. Contractor shall indicate in writing any deviation in submittals from requirement of Contract Documents.
3. Forward all submittals to the Architect, together, at one (1) time. Individual or incomplete submittals will not be acceptable. Only one (1) request for substitution will be considered on each item of materials or equipment.
4. Wherever catalog numbers and specific brands or trade names, not preceded by the designation "equal to", or followed by the designations "or equal", "or accepted equal", or "or approved equal", are mentioned in these Specifications or Drawings, no substitutions will be accepted.
5. Identify each item by manufacturer, brand, trade name, number, size, rating, or whatever other data is necessary to properly identify and check materials and equipment. The words "as specified" will not be sufficient identification.
6. Identify each submittal item by reference to Specification Section paragraph in which the item is specified, or Drawing and Detail number.
7. Organize submittals in binders, in the same sequence as they appear in Specification Sections, article or paragraphs.
8. Shop Drawings shall show physical arrangement, construction details, finishes, materials used in fabrication, provisions for conduit entrance, access requirements for installation and maintenance, physical size, electrical characteristics, foundation and support details, and weight. Reuse of the Contract Drawings as Shop Drawings will not be acceptable.

    a. Specifically show, by drawn detail or note, that equipment complies with each specified requirements of the Contract Documents.
    b. Drawings shall be to scale and dimensioned (except wiring diagrams need not be to scale), and may be prepared by a vendor but shall be submitted as instruments of Contractor, thoroughly checked and stamped by Contractor before submission to Architect for review.
    c. Catalog cuts and published material may be included to supplement scale drawings.

9. Internal wiring diagrams of equipment shall show wiring as actually furnished for this project, with all optional items clearly identified as included or excluded. Clearly identify external wiring connections. Identify and obliterate superfluous material.
10. External system wiring diagrams shall show wiring as actually installed, connected and identified for this project. Include identification of cables, cable conductors, terminals in terminal cabinets, and connections to the identified external wiring connection points on equipment. Prepare Drawings on twenty-two inches (22") by thirty-four inches (34") tracing sheets bearing title block of equipment manufacturer, manufacturer's local engineering distributor, or Contractor, prepared to accepted drafting standards and bearing Contractor's approved stamp.
11. Acceptance of a substitute is not to be considered a release from the Specifications. Correct any deficiencies in an item, even though approved, at Contractor's expense.
12. Be response for installation of approved substitution. Make any changes required for installation of approved substituted equipment at no increase in Contract Sum.
13. Provide design and details of anchorages and/or restraints conforming to 2013 California Building Code.

B. Operating and Maintenance Instructions and Materials:

1. Subsequent to final completion and testing operations, part of the Work of this Division shall be responsible for instructing the Owner's authorized representatives in operation, adjustment and maintenance of electrical plant. Submit three (3) copies of certificate, signed by Owner's representatives, attesting to their having been instructed.
2. Before Owner's personnel assume operation of systems, submit three (3) bound sets of Operating and Maintenance Instructions, Manuals, and Parts Lists on the electrical plant and its component parts, including all major equipment and that which requires or for which manufacturer recommends, maintenance in a specified manner. Provide names, addresses and telephone numbers of source of supply for parts.

1.7 ELECTRONIC MEDIA:

A. Computer aided design (CAD) working copy shall be available to Contractor for preparation of shop or record drawing submittals. Each CAD drawing as shown on Contract Documents will be released in AutoCAD format by means of electronic mail. CAD drawings will be released upon receiving signature of Electronic Data Transfer Agreement. Release of CAD drawings shall be subject to approval of Architect and Engineer.

1.8 PROJECT RECORD DOCUMENTS:

A. Provide full size copies of “As Built” One Line Diagrams, in metal frames with glass front. Have “As Built” prints framed by a firm normally engaged in this work. Locate diagrams in vicinity of switchboard.

B. Upon completion of Work, furnish Architect with complete sets of plans (not marked blueprints) upon which shall be shown all Work installed under Contract which are not in accordance with original Contract Drawings. Refer also to requirements of Division 1.

C. All symbols and designations used in preparing Record Drawings shall match those used in Contract Drawings.

1.9 PRODUCT DELIVERY, STORAGE, AND HANDLING:

A. Identify materials and equipment delivered to site to permit check against materials list and Shop Drawings.

B. Protect from loss or damage. Replace lost or damaged materials and equipment with new at no increase in Contract Sum.

1.10 SITE EXAMINATION AND CONDITIONS:

A. Examine site; verify dimensions and locations against Drawings and become informed of all conditions under which Work is to be done before submitting proposals.

B. Information shown relative to services is based upon available records and data but shall be regarded as approximate only. Make deviations found necessary to conform with actual locations and conditions with no increase in Contract Sum. Verify locations and elevation of utilities prior to commencement of excavation for new underground installations.

C. Exercise extreme care in excavating near existing utilities to avoid any damage thereto; be responsible for any damage caused by such operations.

1.11 DRAWINGS AND COORDINATION WITH OTHER WORK:

A. Drawings:

1. For purposes of clarity and legibility, Drawings are essentially diagrammatic to the extent that many offsets, bends, special fittings, and the exact locations of items are not shown, unless specifically dimensioned.
2. Exact routing of wiring and locations of outlets, panels, and other items, shall be governed by structural conditions, and materials and equipment already in place. Use data in the Contract Documents. In addition, the Architect reserves the right, at no increase in Contract Sum, to make any

reasonable change in locations of exposed electrical items, to group them into orderly relationship and/or increase their utility. Verify the Architect's requirements in this regard prior to roughing-in.
3. Dimensions, locations of doors, partitions and similar physical features shall be taken from Architectural Drawings, and verified at the site as part of the Work of this Division. Consult the Architectural Drawings for exact location of outlets to center with architectural features, panels, and similar items, at the approximate locations shown on the Electrical Drawings.
4. Mounting heights of brackets, outlets, and similar items, shall be as required.
5. Drawings indicate, generally, routes of all branch circuits. All runs to panels are indicated as starting from nearest outlet, pointing to direction of panel. Continue all such circuits, conduits to panel as though routes were indicated in their entirety.

B. Coordination:

1. Work out all "tight" conditions involving Work of this Division and Work of other Divisions in advance of installation. Provide additional Work necessary to overcome "tight" conditions, at no increase in Contract Sum.
2. Differences of disputes concerning coordination, interference or extent of Work between Divisions shall be decided by Contractor. His decision, if consistent with Contract Document requirements, shall be final.
3. Provide adequate working space around electrical equipment in compliance with 2013 C.E.C. In general, provide six and one-half feet (6 1/2') of headroom and thirty inches (30") wide minimum clear work space in front of panelboards and controls. In addition, provide the following working clearances:

Equipment Front to Workman's Back

Voltage to Ground Minimum Clear Distance
0-150 (208/120V, 120/240V/ systems) 3 feet

4. Coordinate electrical interface of mechanical equipment with the Work of Division 15, Mechanical and Plumbing.
5. Provide templates, information and instructions for Work of other Divisions to properly locate holes and openings to be cut or provided for Electrical Work.
6. Size all feeders (conduit and wiring), motor starters, overload protection and circuit breakers to suit horsepower of motors or wattages of equipment furnished as part of the Work of the various Sections of the Specifications. In no case shall feeders and branch circuits (conduit and wiring) and circuit breakers be of smaller capacities or sizes than those shown or specified.
7. Schedule of Work – Refer to Section on Work Sequence.
8. Make every effort to keep existing electrical circuits, including telephone, public address, fire alarm, power, and other electrical services, in operation. Where power outages are unavoidable, schedule such outages with the Architect to occur at such times as to cause the least disruption of normal facility functions.

C. Equipment Rough-In:

1. Rough-in locations shown on Electrical Drawings for equipment furnished by the Owner and for equipment furnished under other Divisions are approximate only. Obtain exact rough-in locations from the following sources:

   a. From Shop Drawings for Contractor-furnished and installed equipment.
   b. From the Architect for Owner-furnished, Contractor-installed equipment.
   c. From the Architect for existing equipment where such equipment is relocated as part of the Work of this Contract.

2. Verify electrical characteristics of equipment before starting rough-in.
3. Unless otherwise shown or specified, equipment which requires electrical connection shall be installed as part of the Work of the Division in which specified. Internal components shall be wired to a single point with wiring in raceway direct connection (hardwired) to building electrical system or internal wiring and connections with cord and plug for receptacle connection to building wiring.

4. Unless otherwise shown or specified, provide direct raceway and conductor connections from building wiring system to equipment terminals for direct-connected equipment terminals for direct-connected equipment which is Contractor-furnished and Contractor-installed, Owner-furnished and Contractor-installed, and for existing equipment relocated by the Contractor.
5. Insert plug in receptacle for cord-connected equipment which is Contractor-furnished and Contractor-installed, Owner-furnished and Contractor-installed and for existing equipment relocated by the Contractor. Provide new cord and plug if required on Owner-furnished and Contractor-installed equipment.
6. Provide disconnect switches, flush type in finished spaces, where shown or required by Codes for direct-connected equipment.
7. Disconnect existing equipment from building electrical system, disconnect internal wiring required for relocation of existing equipment, and reconnect at new location for existing equipment relocated.

1.12 TEMPORARY WIRING:

A. Furnish and install temporary wiring and maintain power to the facility.

B. Whenever Work makes it necessary to cut off a circuit, either a feeder or branch circuit, and it stands to remain out of service for some time, make temporary connections so remaining outlets or load will continue to be energized. Facility will remain in operation during construction and Contractor shall make every effort to keep electrical circuits, which includes power, telephone system, etc., in operation. Some outlets and wiring in remodel area will remain undisturbed. Reconnect these circuits, extending where necessary so all circuits will operate satisfactorily upon completion of job. Existing fire alarm and intrusion alarm system must be operational when workman leave job at the end of the day.

C. Where power outages are unavoidable, such outages shall be scheduled in advance with Building Manager and shall occur at such times as to cause the least disruption of the normal facility functions.

D. Building Manager shall be notified at least seventy-two (72) hours in advance of any power shutdown, and shutdown shall be at convenience of Owner. No allowance for overtime labor during such period shall be allowed under this Contract.

1.13 GUARANTEE:

A. Furnish one (1) year guarantee in accordance with and in form required under Division

1. Repair or replace as may be necessary any defective work, material or part with no increase in Contract Sum including repair or replacement of other Work, furnishing, equipment or premises caused by such repair or replacement of defective work.

PART 2 - PRODUCTS

2.1 MATERIALS:

A. Identify materials and equipment by manufacturer’s name and nameplate data. Remove unidentified materials and equipment from site.

B. Equipment specified by manufacturer’s number shall include all accessories, controls and other components, listed in catalog as standard with equipment. Furnish optional or additional accessories as specified. All materials shall be UL labeled and in accordance with NEMA Standards.

C. Where no specific make of material or equipment is mentioned, any high quality product of a reputable manufacturer may be used, provided it conforms to requirements of system and meets with Architect’s acceptance.

D. Conflicts between Plans and Specifications, exclusive of the General Conditions of the Contract, the most stringent and higher quality requirement shall govern.

E. If the Contract Documents are not complete as to any detail such as accessories or hardware, or a required construction system or with regard to manner of installing of parts, materials, or equipment, but there exists an accepted trade standard for good and workmanlike construction, such detail or accessories shall be deemed to have been implicitly required by the Contract Documents in accordance with such standard.

F. Equipment and material damaged during transportation, installation, or operation will be considered as totally damaged. Replace with new. Variance from this will be permitted only with written acceptance.

G. Provide an authorized representative to constantly supervise the Work of this Division and to check all materials prior to installation for conformance with the Contract Documents.

H. Do not use equipment exceeding dimensions indicated for equipment, or arrangements that reduce required clearances, or exceed specified maximum dimensions.

I. Miscellaneous Accessories: Channels, joiners, hangers, caps, nuts, and bolts and associated parts shall be plated electrolytically with zinc, followed immediately thereafter by treating the freshly deposited zinc surfaces with chromic acid to obtain a surface which will not form a white deposit on surface for an average of one hundred twenty (120) hours when subjected to a standard salt spray cabinet test; or accessories shall be hot-dipped galvanized.

J. All items of materials in each category of equipment shall be products of one (1) manufacturer and shall be labeled by Underwriters' Laboratories, Inc.

K. Use only self-extinguishing, non-hygroscopic corrosion-resistant material and equipment.

L. Conform with conditions shown and specified. Coordinate with other trades for best possible assembly of combined Work. Relocate equipment when necessitated by failures to coordinate Work or to advise Architect of conflicts in writing.

M. Use printed descriptions, specifications and recommendations of manufacturers as a guide for installation of Work.

N. Design of wiring systems is generally based on product of one (1) of the manufacturers cited. Where wiring for product installed necessitates modification of wiring shown on Plans, Contractor is responsible for installation of wiring appropriate to product installed.

O. Effectively bond electrical cabinets, enclosures, and conduit raceways to Code approved grounds as parts of continuous grounding system.

P. Materials and Equipment - General Requirements:

1. New.
2. Approved for use by State Fire Marshal and local building inspection department when applicable.
3. Testing agency labeled or with other identification wherever standards have been established.
4. Architect reserves right to reject items not in accordance with this Specification either before or after installation.
5. Comprised to render complete and operable systems; provide additional item needed to complete installation to realize design.
6. Groups of items having same or similar function (motor starters, circuit breakers, etc.) shall be by single manufacturer to facilitate maintenance and service.
7. Compatible with space allocated. Modifications necessary to adjust items to space limitations at Contractor's expense.
8. Installed fully operating and without objectionable noise or vibration.

Q. Electrical Equipment and Material Categories:

1. Conduit:

    a. Rigid Steel Conduit: UL 6.
    b. Intermediate Metallic Conduit (IMC): UL 1242, Type 1.
    c. Coated Rigid Steel Conduit: NEMA RN 1, forty (40) mil. thick polyvinyl-chloride (PVC) coating factory bonded to the galvanized outer surface of the conduit.
    d. PVC Conduit: Type 40 and Type 80, NEMA TC 6, UL 651.
    e. Electrical Metallic Tubing (EMT): UL 797, F.S. WW-C-563.
    f. Flexible Conduit: UL 360, F.S. WW-C-566.

2. Outlet Boxes and Fittings: UL 514, F.S. W-C-586, W-J-800.
3. Cabinets and Boxes: UL 50.
4. Wires: Insulated copper conforming to the Requirements of the 2013 California Electrical Code for application.
5. Tape: Plastic F.S. HH-I-595.
6. Safety Switches: F.S. W-S-865, Type “HD” with externally operated handle. Switches shall be rated 250 and 600 volts AC, of size and poles as shown.
7. Fuses:

    a. All fuses rated up to 600 amperes: UL labeled as Class RK1 or Class J (RK5) with time delay and suitable for up to 200,000 amperes, current limiting, such as Gould/Shawmut Amp-Trap, Bussman Low-Peak, (Fusetron) or equal. Time delay: ten (10) seconds minimum at five hundred percent (500%) of fuse rating.
    b. Spare Fuses: Provide minimum of three (3) of each ampere rating.
    c. Fuseholders: Rejection type. Where Class J fuses are used, holders will required Class J spacing.

8. Pull Line: Jet Line No. 232, Greenlee No. 430, or equal, one-eight inch (1/8”) diameter braided line of polypropylene line of continuous fiber polyolefin; minimum break strength, two hundred (200) pounds. Furnish pull line in all unused (empty) raceways.

R. Fabrication and Manufacture: Follow manufacturer’s directions where manufacturers of articles used furnish directions covering points not shown or specified.

PART 3 - EXECUTION

3.1 INSTALLATION:

A. Manufacturer’s Directions: Follow manufacturer’s directions where manufacturers of articles used furnish directions covering points not specified or shown.

B. Equipment: Accurately set and level, neatly place support and anchor properly. Anchorage shall conform to the requirements of 2013 California Building Code Part 2, Table 13A-0. No allowance will be made for negligence to foresee means of placing, installing or supporting equipment in position.

C. Assemble together all equipment which requires assembling including Contractor-supplied bussing, internal wire connections where required; connect all incoming conduit, cable and wires properly; and adjust and make ready for service electrical equipment and material required by this Contract.

D. All Work shall be done in orderly, workmanlike manner and present neat appearing installation when completed.

E. Normal Contingencies:

1. Existing conduits which are required to be extended, altered, or reconnected shall be accomplished as shown or as directed. Existence of any wires, conduits, or other facilities are shown in a general way only. Determine existence, location, and condition on site.
2. Where existing conduits which are shown to be revised or which will be essential to functioning of particular system are cut or exposed due to construction changes, new connections shall be made in most expeditious manner as directed or shown. Where wiring is involved, new wires shall be "pulled-in" between nearest available accessible reused outlets. In all cases where new wires are required, shown, or specified to be installed in existing conduits, if same cannot be installed, new conduits shall be provided therefore as directed.
3. Existing switchboards, motor control centers, bus duct, and panelboards which are required to be extended, altered or modified under the Work of this Division shall be provided with new sections, bus extensions, and all necessary hardware for a complete and operating system. Maintain all testing agency certifications.
4. Attention is called to the fact that all new conduit, wiring, and apparatus shown or specified shall be connected to existing systems so as to function as complete units.
5. All conduits, electrical apparatus, and similar items, in place and not shown or specified to be reused or which will not be essential to functioning of various systems when Work is completed, shall be removed. No existing material shall be reinstalled or reused, unless shown or specified. Concealed conduits which are not shown or specified to be reused and become exposed due to construction changes shall be removed to nearest available accessible reused outlets.

F. Protection: In performance of Work, protect existing facility and protect Work of other Sections as well as Work of this Section from damage.

3.2 PERFORMANCE:

A. Excavation and Backfilling:

1. As specified in Earthwork Section.
2. Provide all necessary shoring, sheeting, pumping as part of Work of this Division. Excavate and backfill as required for installation of Electrical Work.
3. In asphalt or concrete paved areas, backfill only to subgrade level.
4. Support conduit for entire length on undisturbed original earth. Minimum conduit depth of pipe crown shall be two feet (2') below finished or natural grade.
5. Restore all surfaces, roadways, walks, curbs, walls, existing underground installations, and other construction or improvements damaged by installation of Electrical Work, to original condition in an acceptable manner.
6. Maintain all warning signs, barricades, flares, and lanterns as required.

B. Concrete:

1. Concrete for conduit encasement shall be a mixture of approximately 50% sand and 50% rock, which will pass a 1 inch square screen, and four sacks of cement to the cubic yard of finished concrete. It shall be thoroughly consolidated.
2. Concrete used for encasement of electrical conduits shall contain red oxide in mix, five (5) pounds per cubic yard.
3. Concrete for other than concrete encasement shall be as specified in Division 3.

C. Sleeves, Chases, and Concrete Inserts:

1. This Division shall provide, to cause no delay, all required sleeves, chases, concrete inserts, anchor bolts, and similar items before concrete is placed, and be responsible for correct location and installation of same.
2. Sleeves and chases are prohibited in structural members, except where shown or as otherwise approved in writing.

D. Cutting and Patching:

1. Do all cutting and patching, including structural reinforcing, necessary for the Work of this Division.

2. Do no cutting or patching without prior approval. Repair damage done by cutting and patching equal to original condition, in Architect's opinion.

E. Provide metal backing plates, anchor plates, and similar items that are required for anchorage for the Work of this Section; securely weld or bolt to metal framing. Wood blocking or backing will not be permitted in combination with metal framing.

F. Special forming, recesses, chases, and similar items, and wood blocking, backing, and grounds necessary for the proper installation of Electrical Work will be provided as part of the Work of other Sections.

G. Motor Connections:

1. Receive, uncrate and store equipment furnished as part of the Work of other Divisions, but installed and connected as part of the Work of this Division.
2. Install individual magnetic and manual motor starters.
3. Provide motor power circuit complete, for all equipment furnished as part of the Work in other Division as specified.

    a. Provide all disconnect switches.
    b. Line and low voltage temperature control and interlock wiring is provided as part of the Work of Division 15, Mechanical.

H. Miscellaneous Equipment Connections:

1. Coordinate the exact method of making connections to equipment provided as part of the Work of other Divisions and this Division. Provide additional labor, materials required for complete connections. Determine exact stub-up locations and outlet heights from equipment installers

3.3 TESTING AND ADJUSTING:

A. Furnish all labor and test equipment required for the Work of this Division. Testing work is defined as that work necessary to establish that equipment has been properly assembled, connected, and checked to verify that intent and purpose of Drawings, manufacturer's instruction manuals, and directions of Architect have been accomplished in satisfactory manner.

B. Test each individual circuit at panel with equipment connected for proper operation. Verify control circuit integrity: Field tests to verify component compliance with Specifications, adjusting, calibrating, and setting circuit breakers, relays, timers, etc.

C. Ground tests shall meet requirements stated in Specification Section 260526.

D. Tighten nuts, bolts, lugs, connections, and similar items of switchboards, panels and motor control centers to manufacturer's torque values.

E. After completion of testing and adjustment, operate the different systems and equipment under normal working conditions and show specified performance. If, in the opinion of the Architect, performance of equipment or systems is not in accordance with Contract Document or submitted data, alter or replace equipment at no increase in Contract Price.

F. Do not allow or cause any Work installed hereunder to be covered up or enclosed before it has been inspected and accepted. Should any Work be enclosed or covered up before it has been approved, uncover such Work, and after it has been inspected and approved, make all repairs necessary to restore Work of Others to condition in which it was found at time of cutting, all at no increase in Contract Price.

G. Provide certified test reports of transformer sound levels where transformers are located within or adjacent to occupied areas.

H. At completion of Work provide written certification that all systems are functioning properly without defects.

3.4 CLEANING AND PAINTING:

A. Properly prepare Work of this Division to be finish painted as part of the Work of Painting Section.

B. Refinish Work supplied with final finish as part of the Work of this Division if damaged as part of the Work of this Division to satisfaction of Architect.

C. Thoroughly clean interiors of switchboards and motor control centers. After other Work is accomplished, clean exposed conduit, panels (interiors and exteriors), fixtures, and equipment, and leave in condition satisfactory to Architect.

D. Clean out and remove from site all surplus materials and debris resulting from this Work, including surplus excavated materials.

3.5 EQUIPMENT IDENTIFICATION:

A. Properly identify panelboards, convertible circuit breakers in panelboards, motor disconnect switches, starters, and other apparatus used for operation of, or control of, circuits, appliances or equipment, by means of engraved three thirty-secondths inch (3/32”) thick laminated plastic descriptive nameplates, with black background and white letters. Mount the nameplates on the apparatus using round-head brass machine screws or pop rivets. Cardholders in any form will not be acceptable.

3.6 SALVAGE MATERIAL AND EQUIPMENT:

A. Where remodel or demolition work is to be accomplished under this Contract, all removed materials and equipment which in the opinion of the Owner are salvable shall remain the property of the Owner. Such salvaged materials and equipment shall be delivered to the Owner on the premises as directed and shall be neatly piled or stored and protected from damage.

B. All materials considered to be scrap and not salvable shall be removed from the premises and disposed of by the Contractor.

3.7 GROUNDING:

A. Ground Fittings: Approved manufactured type, installed and connected in accordance with Code requirement; UL 467.

B. Ground neutral bus and non-current-carrying parts of equipment at each installation in accordance with applicable Codes. Ground Conductor: Copper having a current capacity in accordance with 2013 C.E.C. and Electrical Safety Orders, but not smaller than #6 AWG.

C. Exercise every precaution to obtain good contact at all panelboards, outlets, and similar items. Where it is not possible to obtain good contact, bond conduits around boxes with an insulated conductor, #6 AWG minimum, connected to conduit by means of approved clamps.

D. Completely ground all equipment cases, motor frames, and other items to be grounded in accordance with requirements of 2013 C.E.C. Install bond wire in flexible conduit. Install copper bond wire, sized in accordance with 2013 C.E.C., in all non-metallic raceways and bond to all metallic parts using approved fittings. Bond Wire: Copper.

E. Provide a ground resistance of five (5) ohms maximum. Measure ground resistance in normally dry conditions not less than forty-eight (48) hours after rainfall.

F. Connect service ground conductor to metallic cold water pipe (pipe must be in contact with earth for ten feet [10’] or more and electrically continuous to point of connection of ground electrode conductor). Additional ground electrode shall supplement the water ground. Bond building steel to ground system.

G. Where the specified ground resistance cannot be met, install additional ground rods or radial extensions of counterpoise ground wire until specified resistance is obtained. Rods shall be three-quarter (3/4”) diameter by ten feet (10’) long copper-clad stell.

H. Space ground rods as evenly as possible at least ten feet (10’) apart (fifteen feet [15’] preferred) and connect two feet (2’) below ground.

I. Radial extension of counterpoise ground wire minimum length and depth of trench twenty-five feet (25’) by one and one-half feet (1 1/2").

END OF SECTION

SECTION 26 05 03 - EQUIPMENT WIRING CONNECTIONS

PART 1 - GENERAL

1.01 REQUIREMENTS

A. All applicable portions of Division 1- General Requirements are to be considered as included with this section.

1.02 CODES

A. The following are minimum requirements and shall govern, except that all local, state and/or federal codes and ordinances shall govern when their requirements are in excess hereof.

1.03 DESCRIPTION

A. Furnish all materials, labor, equipment, services, etc., necessary and incidental for the completion of all site clearing and removal work as shown on the drawings and as specified herein.

B. All onsite and offsite work included consists of but is not limited to the following:

1. Removal of existing sidewalks, drives, curbs, pavements, etc. per plans. Trees, shrubs, irrigation. See Abatement Report.
2. Removal and capping off or relocation of existing underground utilities, underground structures, etc. per plans.
3. Removal from site and disposal of all waste, debris and unusable material.
4. Backfill all open excavations created by the removal of underground utilities, underground structures, etc.

1.04 RELATED SECTIONS

A. Related work specified elsewhere:

1. Section 02200 - EARTHWORK

1.05 QUALITY ASSURANCE

A. Obtain and pay for any permits, bonds, licenses, etc., required for Site Clearing and Removal work.

B. All clearing and removal work shall be accomplished in strict accordance with all local and state building codes, requirements and regulations including but not limited to noise abatement, dust control, classification of disposal materials, etc.

C. Any work within street or highway right-of-way shall be done in accordance with the requirements of the governmental agencies having jurisdiction and shall not begin until these governing authorities have been notified.

1.06 JOB CONDITIONS

A. An attempt has been made to show all existing structures, utilities, drives, pavements, curbs, walks, etc. in their approximate location on the survey and/or working drawings. However, others that are not shown may exist and may be found upon visiting the site or during the clearing and removal work. It will be the responsibility of this contractor to accurately locate all existing facilities and to determine

their extent. If such facilities obstruct the progress of the work and are not indicated to be removed or relocated, they shall be removed or relocated only as directed by the Owner.

1. Report any existing site element not shown on the working drawings to the Architect of Record so that the proper dispensation of that element may be made.

B. Natural features, existing structures, existing landscaping, existing utilities, etc. which are indicated to remain on the drawings and specifications shall be protected and shall not be defaced or damaged in any manner.

C. Restore to their present conditions any pavement in the public right-of-way that is disturbed by the work under this section. All pavement restoration work in public rights-of-way shall be performed to the full satisfaction of the governmental agencies having local jurisdiction.

1.07 ENVIRONMENTAL REQUIREMENTS

A. Noise producing activities shall be held to a minimum. Internal combustion engines and compressors, etc., shall be equipped with mufflers to reduce noise to a minimum. Comply with all noise abatement ordinances.

B. Keep all areas within the clearing and removal area sufficiently dampened to prevent dust from rising due to clearing or removal operations. Comply with all anti-pollution ordinances.

1. This contractor shall see to it that trucks leaving the site shall do so in such a manner that debris, vegetation, mud and earth will not be deposited on adjacent street pavements. Any debris, vegetation, mud or earth deposited on street pavements shall be promptly removed by this contractor.

C. All clearing and removal operations shall be performed in a manner such as to prevent any wash-off of soils from the site into streams and/or storm drainage systems. Appropriate sedimentation ponds, dikes, silt fences, collars, and filter media shall be employed to insure compliance with these requirements. Where a specific statute governs these procedures, such statute shall be complied with in it’s entirety.

1.08 PROTECTION AND SHORING

A. Protect all existing structures, utilities and landscaping indicated to remain on the drawings.

1. All trees, shrubs, and other items, indicated to remain shall be protected during the entire progress of the work. This includes protection of the root system. The trees shall be fenced if they are located in or near an area being used for material storage or subject to damage by traffic during construction. Low hanging branches and unsound or unsightly branches on trees or shrubs designated to remain shall be removed. All trimmings shall be done by skilled workmen and in accordance with good tree surgery practices.

B. Any damage done by this contractor to existing structures, pipe lines, utilities, landscaping, etc. indicated to remain shall be repaired by him and at his expense in a manner acceptable to the Owner of the damaged property. This contractor shall report any existing damage prior to the beginning of this work.

C. All temporary shoring, bracing, etc., and maintenance there to required for the completion of clearing and removal work shall be provided by the Contractor whose work requires protection.

1. This contractor shall work in concert per local and state codes to insure the provisions of adequate bracing, shoring, temporary cross over for pedestrian and vehicular traffic including guard rails, lamps, warning signs and flags as required by agencies having jurisdiction as directed by the Owner. Remove same when necessity for protection ceases.

1.09 DRAINAGE MAINTENANCE

A. During the entire course of clearing and removal operations, all existing drainage ways, both into and from the project area shall be rerouted as required and/or maintained in a functional condition.

B. At all times during the clearing and removal operation, the exposed areas of subgrade shall be maintained in a condition compatible with positive drainage of the work area. Failure to maintain such drainage shall be considered adequate cause for the District Representative to order temporary suspension of the work.

C. If it should become necessary to stop work for indefinite periods, take every precaution to prevent damage or deterioration of the work already performed. Provide suitable and functional drainage by installing ditches, filter drains, temporary cut-off lines, etc., and erect temporary protective structures where necessary. All embankments shall be back-bladed and suitably sealed to protect against adverse weather conditions.

PART 2 - PRODUCT

2.01 MATERIALS

A. All materials used to backfill excavations, trenches, holes, pits, etc. caused by utility, underground structure or underground storage tank removal shall meet the requirements for fill material and compaction indicated in Section 02200 and 02210.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Visit the site so that a full understanding of the difficulties and restrictions attending complete clearing of the site and removal of underground tanks and utilities is obtained. Verify the location of all pertinent items.

B. Verify with sewer department, water department, gas company, electric company, etc. that all existing utilities, services and overhead lines have been deactivated and abandoned prior to beginning removal work. Notify affected utility department or company prior to beginning removal work.

1. Contact the local “Miss Dig” prior to beginning clearing and removal work.

3.02 PREPARATION

A. Cut drainage swales and provide temporary grading to carry storm water away from clearing area. No storm water will be permitted to stand in open excavations.

B. Provide, erect and maintain temporary barriers and security devices as required. Protect all existing landscaping, structures, utilities and site elements which are not to be demolished.

C. Notify all affected utility companies and local authorities and agencies prior to beginning the work.

D. Identify and tag all existing trees and other landscaping designated to remain.

E. Identify and locate a permanent stockpile area for topsoil. Verify with District Representative and see plans for fill soil stockpile area. Coordinate with Landscape Contractor.

F. Identify and locate a waste area for temporary storage of removed materials and a permanent topsoil stockpile area.

1. No materials may be buried or burned on the site as a means of disposal.

3.03 PERFORMANCE

A. This contractor shall be responsible for all clearing, grubbing, removing and disposing of trash and debris and for clearing and stockpiling all topsoil which are within the designated limits of the property, easements and roadway rights-of-way, unless otherwise indicated on the drawings.

B. Prior to rough grading, storage of construction materials or the installation of any temporary construction facilities, strip areas per plans to be occupied by site improvements.

C. This contractor shall be responsible for removal of sidewalks, pavements, curbs and gutters, exterior slabs and sidewalks indicated to be removed on plans.

D. This contractor shall be responsible for removal of all underground utilities, underground structures, etc., according to plans.

E. Protect any existing structures, utilities and all appurtenances to remain. Prevent movement or settling. Provide bracing and shoring as required.

1. Cease cleaning and removal operations immediately if any existing structure or utility appears in danger. Notify the District Representative and Civil Engineer of Records. Do not resume operations until directed.

F. All broken construction material, trash and debris, tree slash, sidewalks, curbs, etc. will be considered "waste" and shall be removed from the site.

G. “Waste” material shall be removed from the site as soon as possible and shall not be allowed to accumulate. Short-term storage of removed material shall be restricted to previously designated “waste” areas or as directed by the District Representative.

1. No burning or burying of “waste” material will be permitted.

H. Continuously dampen all clearing and removal areas to prevent dust from rising during the operation. Provide hoses and/or water trucks as required.

3.04 FIELD QUALITY CONTROL

A. The Owner shall retain an independent inspection firm or contact local officials and inspectors at locations where local building codes require special inspections.

3.05 CLEAN UP

A. Material designated for removal shall become the property of this contractor, and any salvage value therefrom will accrue to this contractor.

B. Remove from the site and make legal disposition of all waste and debris. No waste or debris shall be burned or buried on the site as a means of disposal.

END OF SECTION

SECTION 26 05 19 - INSULATED CONDUCTORS

PART 1 - GENERAL

1.1 CONDITIONS:

A. The Requirements of the General Conditions and Special Conditions apply to the Work of this Section as if fully repeated herein.

1.2 WORK INCLUDED:

A. Provide all wire for all systems including lighting systems, mechanical systems, receptacles, communication system, fire detection systems, electrical service and distribution system.

1.3 PRODUCT, DELIVERY, STORAGE, AND HANDLING:

A. Deliver wire to site in its original unbroken packages, plainly marked or tagged as follows:

1. Underwriters' labels.
2. Size, kind, and insulation of wire.
3. Name of manufacturing company and trade name of wire.

1.4 QUALITY ASSURANCE:

A. Reference Standards:

1. UL - Underwriter's Laboratories, Inc.:

44	Wires and Cables, Rubber-Insulated.
83	Wires and Cables, Thermoplastic-Insulated.
1569	Metal-Clad Cables.

2. NEMA - National Electrical Manufacturer's Association:

WC 5	Thermoplastic-Insulated Wire and Cable for the Transmission and Distribution of Electric Energy.
WC 7	Cross-Linked-Thermosetting-Polyethylene Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy.

3. FS - Federal Specification:

HH-I-595	Insulated Tape, Electrical, Pressure- Sensitive Adhesive, Plastic.

PART 2 - PRODUCTS

2.1 MATERIALS:

A. Wire and Cable:

1. Single conductor, stranded, soft drawn copper wire having conductivity of not less than ninety-eight percent (98%) of that of pure copper, with insulation rated at 600 volts AC, seventy five degrees (75º) C. conductor temperature, type THHN-THWN or equal and ninety degrees (90º) C. conductor temperature, type XHHW or equal. Wire sizes No. 10 AWG and smaller may be solid copper.
2. Minimum Wire Size: No. 12 unless otherwise shown or otherwise stated herein.

3. Factory color code with separate color for each phase and neutral used consistently through system. Isolated grounding conductor shall be green with one yellow stripe.

Phases	A	B	C	N	G
208/120 volts:	Black	Red	Blue	White	Green
480/277 volts:	Brown	Orange	Yellow	White/Grey	Green

B. Metal-Clad cable (Type MC): MC Cable shall be a factory assembly of one or more conductors, each individually insulated and all enclosed in a common galvanized steel armor sheath of interlocking metal tape or a smooth or corrugated tube and manufactured in accordance with the C.E.C Article 334. Each interlocked armor MC cable shall consist of an overall metal sheath, overall cable tape, marker tape, copper conductors with insulation rated at 600 volts and ninety degrees (90º) C. temperature rating (type THHN-THWN) and equipment grounding conductor. AFC cable systems or equal.

C. Termination Lugs and Tools:

1. Terminal lugs: Square D Co., Thomas and Betts, or equal.
2. Terminal lugs for wire sizes from No. 18 to No. 10 AWG: Ring tongue funnel entry, pre-insulated with vinyl.
3. Terminal lugs for wire sizes from No. 8 and larger: Compression connectors T&B series 54000, two-hole long barrel lugs or equal. Bolting pad tin-plated for low contact resistance. Use Belleville compression washers when ambient temperature exceeds thirty degrees (30º) C., T&B series 60800 or equal.
4. Terminating tools: Hexagonal or circumferential type with coding systems for inspection purposes.
5. Reducing Adapters for Copper Cables: Burndy, Mac Products, Inc., or equal.

D. Plastic Tape: F.S. HH-I-595.

E. Metal-Clad Cable Terminations:

1. Type MC connectors shall be T&B “Tite-Bite” with insulated throats and approved for grounding.

PART 3 - EXECUTION

3.1 INSTALLATION:

A. Splices and Joints:

1. Twist together #10 AWG or smaller wiring, electrically and mechanically strong, and insulate with insulated electrical spring connectors, Scotchlok, Ideal or equal. Threaded type wire nuts are not acceptable.
2. Make joints and connections for #8 AWG or larger with solderless tool applied pressure lugs and connectors. Insulate with layers of plastic tape equal to inslation of wire and with all irregular surfaces properly padded with “Scotchfil” putty prior to application of tape for uninsulated lugs and wire ends.
3. Install feeder cables in one (1) continuous length unless splices are approved by the electrical engineer of record. Where permitted, make feeder splicing with high compression sleeve type connector followed by a heavy wall heat shrink tubing, UL approved for direct burial per UL 786D, Thomas & Betts, Series HS or equal.
4. Where oversized cables are used to accommodate voltage drop, whether a single or parallel feeder, provide appropriate reducing adapter and conductors for termination.

B. Install wires or pull line in conduit and furnish all equipment and material required to complete installation. Install all wire connectors where required, cable supports, tape and insulating materials, or any other item of material and equipment to properly install wires and cables.

C. Install all termination lugs used to connect conductors to terminal blocks with ratchet type crimping tool as recommended by manufacturer of connector. No spade-type lugs will be permitted. All work shall be in accordance with 2016 California Electrical Code unless otherwise directed or specified herein.

D. Pull cable into conduit with sufficient length left at ends of cable to make connections conveniently to all equipment or devices. Do not pull wire and cable into conduit until conduit runs are swabbed clean and free from obstructions, sharp corners and inspected for pulling by Project Coordinator.

Install wire and cable so there will be no cuts or abrasions in insulation or protective covering or kinks in conductors. Make no splices in conductors except where devices are supplied with internal leads. Make splices in nearest condulet or junction box or, where devices are physically too small to accept scheduled wires and associated lugs, splices may be made in nearest condulet or junction box with minimum No. 16 AWG size wire.

E. Install all cables in straight and orderly arrangement with no interlacing. Take care to avoid sharply bending or kinking conductor, damaging insulation or stressing cable beyond manufacturer's recommendations during pulling. Protect cable from absorption of moisture during storage, before pulling and after pulling.

F. Cable attachment for pulling shall be of patent cable grips. Difficult pulling is not anticipated. However, maximum pull tension shall not exceed manufacturer's recommended value for cable being measured with tension dynometer. Use pulling compound approved by cable manufacturer to facilitate pulling of cables. Cable pulling to be witnessed by Project Coordinator. Notify Project Coordinator in reasonable amount of time before pull begins.

G. Form cable to avoid sharp bends over edges of conduit bushings upon entering or leaving boxes or cabinets and to avoid bearing against edges of enclosures and supports when entering or leaving enclosures. Neatly cable or clamp conductors using nylon "ty-raps".

H. In installation of power cables which are single conductors, form Phases A, B, and C in pyramid method in order to keep circuits together.

I. Install cables in specific conduit specified. Remove cables installed in incorrect conduit or raceways and if length is not correct, install new cable all at no increase in Contract Sum.

J. Remove and replace any cable damaged during installation with new cable at no increase in Contract Sum.

K. Install all wiring so that when completed system shall be free from short-circuits and non-intentional grounds.

L. Use green insulation on conductors intended solely for grounding purposes.

M. Leave twelve inches (12") minimum of slack wire in every outlet box whether it be in use or left for future use.

N. Install power circuits from distribution panels to individual outlets or control equipment, as shown. Conductors: Size and type shown.

O. Install branch circuit conductors for general lighting system from panelboards to outlets and between outlets. If single distance from panelboard to first outlet exceeds one hundred feet (100'), minimum size conductor for such run shall be 10 gauge.

P. Provide branch circuits to receptacle outlets as shown. For excessively long runs (fifty feet [50'] or more) from panelboard to first receptacle outlet, minimum size wire shall be 10 gauge to first outlet with conductors between outlets being 12 gauge. Make up connections to devices from "thru-feed" branch circuit conductors with pigtails with no interruption of branch circuit conductors.

Q. Neatly and securely bundle all conductors located in branch circuit panelboards and switchboards. Neatly and securely cable all conductors larger than No. 10 located in switchboards and pullboxes in individual circuits. Use nylon cable straps for bundling and cabling cable straps.

R. Where conductors are to be connected to metallic surfaces, coated surfaces shall be cleaned to base metal surface before installing connector. Remove lacquer coating of conduits where ground clamps are to be installed.

S. Provide supports required to make complete cable installation.

T. Provide 12 gauge stranded (green) wire from ground terminal of receptacle to ground bond wire or to stud in outlet box.

U. Installation of metal-clad cables shall comply with 2016 C.E.C. Article 334 and Article 517.

V. Installation of nonmetallic-sheathed cables shall comply with 2016 C.E.C. Article 336.

3.2 INSTALLATION - TYPE MC CABLE:

A. MC cable is acceptable for concealed branch circuit wiring under the following conditions:
1. Branch circuit wiring for receptacle outlets, lighting, control and signal circuits.

2. In dry locations as open runs of cable.

B. Type MC cable shall have a maximum of five (5) conductors, four (4) current carrying conductors and one (1) equipment ground conductor. Ground conductor shall be internal insulated ground copper conductor.

C. Install MC cable in accordance with manufacturer's instructions and in accordance with the C.E.C Article 334. Follow manufacturer's instructions when connecting the cable to fittings and boxes. Secure connectors to the cable, but not over-tightened. Firmly attached connector to the metal boxes.

D. Support and secure cables at intervals not exceeding six (6') feet and within 12 inches of box or fitting using separate metal strap or spring metal clip for each cable. Do not bundle cables together. Do not support cables from raceways or mechanical piping. Do not rest cables on ceiling tiles or allow contact with mechanical piping systems.

E. Provide 1/4 inch threaded or solid rod grid, 4 feet on centers, above ceiling spaces for cable support. Use spring metal clip for cable attachment to rod.

F. Cable connection to light fixtures: Acceptable to attach cable to fixture support wire using spring metal clip.

G. Use steel with insulated throat cable connectors. OZ/Gedney AMC Series or equal. Die cast of pressure cast fittings not permitted.

H. Use cable having color coded conductors as noted. Color coded conductor sleeves are not permitted.

I. Provide separate sleeves and/or fire barriers for cable fire wall penetration, unless cable is UL listed for the application.

J. MC cable is not permitted for homerun use. Extend cable from junction/wireway box having branch circuits for the immediate area. Use conduit for routing branch circuit conductors from junction or wireway box to the panelboard - locate this box in the approximate geometric center of the outlets served by that homerun.

3.3 WIRE IDENTIFICATION:

A. Provide wire markers on each conductor in panelboard, gutters, pullboxes, outlet and junction boxes, and at load connection. Identify with branch circuit or feeder number for power and lighting circuits, and with control wire number as indicated on equipment manufacturer's Shop Drawings for control wiring.

3.4 TESTING:

A. Notify Architect when installed cable is ready to be tested.

B. Apply megger tests. Supply labor, materials and test equipment required to perform continuity checks and megger tests. Submit test data for approval.

C. If any failure is detected, locate failure, determine cause and, as directed by Architect, replace or repair cable or conductor to satisfaction of Architect at no increase in Contract Sum.

D. Subject feeder cables rated 600 volts AC to one (1) minute withstand test, or until stable reading is obtained with 1000-volt megger. Provide written report of megger test results. Test report to include all test conditions.

E. Do not megger any cables after connecting to any equipment, unless specifically directed to do so by Architect.

END OF SECTION

SECTION 26 05 26 - GROUNDING & BONDING FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Rod electrodes.
2. Active electrodes.
3. Wire.
4. Grounding well components.
5. Mechanical connectors.
6. Exothermic connections.

1.2 REFERENCES

1.3 Institute of Electrical and Electronics Engineers:

1. IEEE 142 - Recommended Practice for Grounding of Industrial and Commercial Power Systems.
2. IEEE 1100 - Recommended Practice for Powering and Grounding Electronic Equipment.

B. International Electrical Testing Association:

1. ANSI/NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems.

C. Part 3, Title 24, - California Electrical Code (CEC).

1.4 SYSTEM DESCRIPTION

A. Grounding systems use the following elements as grounding electrodes:

1. Existing Metal underground water pipe.
2. Metal building frame.
3. Concrete-encased electrode.
4. Existing Metal underground gas piping system.
5. Rod electrode.
6. Plate electrode.

1.5 DESIGN REQUIREMENTS

A. Construct and test grounding systems for access flooring systems on conductive floors accordance with IEEE 1100.

1.6 PERFORMANCE REQUIREMENTS

A. Grounding System Resistance: 25 ohms maximum.

1.7 SUBMITTALS

A. Product Data: Submit data on grounding electrodes and connections.

B. Test Reports: Indicate overall resistance to ground [and resistance of each electrode].

C. Manufacturer's Installation Instructions: Submit for active electrodes.

1.8 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of components and grounding electrodes.

1.9 QUALITY ASSURANCE

A. Provide grounding materials conforming to requirements of NEC, IEEE 142, and UL labeled.

1.10 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years experience.

1.11 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site in original factory packaging, labeled with manufacturer's identification.

B. Protect from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original packaging.

C. Do not deliver items to project before time of installation. Limit shipment of bulk and multiple-use materials to quantities needed for immediate installation.

1.12 COORDINATION

A. Complete grounding and bonding of building reinforcing steel prior concrete placement.

PART 2 PRODUCTS

2.2 ROD ELECTRODES

A. Product Description:
   1. Material: Copper-clad steel.
   2. Diameter: 3/4 inch.
   3. Length: 10 feet.

B. Connector: U-bolt clamp.

2.3 ACTIVE ELECTRODES

A. Product Description:
   1. Material: Metallic-salt-filled copper-tube electrode.

2. Shape: Straight.
3. Length: 10 feet.
4. Connector: U-bolt clamp.

2.4 WIRE

A. Material: Stranded copper.

B. Grounding Electrode Conductor: Copper conductor insulated.

C. Bonding Conductor: Copper conductor insulated.

2.5 GROUNDING WELL COMPONENTS

A. Well Pipe: 8 inches NPS by 24 inches long concrete pipe with belled end.

B. Well Cover: Cast iron with legend "GROUND" embossed on cover.

2.6 MECHANICAL CONNECTORS

A. Description: Bronze connectors, suitable for grounding and bonding applications, in configurations required for particular installation.

2.7 EXOTHERMIC CONNECTIONS

A. Product Description: Exothermic materials, accessories, and tools for preparing and making permanent field connections between grounding system components.

PART 2 EXECUTION

3.2 EXAMINATION

A. Verify final backfill and compaction has been completed before driving rod electrodes.

3.3 PREPARATION

A. Remove paint, rust, mill oils and surface contaminants at connection points.

3.4 INSTALLATION

A. Install rod electrodes at locations as indicated on Drawings. Install additional rod electrodes to achieve specified resistance to ground.

B. Install grounding and bonding conductors concealed from view.

C. Install grounding well pipe with cover at each rod location. Install well pipe top flush with finished grade.

D. Bond together metal siding not attached to grounded structure; bond to ground.

E. Install continuous grounding using underground cold water system and building steel as grounding electrode. Where water piping is not available, install artificial station ground by means of driven rods or buried electrodes.

F. Permanently ground entire light and power system in accordance with NEC, including service equipment, distribution panels, lighting panelboards, switch and starter enclosures, motor frames, grounding type receptacles, and other exposed non-current carrying metal parts of electrical equipment.

G. Accomplish grounding of electrical system by using insulated grounding conductor installed with feeders and branch circuit conductors in conduits. Size grounding conductors in accordance with NEC or as indicated on drawings. Install from grounding bus of serving panel to ground bus of served panel, grounding screw of receptacles, lighting fixture housing, light switch outlet boxes or metal enclosures of service equipment. Ground conduits as necessary by means of grounding bushings on terminations at panelboards and switchboards to grounding bus.

H. Permanently attach equipment and grounding conductors prior to energizing equipment.

3.5 FIELD QUALITY CONTROL

A. Provide visual and mechanical inspection in accordance with NETA ATS, 7.13.1.

B. Perform electrical tests in accordance with NETA ATS, 7.13.2.

C. Grounding and Bonding: Perform inspections and tests listed in NETA ATS, Section 7.13.

D. Perform ground resistance testing in accordance with IEEE 142.

E. Perform continuity testing in accordance with IEEE 142.

F. Provide written test results of grounding electrode system and submit to Architect.

END OF SECTION

SECTION 26 05 29 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Conduit and cable tray supports.
2. Formed steel channel.
3. Spring steel clips.
4. Sleeves.
5. Mechanical sleeve seals.
6. Firestopping relating to electrical work.
7. Firestopping accessories.
8. Floor and wall mounted equipment bases and supports.

1.2 REFERENCES

A. ASTM International:

1. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
2. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.
3. ASTM E814 - Standard Test Method for Fire Tests of Through-Penetration Fire Stops.
4. ASTM E1966 - Standard Test Method for Fire-Resistive Joint Systems.

B. Part 3, Title 24, - California Electrical Code (CEC).

C. Underwriters Laboratories Inc.:

1. UL 1479 - Fire Tests of Through-Penetration Firestops.
2. UL - Fire Resistance Directory.

1.3 DEFINITIONS

A. Firestopping (Through-Penetration Protection System): Sealing or stuffing material or assembly placed in spaces between and penetrations through building materials to arrest movement of fire, smoke, heat, and hot gases through fire rated construction.

1.4 SYSTEM DESCRIPTION

A. Firestopping Materials: UL 1479, to achieve fire ratings in accordance with UL Design Numbers noted on Drawings.

1.5 PERFORMANCE REQUIREMENTS

A. Penetrations: Provide through-penetration firestop systems that are installed to resist the spread of fire, passage of smoke and other hot gases according to requirements indicated, to restore the original fire-resistance rating of assembly penetrated.

1. Install complete through penetration firestop systems that have been tested and are listed by recognized testing agencies per ASTM E 814 or UL 1479 fire tests in a configuration that is representative of site conditions.
2. F-Rated Systems: Install through-penetration firestop systems with F-ratings indicated, as determined per ASTM E 814 or UL 1479, but not less than the fire resistance rating of the assembly being penetrated.
3. T-Rated Systems: Install through-penetration firestop systems with T-ratings indicated, as well as F-ratings, as determined per ASTM E 814 or UL 1479, where required by the Building Code.

1.6 SUBMITTALS

A. Shop Drawings: Indicate system layout with location and detail of trapeze hangers.

B. Product Data:
1. Hangers and Supports: Submit manufacturers catalog data including load capacity.
2. Firestopping: Submit data on product characteristics, performance and limitation criteria.

C. Firestopping Schedule: Submit schedule of opening locations and sizes, penetrating items, and required listed design numbers to seal openings to maintain fire resistance rating of adjacent assembly.

D. Design Data: Indicate load carrying capacity of trapeze hangers and hangers and supports.

E. Manufacturer's Installation Instructions:
1. Hangers and Supports: Submit special procedures and assembly of components.
2. Firestopping: Submit preparation and installation instructions.

F. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

G. Engineering Judgements: For conditions not covered by UL or WH listed designs, submit judgements by licensed professional engineer suitable for presentation to authority having jurisdiction for acceptance as meeting code fire protection requirements.

1.7 SEISMIC DETAILS AND CALCULATIONS

A. Submit details and calculations for support and anchors that are not specifically detailed on the Drawings where required by California Building Standards Code, California Code of Regulations, Title 24. Pre-approved systems may be used as noted below only if the pre-approval is current and accepted by the local agency having jurisdiction.

B. Where pre-approved bracing systems will be employed, submit:
1. System component brochure describing components used and detailed installation instructions.
2. Loads to be transmitted to the structure at anchor points.

C. Where pre-approved bracing systems are not used, submit details and calculations of proposed systems. Include:

1. Detailed drawings and calculations showing system to be installed, stamped by a Structural Engineer registered in the state of California.
2. Loads to be transmitted to the structure at anchor points.

D. Submit detailed routing and installation drawings of all raceway systems requiring seismic supports for review. Include attachment points, raceway sizes and methods proposed for securing and attaching.

1.8 QUALITY ASSURANCE

A. Through Penetration Firestopping of Fire Rated Assemblies: UL 1479 with 0.10 inch water gage minimum positive pressure differential to achieve fire F-Ratings and temperature T-Ratings as indicated on Drawings, but not less than 1-hour.

1. Wall Penetrations: Fire F-Ratings as indicated on Drawings, but not less than 1-hour.
2. Floor Penetrations: Fire F-Ratings and temperature T-Ratings as indicated on Drawings, but not less than 1-hour.
   a. Floor Penetrations Within Wall Cavities: T-Rating is not required.

B. Through Penetration Firestopping of Non-Fire Rated Floor and Roof Assemblies: Materials to resist free passage of flame and products of combustion.

1. Noncombustible Penetrating Items: Noncombustible materials for penetrating items connecting maximum of three stories.
2. Penetrating Items: Materials approved by authorities having jurisdiction for penetrating items connecting maximum of two stories.

1.9 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years experience.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site in original factory packaging, labeled with manufacturer's identification.

B. Protect from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original packaging.

1.11 ENVIRONMENTAL REQUIREMENTS

A. Do not apply firestopping materials when temperature of substrate material and ambient air is below 60 degrees F.

B. Maintain this minimum temperature before, during, and for minimum 3 days after installation of firestopping materials.

C. Provide ventilation in areas to receive solvent cured materials.

PART 2 PRODUCTS

2.1 CONDUIT SUPPORTS

A. Hanger Rods: Threaded high tensile strength galvanized carbon steel with free running threads.

B. Beam Clamps: Malleable Iron, with tapered hole in base and back to accept either bolt or hanger rod. Set screw: hardened steel.

C. Conduit clamps for trapeze hangers: Galvanized steel, notched to fit trapeze with single bolt to tighten.

D. Conduit clamps - general purpose: One hole malleable iron for surface mounted conduits.

E. Cable Ties: High strength nylon temperature rated to 185 degrees F. Self locking.

2.2 FORMED STEEL CHANNEL

A. Product Description: 1 5/8 inches square Galvanized 12 gage thick steel. With holes 1-1/2 inches on center.

2.3 SPRING STEEL CLIPS

A. Product Description: Mounting hole and screw closure.

2.4 SLEEVES

A. Sleeves for Through Non-fire Rated Floors: 18 gage thick galvanized steel.

B. Sleeves for Through Non-fire Rated Beams, Walls, Footings, and Potentially Wet Floors: Steel pipe or 18 gage thick galvanized steel.

C. Sleeves for Through Fire Rated and Fire Resistive Floors and Walls, and Fire Proofing: Prefabricated fire rated sleeves including seals, UL listed.

D. Fire-stopping Insulation: Glass fiber type, non-combustible.

2.5 MECHANICAL SLEEVE SEALS

A. Product Description: Modular mechanical type, consisting of interlocking synthetic rubber links shaped to continuously fill annular space between object and sleeve, connected with bolts and pressure plates causing rubber sealing elements to expand when tightened, providing watertight seal and electrical insulation.

2.6 FIRESTOPPING

A. Product Description: Different types of products by multiple manufacturers are acceptable as required to meet specified system description and performance requirements; provide only one type for each similar application.

1. Silicone Firestopping Elastomeric Firestopping: Single component silicone elastomeric compound and compatible silicone sealant.
2. Foam Firestopping Compounds: Single component foam compound.
3. Formulated Firestopping Compound of Incombustible Fibers: Formulated compound mixed with incombustible non-asbestos fibers.

4. Fiber Stuffing and Sealant Firestopping: Composite of mineral fiber stuffing insulation with silicone elastomer for smoke stopping.
5. Mechanical Firestopping Device with Fillers: Mechanical device with incombustible fillers and silicone elastomer, covered with sheet stainless steel jacket, joined with collars, penetration sealed with flanged stops.
6. Intumescent Firestopping: Intumescent putty compound which expands on exposure to surface heat gain.
7. Firestop Pillows: Formed mineral fiber pillows.

2.7 FIRESTOPPING ACCESSORIES

A. Primer: Type recommended by firestopping manufacturer for specific substrate surfaces and suitable for required fire ratings.

B. Installation Accessories: Provide clips, collars, fasteners, temporary stops or dams, and other devices required to position and retain materials in place.

C. General:

1. Furnish UL listed products.
2. Select products with rating not less than rating of wall or floor being penetrated.

D. Non-Rated Surfaces:

1. Stamped steel, chrome plated, hinged, split ring escutcheons or floor plates or ceiling plates for covering openings in occupied areas where conduit is exposed.
2. For exterior wall openings below grade, furnish modular mechanical type seal consisting of interlocking synthetic rubber links shaped to continuously fill annular space between conduit and cored opening or water-stop type wall sleeve.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify openings are ready to receive sleeves.

B. Verify openings are ready to receive firestopping.

3.2 PREPARATION

A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other matter affecting bond of firestopping material.

B. Remove incompatible materials affecting bond.

C. Install damming materials to arrest liquid material leakage.

D. Obtain permission from Architect/Engineer before using powder-actuated anchors.

E. Do not drill or cut structural members.

3.3 INSTALLATION - HANGERS AND SUPPORTS

A. Anchors and Fasteners:

1. Concrete Structural Elements: Provide precast inserts, expansion anchors, powder actuated anchors and preset inserts.
2. Steel Structural Elements: Provide beam clamps, spring steel clips, steel ramset fasteners, and welded fasteners.
3. Concrete Surfaces: Provide self-drilling anchors and expansion anchors.
4. Hollow Masonry, Plaster, and Gypsum Board Partitions: Provide structural backing plate.
5. Solid Masonry Walls: Provide expansion anchors and preset inserts.
6. Sheet Metal: Provide sheet metal screws.
7. Wood Elements: Provide wood screws.

B. Inserts:

1. Install inserts for placement in concrete forms.
2. Install inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
3. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches.
4. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
5. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut flush with top of slab.

C. Install conduit and raceway support and spacing in accordance with the California Electrical Code.

D. Install all support devices according to manufacturer's guidelines and recommendations.

E. Do not fasten supports to pipes, ducts, mechanical equipment, or conduit.

F. Do not drill through structural framing members.

G. Do not support equipment or fixtures from the roof deck. Provide necessary framing and joist hangers to span between structural members to locate hangers properly.

H. Install multiple conduit runs on common hangers.

I. Supports:

1. Fabricate supports from structural steel or formed steel channel. Install hexagon head bolts to present neat appearance with adequate strength and rigidity. Install spring lock washers under nuts.
2. Install surface mounted cabinets and panelboards with minimum of four anchors.
3. In wet and damp locations install steel channel supports to stand cabinets and panelboards 1 inch off wall.
4. Support vertical conduit at every [other] floor.

3.4 INSTALLATION - FIRESTOPPING

A. Install material at fire rated construction perimeters and openings containing penetrating sleeves, piping, ductwork, conduit and other items, requiring firestopping.

B. Apply primer where recommended by manufacturer for type of firestopping material and substrate involved, and as required for compliance with required fire ratings.

C. Apply firestopping material in sufficient thickness to achieve required fire and smoke rating.

D. Fire Rated Surface:

1. Seal opening at floor, wall, partition, ceiling, and roof as follows:
   a. Install sleeve through opening and extending beyond minimum of 1 inch on both sides of building element.
   b. Size sleeve allowing minimum of 1 inch void between sleeve and building element.
   c. Pack void with backing material.
   d. Seal ends of sleeve with UL listed fire resistive silicone compound to meet fire rating of structure penetrated.
2. Where cable tray, conduit, and wireway penetrates fire rated surface, install firestopping product in accordance with manufacturer's instructions.

E. Non-Rated Surfaces:

1. Seal opening through non-fire rated wall, partition, floor, ceiling, and roof opening as follows:
   a. Install sleeve through opening and extending beyond minimum of 1 inch on both sides of building element.
   b. Size sleeve allowing minimum of 1 inch void between sleeve and building element.
   c. Install type of firestopping material recommended by manufacturer.
2. Install escutcheons, floor plates or ceiling plates where conduit, penetrates non-fire rated surfaces in occupied spaces. Occupied spaces include rooms with finished ceilings and where penetration occurs below finished ceiling.
3. Exterior wall openings below grade: Assemble rubber links of mechanical seal to size of conduit and tighten in place, in accordance with manufacturer's instructions.

3.5 INSTALLATION - EQUIPMENT BASES AND SUPPORTS

A. Provide housekeeping pads of concrete, minimum 4 inches thick and extending 6 inches beyond supported equipment.

B. Using templates furnished with equipment, install anchor bolts, and accessories for mounting and anchoring equipment.

3.6 INSTALLATION - SLEEVES

A. Exterior watertight entries: Seal with adjustable interlocking rubber links.

B. Conduit penetrations not required to be watertight: Sleeve and fill with silicon foam.

C. Set sleeves in position in forms. Provide reinforcing around sleeves.

D. Size sleeves large enough to allow for movement due to expansion and contraction. Provide for continuous insulation wrapping.

E. Extend sleeves through floors 1 inch above finished floor level. Caulk sleeves.

F. Where conduit or raceway penetrates floor, ceiling, or wall, close off space between conduit or raceway and adjacent work with fire stopping insulation and caulk. Provide close fitting metal collar or escutcheon covers at both sides of penetration.

G. Install chrome plated steel escutcheons at finished surfaces.

3.7 FIELD QUALITY CONTROL

A. Inspect installed firestopping for compliance with specifications.

3.8 CLEANING

A. Clean adjacent surfaces of firestopping materials.

3.9 PROTECTION OF FINISHED WORK

A. Protect adjacent surfaces from damage by material installation.

END OF SECTION

SECTION 26 05 33 - CONDUIT, FITTINGS & SUPPORTS

PART 1 - GENERAL

1.1 CONDITIONS:

A. The Requirements of this Section apply to all Work of Division 16, as applicable.

B. Where items specified in other Sections of Division 16 conflict with Requirements of this Section, the most stringent requirements shall govern.

1.2 WORK INCLUDED:

A. Furnish, assemble, erect, install, connect, and test all power, control and lighting conduits, including fittings, boxes, sealing materials, drain fittings and any other miscellaneous equipment and material required and as specified herein and as shown to form complete installation.

B. Install all equipment in accordance with Requirements of 2013 California Electrical Code unless otherwise specified or shown.

C. Surface nonmetallic raceway system used for branch circuit wiring or data network, voice, video and other low-voltage wiring where shown on drawings. The nonmetallic raceway system shall consist of raceway, appropriate fittings and device boxes to complete installation. Surface nonmetallic raceway is to be utilized in dry interior locations only as covered in Article 352 Part B of the National Electrical Code, as adopted by the National Fire Protection Association and as approved by the American National Standards Institute. The Wiremold/Legrand Raceway System is listed by Underwriters Laboratories Inc. under File Nos. E90378 Guide RJTX and E90377Guide RJYT.

1.3 QUALITY ASSURANCE:

A. Reference Standards:

1. ANSI - American National Standards Institute

C80.3	Specification for Electrical Metallic Tubing, Zinc-Coated.
C80.1	Specification for Rigid Steel Conduit, Zinc-Coated.
C33.91	Specification for Rigid PVC Conduit.

2. FS - Federal Specifications

WW-C-563	Conduit, Metal, Rigid: Electrical, Thin-Wall Steel Type (Electrical Metallic Tubing); Straight Lengths, Elbows, and Bends.
WW-C-566	Conduit, Metal, Flexible.
WW-C-581E	Conduit, Metal, Rigid; and Coupling, Elbow, and Nipple, Electrical Conduit: Zinc-Coated.
W-C-1094A	Conduit and Conduit Fittings, Plastic, Rigid.
W-C-586	Conduit, Outlet Boxes, Bodies and Entrance Caps (Cast Metal).
W-J-800	Junction Box; Extension, Junction Box; Cover, Junction Box (Steel, Cadmium, or Zinc-Coated).
W-S-865	Switch, Box (enclosed), Surface-Mounted.

3. NEMA - National Electrical Manufacturer's Association

RNI	Polyvinyl-Chloride Externally Coated Galvanized Rigid Steel Conduit and Electrical Metallic Tubing.
TC-2	Electrical Plastic Tubing (EPT) and Conduit (EPC-40 and EPC-80).
TC-3	PVC Fitting for Use with Rigid PVC Conduit and Tubing.
TC-6	PVC and ABS Plastic Utilities Ducts for Underground Installation.

4. UL - Underwriter's Laboratories, Inc.

6	Rigid Metal Electrical Conduit.
360	Liquid-Tight Flexible Steel Conduit.
514	Metallic Outlet Boxes, Electrical.
651	Schedule 40 and 80 PVC Conduit.
797	Electrical Metallic Tubing.
1242	Intermediate Metal Conduit.

PART 2 - PRODUCTS

2.1 MATERIALS: Use only self-extinguishing, non-hygroscopic corrosion- resistant material and equipment.

A. Conduit, Fittings and Supports:

1. Rigid Steel Conduits (RSC), Condulets, and Fittings: Hot-dipped galvanized; ANSI C80.1, UL6, and FS WW-C-581E.
2. Intermediate Metallic Conduit (IMC): Hot-dipped galvanized; UL 1242 and FS WW-C-581E.
3. Electrical Metallic Tubing (EMT): Electro-galvanized; ANSI C80.3, UL 797, and FS WW-C-563. EMT only on interior of buildings.
4. Coated Rigid Steel Conduit: Polyvinyl-chloride (PVC) coating factory bonded to outer surface of RSC conduit. Bond between PVC coating and conduit surface shall be greater than the tensile strength of PVC. Thickness of Coating: Forty (40) mil. minimum. Tensile Strength: 3500 psi. All fittings with same coating as conduit, PVC sleeve over fittings shall extend beyond the hub or coupling approximately one (1) diameter or one and one-half inches (1 1/2"), whichever is smaller. Coated Conduit: NEMA Standard RNI (Type A). Occidental Coating Company “OCCAL-40”, Plastic Applicators “KorKap”, RobRoy Industries “Plasti-Bond” or equal.
5. PVC Conduit: Type 40 and Type 80, ninety degrees (90^{o}) C., composed of polyvinyl-chloride, NEMA TC-2, TC-3 (fittings UL 514), FS W-C-1094A, UL 651 and ANSI C33.91. Tensile Strength: 7,000 psi at seventy-three point four degrees (73.4^{o}) F. Flexural Strength: 11,000 psi. Compressive Strength: 8,600 psi. Fittings shall be by same manufacturer. Joints: Solvent welded.
6. Flexible Conduit: FS WW-C-566. Flexible steel, zinc coated on both inside and outside by hot-dipping process, interlocked spirally wound steel strip. Liquid tight flexible conduit shall be with extruded polyvinyl covering and with continuous copper bonding conductor wound spirally between convolutions or installed with ground type end fittings at each end to accommodate grounding jumper to provide continuous ground bond. Minimum size: One-half inch (1/2”) except where supplied as part of an approved manufactured assembly integrally wired into recessed light fixtures.
7. Fittings: UL Standard No. UL 514 and listed in UL Electrical Construction Materials List.
8. Fittings types:

   a. Condulets: Crouse-Hinds “Form 8” or equal.
   b. Flexible Conduit Fittings: Squeeze type, clamp type or water-tight type with gland nut where required with insulated throats. Set screw type, not acceptable.
   c. EMT Fittings: Two-inch (2”) trade size and smaller, raintight, steel compression type requiring tightening of a nut. Set screw type, two and one half (2 1/2") trade size and larger. Box connector with insulated throat. Do not use insulated throat for #4 AWG conductors or larger, use separate insulated bushings.
   d. RSC and IMC Couplings and Unions Four inch (4”) Diameter and Smaller. Threaded type.
   e. Chase Nipple with Insulators, Steel Locknuts, and Insulated Bushings: Thomas & Betts Company or equal.
   f. Reducing Bushings, Condulet Gaskets, and Condulet Covers: Crose-Hinds types or equal.
   g. Threadless Metallic Insulating Bushings for EMT, EMT Straps, Rigid Steel Conduit Straps and Rigid Steel Conduit Couplings: EFCOR or equal.

9. Electrical Support Types:

    a. Electrical Supports: One and five-eighths inches (1 5/8") by one and five-eighths inches (1 5/8") hot dipped galvanized ASTM A-123 and A-153 (outdoor use), electrogalvanized ASTM B-633-85 (indoor use) channel formed from U.S.S.G. No. 12 or 0.109 inch material; cold formed from prime pickled and oiled mild strip steel. Length of Each Section: Ten feet (10').
    b. All Electrical Supports, Fittings, and Accessories: Of same manufacturer and shall fit together as system without modification.
    c. Threaded Rods, Couplings, Screws, and Nuts: Electrogalvanized in compliance with ASTM B-633-85.
    d. Finish On All Other Items: For outdoor use, hot-dipped galvanized after fabrication; after cutting, de-burring, and hole drilling; zinc weight two ounces (2 oz) per square foot of surface; ASTM A123 and A153. For indoor use, electrogalvanized ASTM B-633-85 after fabrication, cutting, de-burring, and hole drilling.

B. Outlet and Junction Boxes:

1. Outlet Boxes and Fittings: UL 514.
2. Outlet Boxes: Galvanized sheet steel for indoor locations and of proper Code size for required number of conductors; four inch (4") square unless specifically shown on Drawings; complete with approved type of connectors and required accessories. Boxes for one-inch (1") conduit or larger, four and eleven-sixteenths inches (4 11/16") minimum trade size.
3. Outlet boxes shall be complete with raised device covers as required to accept device installed. Securely fasten all outlet boxes in position with exposed edge of raised device cover set flush with finished surface. Install approved factory made knockout seals where knockouts are not intact.
4. Surface Mounted Outlet Boxes Located Indoor Below Eight Feet (8') Above Floor Line: Threaded Cast Boxes.
5. Outlet Boxes Located on Exterior in Damp or Wet Locations or As Otherwise Shown or Specified: NEMA 4 threaded cast boxes.
6. Equip receptacle outlet boxes with grounding lead. Connect to grounding terminal of device.
7. Pullboxes: Galvanized sheet steel, Code gauge, except 12 gauge shall be minimum.
8. Paint for Touch-up for Wrench Marks: Glyptal, PVC paste or equal.
9. Ceramic Fiber: Babcock & Wilcox "Kaowool", Carborundum "Fiberflex", John Mansville "Ceraflex" or equal.
10. Channel Supports for Conduit and Larger Junction and Pullboxes: B-Line, Unistrut, Superstrut or equal.

PART 3 - EXECUTION

3.1 INSTALLATION OF CONDUIT AND BOXES:

A. Installation:

1. Install into complete, integrated arrangement with like elements to make Work neat appearing and finished.
2. Do not install PVC conduit above ground.
3. All Conduits Shall Be Rigid Steel or IMC, except EMT may be used at the following locations:

    a. In dry locations in furred spaces.
    b. In partitions other than concrete or solid masonry.
    c. In exposed (above eight feet (8')) interior/exterior locations and in electrical/mechanical/communications rooms made up with watertight compression type connectors and couplings. Connectors to outlets shall be insulated throat type with integral non-removable plastic insulator lining.

4. Minimum Size Conduit: Three-quarter inch (3/4"). Minimum size PVC conduit outside foundation line shall be one inch (1"). Use Type THW wire for sizing conduit fill.
5. All Conduit Embedded in Floor Slab or in Concrete Walls or on Roof: Rigid steel or IMC Conduit.
6. Use coated rigid steel conduit in soil or underground.
7. PVC Conduit with Code Size Ground Wire may be Used in Soil or in Concrete under the following conditions:

    a. Terminate with coated rigid steel elbows and short length of coated rigid steel conduits out of soil or concrete.
    b. Install PVC conduit in sand or fine earth envelope of at least three inches (3") all around inside foundation line. Bends and elbows shall be PVC Type 80 conduit centered at foundation line.
    c. Underground PVC conduit runs outside foundation line shall be installed under the following conditions:

        1) Bends and ells shall be PVC Type 80 coupled with proper adapters. Conduit through foundation wall shall have one length of PVC Schedule 80 conduit centered at foundation line.
        2) Lay runs straight. Make couplings watertight.
        3) Terminate conduit entering pull hole with manufactured end bells.
        4) Place approximately twelve inches (12") below finished grade and over primary and secondary service conduit duct line, a five (5) mil. brightly colored plastic tape not less than three inches (3") in width and suitably inscribed at not more than ten feet (10') on centers with a continuous metallic backing and a corrosion resistant one (1) mil. metallic foil core to permit easy location of the duct line.

    d. Patch all coated conduit according to the manufacturer's recommendation. Completely coat all holidays and tool marks using paste recommended by manufacturer. Coat remaining exposed conduit threads with paste when installation is complete.

8. Cut conduit square, thread, and paint. Remove burrs and sharp edges at ends of each conduit with tapered reamer. Field Threads: Same type and have same effective lengths as factory threads.
9. Cap open ends of conduits with manufactured conduit seals as soon as installed and keep capped until ready to install conductors. Swab out conduits before wires are pulled in.
10. Terminate conduit with insulated bushings. Seal ends of conduit to prevent entrance of foreign material and protect threads.
11. Conceal conduit in all areas except within mechanical and electrical areas where they may be run exposed, if they cannot be concealed.

    a. Assemble conduit threads with anti-corrosion, conductive, anti-seize compound and tighten joints securely. Where conduit is embedded, paint wrench marks with "Glyptol" or equal.
    b. Install conduit so there will be no traps to collect condensation.
    c. Fasten conduit securely to boxes with locknuts and bushings to provide good grounding continuity. Terminate all conduit with insulating bushing or insulated throat.
    d. Rigid Steel Feeder Conduit Bushings shall be complete with non- removable insulated lining, O.Z. type "BLG" with lug type grounding connector, except where otherwise shown or specified.
    e. Make long radius conduit bends free from kinks, indentations or flattened surfaces. Make bends carefully to avoid injury or flattening. Bends in conduit one and one-quarter inch (1-1/4") size and larger shall be factory made ells, or be made with a manufactured mechanical bender. Heating of steel conduit to facilitate bending will not be permitted. Bend conduit cold to prevent damage to galvanized coating. Remove burrs and sharp edges at end of each conduit with tapered reamer.

f. Where exposed, run conduit parallel with walls or structural elements; vertical runs plumb; horizontal runs level or parallel with structure as appropriate; groups racked together neatly with both straight runs, bends parallel, and uniformly spaced. Exposed conduit below eight feet (8') from floor shall be rigid type. Maintain a minimum of six inches (6") clearance from steam or hot water pipes.

12. Install exposed conduit as high as practical to maintain adequate headroom as shown or required. Notify Architect before installation whenever headroom of less than eight feet six inches (8'6") will result. Coordinate with Work of other Divisions to achieve proper headroom as specified in this Division.
13. Clearance: Do not obstruct spaces required by Code in front of electrical equipment, access doors, and similar items.
14. Penetrations:

    a. Pack space between conduit and walls with non-combustible materials. Make penetrations through floors watertight, even when concealed within wall or furred space.
    b. Make penetrations through any dampproofed/waterproofed surfaces dampproof/waterproof by appropriate means to maintain integrity of system penetrated. This includes penetrations made by hangers suspended from such surfaces.
    c. Provide chrome plated escutcheon plates at exposed wall, ceiling and floor conduit penetrations.

15. Firestopping:

    a. Seal all conduit penetrations through fire rated walls and floors fire and smoke tight in conformance with CBC Sections 709 and 710, and 2013 CEC 300-21.
    b. Refer to provisions of Section 07270.

16. To facilitate pulling of feeder conductors install pullboxes as shown or required, junction boxes where specified.
17. Chasing: Do not "chase" concrete to install conduit unless specifically directed by the Architect.
18. Expansion Joints: Where crossing of expansion joints is unavoidable, cross concealed conduit in concrete structure at right angels with expansion sleeve fitting. Expansion Fitting: Designed to compensate for expansion and contraction in line of conduit. Seal expansion end by high-grade packing, which will prevent entrance of water or moisture. Provide end of conduit with insulated bushings. Provide copper grounding rings or auxiliary flexible bonding jumper, equal to at least three (3) times the nominal width of joint, carefully installed to insure proper operation, to secure continuous ground between conduit and fitting. Provide expansion fitting as follows:

    a. Provide conduit expansion fitting in each conduit run, which is mechanically attached to separate structures to relieve strain caused by shift of one structure in relation to another.
    b. Provide conduit expansion fitting in each conduit run wherever it crosses expansion joint in structure to which it is attached.
    c. Provide expansion fittings where expansion and contraction are a consideration in long runs of exposed conduits (one inch [1"] or larger conduit in excess of one hundred feet [100']).

19. Seal underground conduit terminating in exposed or outdoor equipment and junction boxes and underground conduit entering equipment with Babcock & Wilcox "Kaowool", Carborundum "Fiberflex", John Mansville "Ceraflex", and Flammastic "Mastic" or equal.
20. Supports: Sizes of rods and cross channels shall be capable of supporting four (4) times actual load. Hanger rods shall have safety factor of five (5) based on ultimate strength of material used. Anchorage shall support combined weight of conduit, hanger and conductors.

a. Support individual horizontal conduit one and one-half inch (1 1/2") size and smaller by means of two (2) hole straps or individual hangers. Support larger size conduit with hangers. Perforated strap hangers not acceptable.

   1) Exposed EMT shall be supported with one (1) hole strap within thirty-six inches (36") of connector or within thirty-six inches (36") on each side of coupling.

b. Galvanized iron hanger rods sizes one-quarter inch (1/4") diameter and larger with spring steel fasteners, clips or clamps specifically designed for purpose for conduit up to one inch (1") size may be used.

c. Individual conduit three-quarter inch (3/4") and smaller run above suspended ceilings shall be supported from an independent hanger wire with approved spring steel clips. Conduit shall not be secured to, or supported by, the ceiling assembly, including ceiling support wires.

d. Support conduit to wood structure by means of bolts or lag screws in shear, to concrete by means of insert or expansion bolts and to brickwork by means of expansion bolts.

e. Support multi-parallel vertical conduit runs with galvanized "Unistrut", or approved equal, type supports anchored to wall. Where larger conduit of multi-story buildings pass through floors, support conduit with riser clamps at each floor.

21. Conduit support spacings shall be in accordance with NECA Standard of Installation, as follows:

Conduit Size Inches	No. of Conductors In Run	Location	Max. Spacing of Supports Ft.
Horizontal Runs			
3/4	1 or 2	Flat ceiling or wall	5
3/4	1 or 2	Where it is difficult to provide supports except at intervals fixed by the building construction	7
3/4	3 or more	Any location	7
1 and larger	1 or 2	Flat ceiling or wall	6
1 and larger	1 or 2	Where it is difficult to provide support except at intervals fixed by the building construction	10
1 and larger	3 or more	Any location	10
Any	- - -	Concealed	10
Vertical Runs			
3/4	- - -	Exposed	7
1, 1-1/4	- - -	Exposed	8
1-1/2 & larger	- - -	Exposed	10
Up to 2	- - -	Shaftway	14
2-1/2 & larger	- - -	Shaftway	28
Any	- - -	Concealed	10

Screws Sizes for Conduit Supports	
3/4" RSC, 1/2" - 1-1/4" EMT:	#10
1" RSC, 1-1/2" EMT:	1/4"
1-1/2" - 2" RSC, 2" - 3" EMT:	3/8"
3" RSC, 4" EMT:	1/2"

22. All empty conduits that are installed for future use shall have pull line.

23. Provide polypropylene pull line in each empty conduit run.

3.2 SPECIAL SEISMIC REQUIREMENTS:

A. Conduits shall be supported and braced per OSHPD Anchorage Pre-approval No. R-0010, the SMACNA “Guidelines for Seismic Restraints of Mechanical Systems and Plumbing Piping Systems”, No. R-0003 the “Superstrut Seismic Restraint System” for pipes and conduits only.

3.3 INSTALLATION - OUTLET, JUNCTION BOXES, PULLBOXES:

A. Where boxes are used in connection with exposed conduit, plain covers attached to box with suitable number of countersunk flathead machine screws may be used.

B. Securely fasten boxes. Set in position with exposed edge of raised device cover flush with finished surface.

C. Install pullboxes as required in accessible spaces but do not install in finished areas unless directed by Architect.

D. Pull Holes/Pullboxes: Top flush in finished areas and one inch (1”) above finished grade in landscape areas. Install two inch (2”) drain at bottom to a dry well eight inches (8”) diameter by thirty inches (30”) deep filled with gravel. Seal all conduit terminating in pull hole watertight. Covers/lids shall be removable without damage to adjacent finish surfaces.

E. Installation of conduit and outlet boxes in fire-resistive walls and partitions shall comply with Title 24, Part 2, Section 709.

F. Installation of conduit and outlet boxes in fire-resistive floors, floor-ceiling or roof-ceiling assemblies shall comply with Title 24, Part 2, Section 710.

G. Outlet Boxes and Junction Boxes: Install in accordance with 2013 CEC Article 370.

3.4 WIREMOLD SURFACE MOUNTED RACEWAY INSTALLATION:

A. Prior to and during installation, refer to system layout drawings containing all elements of the system. Installer shall comply with detailed manufacturer's instruction sheets, which accompany system components, as well as system instruction sheets.

B. Raceway Support: Raceway shall be securely supported in accordance with manufacturer's installation sheets.

C. Completeness: Work shall include furnishing all raceway and appropriate fittings and device plates to install a complete nonmetallic surface raceway system as indicated on the electrical drawings and in this specification. All unused raceway openings shall be closed.

END OF SECTION

Section 25 05 36 – CABLE TRAY

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes steel cable trays and accessories.

1.2 SUBMITTALS

A. Product Data: Include data indicating dimensions and finishes for each type of cable tray indicated.

B. Shop Drawings: Show fabrication and installation details of cable trays, including plans, elevations, and sections of components and attachments to other construction elements. Designate components and accessories, including clamps, brackets, hanger rods, splice-plate connectors, expansion-joint assemblies, straight lengths, and fittings.

1. Seismic-Restraint Details: Signed and sealed by a qualified professional engineer, licensed in the state where Project is located, who is responsible for their preparation.

a. Design Calculations: Calculate requirements for selecting seismic restraints.
b. Detail fabrication, including anchorages and attachments to structure and to supported cable trays.

C. Field quality-control reports.

D. Operation and maintenance data.

1.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Cooper B-Line, Inc.
2. Legrand.
3. or Equal

2.2 MATERIALS AND FINISHES

A. Cable Trays, Fittings, and Accessories: Steel tray and fittings complying with NEMA 20A, Pre-galvanized zinc ASTM A653SS. Hardware and accessories electrogalvanized zinc ASTM B633.

B. Sizes and Configurations: Refer to the Cable Tray Schedule on Drawings for specific requirements for types, materials, sizes, and configurations.

1. Center-hanger supports may not be used.

2.3 CABLE TRAY ACCESSORIES

A. Fittings: Tees, crosses, risers, elbows, and other fittings as indicated, of same materials and finishes as cable tray.

B. Cable tray supports and connectors, including bonding jumpers, as recommended by cable tray manufacturer.

2.4 WARNING SIGNS

A. Lettering: 1-1/2-inch- high, black letters on yellow background with legend "WARNING! NOT TO BE USED AS WALKWAY, LADDER, OR SUPPORT FOR LADDERS OR PERSONNEL."

B. Materials and fastening are specified in Division 16 Section "Electrical Identification."

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with recommendations in NEMA 20A

B. Install as a complete system, including all necessary fasteners, hold-down clips, splice-plate support systems, barrier strips, hinged horizontal and vertical splice plates, elbows, reducers, tees, and crosses.

C. Remove burrs and sharp edges from cable trays.

D. Fasten cable tray supports to building structure and install seismic restraints.

1. Design each fastener and support to carry load indicated by seismic requirements

2. Place supports so that spans do not exceed maximum spans on schedules.
3. Construct supports from channel members, threaded rods, and other appurtenances furnished by cable tray manufacturer. Arrange supports in trapeze or wall-bracket form as required by application.
4. Support bus assembly to prevent twisting from eccentric loading.
5. Manufacture center-hung support, designed for 60 percent versus 40 percent eccentric loading condition, with a safety factor of 3.
6. Locate and install supports according to NEMA 20A.

E. Install expansion connectors where cable tray crosses building expansion joint and in cable tray runs that exceed dimensions recommended in NEMA 20A. Space connectors and set gaps according to applicable standard.

F. Make changes in direction and elevation using standard fittings.

G. Make cable tray connections using standard fittings.

H. Seal penetrations through fire and smoke barriers according to "Through-Penetration Firestop Systems."

I. Sleeves for Future Cables: Install capped sleeves for future cables through firestop-sealed cable tray penetrations of fire and smoke barriers.

J. Workspace: Install cable trays with enough space to permit access for installing cables.

K. After installation of cable trays is completed, install warning signs in visible locations on or near cable trays.

L. Install cables only when cable tray installation has been completed and inspected.

M. Fasten cables on horizontal runs with cable clamps or cable ties as recommended by NEMA 20A. Tighten clamps only enough to secure the cable, without indenting the cable jacket. Install cable ties with a tool that includes an automatic pressure-limiting device.

N. On vertical runs, fasten cables to tray every 18 inches. Install intermediate supports when cable weight exceeds the load-carrying capacity of the tray rungs.

O. Ground cable trays according to manufacturer's written instructions.

P. Install an insulated equipment grounding conductor with cable tray, in addition to those required by NFPA 70.

3.2 FIELD QUALITY CONTROL

A. After installing cable trays and after electrical circuitry has been energized, survey for compliance with requirements. Perform the following field quality-control survey:

1. Visually inspect cable insulation for damage. Correct sharp corners, protuberances in cable tray, vibration, and thermal expansion and contraction conditions, which may cause or have caused damage.
2. Verify that the number, size, and voltage of cables in cable tray do not exceed that permitted by NFPA 70. Verify that communication or data-processing circuits are separated from power circuits by barriers.
3. Verify that there is no intrusion of such items as pipe, hangers, or other equipment that could damage cables.
4. Remove deposits of dust, industrial process materials, trash of any description, and any blockage of tray ventilation.
5. Visually inspect each cable tray joint and each ground connection for mechanical continuity. Check bolted connections between sections for corrosion. Clean and re-torque in suspect areas.
6. Check for missing or damaged bolts, bolt heads, or nuts. When found, replace with specified hardware.
7. Perform visual and mechanical checks for adequacy of cable tray grounding; verify that all takeoff raceways are bonded to cable tray.

B. Report results in writing.

END OF SECTION 16139

SECTION 26 05 53 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Nameplates.
2. Labels.
3. Wire markers.
4. Conduit markers.
5. Underground Warning Tape.
6. Lockout Devices.

1.2 **SUBMITTALS**

A. Product Data:

1. Submit manufacturer’s catalog literature for each product required.
2. Submit electrical identification schedule including list of wording, symbols, letter size, color coding, tag number, location, and function.

1.3 **QUALITY ASSURANCE**

A. Provide material supplied by a manufacturer producing identification systems

B. Comply with OSHA, NFPA or local jurisdiction identification requirements for electrical systems.

1.4 **DELIVERY, STORAGE, AND HANDLING**

A. Accept identification products on site in original containers. Inspect for damage.

B. Accept materials on site in original factory packaging, labeled with manufacturer's identification, including product density and thickness.

C. Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping.

1.5 **ENVIRONMENTAL REQUIREMENTS**

A. Install labels or nameplates only when ambient temperature and humidity conditions for adhesive are within range recommended by manufacturer.

PART 2 PRODUCTS

2.2 **NAMEPLATES**

A. Product Description: Laminated three-layer plastic with engraved white letters on contrasting background color.

1. Provide minimum letter height as follows:

a. For Panelboards, Distribution boards, Switchboards, Battery Panels and Motor Control Center: 1/2 inch letters to identify equipment designation. Use 1/4 inch letters to identify voltage, phase and wires.
b. For Individual Circuit Breakers, Switches and Motor Starters in Distribution panelboards, Distribution boards, Switchboards, Switchgear and Motor Control Centers use 3/8 inch letters to identify equipment designation. Use 1/8 inch letters to identify all other.
c. For Individual mounted Circuit Breakers, Disconnect Switches, Enclosed Switches and motor Starters use 3/8 inch letters to identify equipment designation. Use 1/8 inch letters to identify all others.
d. For Transformers use 1/2 inch letters to identify equipment designation. Use 1/4 inch letters to identify primary and secondary voltages, primary disconnect location, and other specified data.
e. For equipment cabinets, terminal cabinets, control panels and other cabinet enclosed apparatus use 3/8 inch letters to identify equipment designation.

B. Minimum nameplate thickness: 1/16 inch for signs up to 20 square inches, or 8 inches in length; 1/8 inch thick for larger sizes. Furnish with pre-punched holes for mechanical fasteners.

2.3 LABELS

A. Labels: Thermal transfer laminated adhesive tape, with 1/8-inch black letters on clear tape cartridge.

2.4 WIRE MARKERS

A. Description: Self-adhering, pre-printed, machine printable or write-on, self-laminating vinyl wrap around strips. Inscribe blank markers using the printer or pen recommended by the manufacturer for this purpose.

B. Legend:
1. Power and Lighting Circuits: Branch circuit or feeder number as indicated on Drawings.
2. Control Circuits: Control wire number as indicated on shop drawings.

2.5 CONDUCTOR PHASE MARKERS

A. Colored vinyl plastic electrical tape, 3/4 inch wide, for identification of phase conductors.

2.6 CONDUIT AND RACEWAY MARKERS

A. Description: Labels fastened with adhesive.

B. Color:
1. 480 Volt System: Orange lettering on white background.
2. 208 Volt System: Blue lettering on white background.
3. Fire Alarm System: Red lettering on white background.

C. Legend:
1. 480 Volt System: 480 VOLTS.

2. 208 Volt System: 208 VOLTS.
3. Fire Alarm System: FIRE ALARM.

2.7 UNDERGROUND WARNING TAPE

A. Description: 4 inch wide plastic tape, detectable type, colored yellow with suitable warning legend describing buried electrical lines.

2.8 LOCKOUT DEVICES

A. Lockout Hasps:
   1. Reinforced nylon hasp with erasable label surface; size minimum 7-1/4 x 3 inches.

PART 2 EXECUTION

3.1 PREPARATION

A. Degrease and clean surfaces to receive adhesive for identification materials.

3.2 INSTALLATION

A. Install identifying devices after completion of painting.

B. Nameplate Installation:
   1. Install nameplate parallel to equipment lines.
   2. Install nameplate for each electrical distribution and control equipment enclosure with corrosive-resistant mechanical fasteners, or adhesive.
   3. Install nameplates for each control panel and major control components located outside panel with corrosive-resistant mechanical fasteners.
   4. Secure nameplate to equipment front using rivets.
      a. Provide color coded nameplates as applicable, with the following information:
         1) Equipment or device designation.
         2) Amperage, KVA or horsepower rating, where applicable.
         3) Voltage or signal system name.
         4) "Served from" identification.
         5) Miscellaneous information as shown in "Examples".
         6) Examples:

Panels:2EH1
225A
277/480V, 3PH, 4W
Served From: 2EHD1

Transformers: ETX-1
150KVA
480V - 120/208V, 3PH, 4W
Served From: EHD1

Load Served: EL1

Motor Control Centers:
Main Nameplate:
Each Compartment
MCC-NH1 EF-1
600A Main Bus 20 HP
480V,3PH,3W Switch Size: 100A
Served From:HDD1A-2 Starter Size: 1

Disconnects or Individual Motor Starters.
EF-1
20HP
480V,3PH,3W
Served From: MCCNH-1

Signal: STB-3
Public Address System
Served From: STBM

C. Nameplates for power system distribution equipment and devices are to be colored as follows: (Unless otherwise noted)
   1. 277/480 VAC Normal - Black with white letters.
   2. 120/208 VAC Normal -Black with white letters.

D. Nameplates for signal systems equipment and devices are to be black except as follows:
   1. Fire alarm and life safety - White with red letters
   2. Security/Card access/CCTV systems – Black with white letters
   3. Clock, intercom, sound, MATV, CATV: Black with white letters
   4. Building management system (BMS): Black with white letters

E. Label Installation:
   1. Install label parallel to equipment lines.
   2. Install label for identification of individual control device stations, receptacles and switches.
   3. Locate the top of label 1/2 inch below the top edge of coverplates.
   4. Install label for multi-outlet assembly receptacles.
   5. Install labels for permanent adhesion.

F. Wire Marker Installation:
   1. Install wire marker for each conductor at panelboard gutters, pull boxes, outlet and junction boxes, each load connection.
   2. Provide colored plastic phase tape in half-lapped turns for a distance of 3 inches from terminal points and in boxes where splices or taps are made.

G. Junction box identification:
   1. Color code and identify all junction boxes located above suspended ceilings and below ceilings in non-public areas.
   2. Use finish paint suitable for use on metal surfaces.
   3. Boxes shall be identified with permanent felt tip marker on cover indicating panel and circuit numbers. Paint junction box covers using the color coding listed below.

a. 480/277 Volt System: Orange.
b. 208/120 Volt System: Blue.
c. Fire Alarm System: Red.
d. Security System: Green.

H. Conduit Marker Installation:

1. Install conduit marker for each conduit longer than 6 feet.
2. Conduit Marker Spacing: 20 feet on center.
3. Raceway Painting: Identify conduit using field painting in accordance with Section 09 90 00.
   a. Paint colored band on each conduit longer than 6 feet.
   b. Paint bands 20 feet on center.
   c. Color:
      1) 480 Volt System: Orange.
      2) 208 Volt System: Blue.

3.3 UNDERGROUND WARNING TAPE:

A. Install underground warning tape along length of each underground conduit, raceway, or cable 6 to 8 inches below finished grade, directly above buried conduit, raceway, or cable.

3.4 WARNING, CAUTION AND INSTRUCTION SIGNS

A. Provide warning, caution or instruction signs where required by OSHA, where indicated, or where reasonably required to assure safe operation and maintenance of electrical systems.

1. Install engraved plastic-laminated instruction signs with approved legend where instructions or explanations are needed for system of equipment operation
2. Provide polyester film self-adhesive signs fo indoor/outdoor equipment and door warning. Use rigid polyethylene non-adhesive signs where adhesives will not work; for example, installing on a metal fence. Provide sign color and marking that meets OSHA regulations. For example, DANGER (red background with white letters), HIGH VOLTAGE (white with black letters.
   a. Use 2 by 4 inch signs for small equipment or enclosure doors.
   b. Use 7 by 10 inch or 10 by 14 inch signs for large equipment or enclosure doors.

B. Emergency Operating Signs: Install engraved laminate signs with white letters on red background with minimum 3/8 inch high lettering for emergency instructions on power transfer, load shedding, or other emergency operations.

END OF SECTION

SECTION 26 22 00 - LOW VOLTAGE TRANSFORMERS

GENERAL

1.1 SUMMARY

A. Section Includes:
1. Two-winding transformers.
2. Shielded transformers.
3. Autotransformers.
4. Buck-and-boost transformers.

B. Related Requirements:
1. Specification Section - Grounding and Bonding for Electrical Systems.
2. Specification Section - Hangers and Supports for Electrical Systems.
3. Specification Section - Raceway and Boxes for Electrical Systems.
4. Specification Section - Identification for Electrical Systems.

1.2 REFERENCE STANDARDS

A. National Electrical Manufacturers Association:
1. NEMA ST 1 - Specialty Transformers (Except General Purpose Type).
2. NEMA ST 20 - Dry Type Transformers for General Applications.

1.3 SUBMITTALS

A. Submittal Procedures: Submittal procedures.

B. Product Data: Submit outline and support point dimensions of enclosures and accessories, unit weight, voltage, kVA, and impedance ratings and characteristics, tap configurations, insulation system type, and rated temperature rise.

C. Test and Evaluation Reports: Indicate loss data, efficiency at 25, 50, 75 and 100 percent rated load, and sound level.

D. Source Quality Control Submittals: Indicate results of factory tests and inspections.

E. Field Quality Control Submittals: Indicate results of Contractor furnished tests and inspections.

1.4 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years experience.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store in clean, dry space. Maintain factory wrapping or provide additional canvas or plastic cover to protect units from dirt, water, construction debris, and traffic.

B. Handle in accordance with manufacturer's written instructions. Lift only with lugs provided. Handle carefully to avoid damage to transformer internal components, enclosure, and finish.

PART 2 PRODUCTS

2.1 TWO-WINDING TRANSFORMERS

A. Manufacturers: Eaton, Square D, General Electric.

B. Description: NEMA ST 20, factory-assembled, air-cooled, dry type transformers, ratings as indicated on Drawings.

C. Operation:
1. Primary Voltage:480 volts, 3 phase.
2. Secondary Voltage: 208Y/120 volts, 3 phase.
3. Insulation system and average winding temperature rise for rated kVA as follows:
4. 1-15 kVA: Class 185 with 115 degrees C rise.
5. 16-500 kVA: Class 220 with 150 degrees C rise.
6. Case temperature: Do not exceed 35 degrees C rise above ambient at warmest point at full load.
7. Winding Taps:
   a. Transformers Less than 15 kVA: Two 5 percent below rated voltage, full capacity taps on primary winding.
   b. Transformers 15 kVA and Larger: NEMA ST 20.
8. Basic Impulse Level: 10 kV for transformers less than 300 kVA, 30 kV for transformers 300 kVA and larger.
9. Mounting:
   a. 1-15 kVA: Suitable for wall mounting.
   b. 16-75 kVA: Suitable for wall, floor, or trapeze mounting.
   c. Larger than 75 kVA: Suitable for floor or trapeze mounting.

D. Materials:
1. Ground core and coil assembly to enclosure by means of visible flexible copper grounding strap.
2. Coil Conductors: Continuous aluminum windings with terminations brazed or welded.
3. Enclosure: NEMA ST 20, Type 1 indoor, Type 3R outdoor ventilated. Furnish lifting eyes or brackets.

E. Fabrication:

1. Isolate core and coil from enclosure using vibration-absorbing mounts.

2. Nameplate: Include transformer connection data and overload capacity based on rated allowable temperature rise.

PART 3 EXECUTION

3.1 EXAMINATION

A. Execution and Closeout Requirements: Requirements for installation examination.

B. Verify mounting supports are properly sized and located including concealed bracing in walls.

3.2 PREPARATION

A. Execution and Closeout Requirements: Requirements for installation preparation.

B. Provide concrete pads under provisions of Concrete Section.

3.3 DEMOLITION

A. Disconnect and remove abandoned transformers.

B. Maintain access and adequate ventilation to existing transformers and other installations remaining active and requiring access and ventilation. Modify installation or provide access panel or ventilation grilles.

3.4 INSTALLATION

A. Set transformer plumb and level.

B. Use flexible conduit, minimum length, for connections to transformer case. Make conduit connections to side panel of enclosure.

C. Install grounding and bonding in accordance with Grounding and Bonding for electrical Systems section.

3.5 ADJUSTING

A. Execution and Closeout Requirements: Testing, adjusting, and balancing.

B. Measure primary and secondary voltages and make appropriate tap adjustments.

3.6 CLEANING

A. Clean existing transformers to remain or to be reinstalled.

END OF SECTION

SECTION 26 24 13 - SWITCHBOARDS

GENERAL

1.1 SUMMARY

A. Section includes main and distribution switchboards.

1.2 REFERENCES

A. Institute of Electrical and Electronics Engineers:

1. IEEE C62.41 - Recommended Practice on Surge Voltages in Low-Voltage AC Power Circuits.

B. National Electrical Manufacturers Association:

1. NEMA PB 2 - Deadfront Distribution Switchboards.
2. NEMA PB 2.1 - General Instructions for Proper Handling, Installation, Operation, and Maintenance of Deadfront Distribution Switchboards Rated 600 Volts or Less.

C. International Electrical Testing Association:

1. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.

D. Underwriters Laboratories Inc.:

1. UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit-Breaker Enclosures.
2. UL 891 - Dead-Front Switchboards.

1.3 SUBMITTALS

A. Shop Drawings: Indicate front and side views of enclosures with overall dimensions shown; conduit entrance locations and requirements; nameplate legends; size and number of bus bars for each phase, neutral, and ground; and switchboard instrument details.

B. Product Data: Submit electrical characteristics including voltage, frame size and trip ratings, fault current withstand ratings, and time-current curves of equipment and components.

C. Seismic Qualification: Submit manufacturer’s certificate of seismic compliance in according with the American Society of Civil Engineers ASCE/SEI-7-05 and the California Code.

D. Test Reports: Indicate results of factory production and field tests.

1.4 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations, configurations, and ratings of switchboards and their components on single line diagrams and plan layouts.

B. Operation and Maintenance Data: Submit spare parts data listing; source and current prices of replacement parts and supplies; and recommended maintenance procedures and intervals.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years' experience.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver in 48 inch maximum width shipping splits, individually wrapped for protection and mounted on shipping skids.

B. Accept switchboards on site. Inspect for damage.

C. Store in clean, dry space. Maintain factory wrapping or provide additional canvas or plastic cover to protect units from dirt, water, construction debris, and traffic.

D. Handle in accordance with NEMA PB 2.1. Lift only with lugs provided. Handle carefully to avoid damage to switchboard internal components, enclosure, and finish.

1.7 ENVIRONMENTAL REQUIREMENTS

A. Conform to NEMA PB 2 service conditions during and after installation of switchboards.

1.8 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.9 SEQUENCING

A. Sequence Work to avoid interferences with building finishes and installation of other products.

1.10 MAINTENANCE MATERIALS

A. Furnish two of each key.

PRODUCTS

1.11 DISTRIBUTION SWITCHBOARDS

A. Manufacturers:

1. Eaton Electrical/Cutler-Hammer, Square D, General Electric.

B. Product Description: NEMA PB 2, enclosed switchboard with electrical ratings and configurations as indicated on Drawings.

C. Short Circuit Ratings: Switchboards and all overcurrent devices shall be fully rated for the available fault current. Series rated equipment is not allowed.

D. Device Mounting:

1. Main Section: Individually mounted.
2. Distribution Section: Group mounted.

E. Bus:

1. Material: Copper with silver plating, standard size.
2. Connections: Bolted, accessible from front for maintenance.

F. Ground Bus: Extend length of switchboard.

G. Minimum Short Circuit Rating: 65,000 symmetrical amperes rms, fully rated, or as indicated.

H. Line and Load Terminations: Accessible from front only of switchboard, suitable for conductor materials and sizes as indicated on Drawings.

I. Utility Metering Compartment: Furnish metering transformer compartment for Utility Company's use, in accordance with Utility Company requirements.

J. Future Provisions: Fully equip spaces for future devices with bussing and bus connections, insulated and braced for short circuit currents. Furnish continuous current rating as indicated on Drawings.

K. Enclosure: Outdoor NEMA 3R

1. Outdoor enclosure shall be non-walk-in and meet applicable NEMA 3R UL requirements
2. Enclosure shall have sloping roof downward toward rear.
3. The enclosure shall be provided with bolt-on rear covers for each section
4. Doors shall have provisions for padlocking
5. Ventilating openings shall be provided complete with replaceable fiber glass air filters.
6. Where indicated on contract documents provide thermostatically controlled space heaters for each structure to prevent the accumulation of moisture.
7. Power for space heaters, lights and receptacles shall be obtained from a source as indicated on the drawings.

L. Align sections at front and rear.

M. Switchboard Height: 90” excluding floor sills, lifting members and pull boxes.

N. Finish: Manufacturer's standard light gray enamel over external surfaces. Coat internal surfaces with minimum one coat corrosion-resisting paint, or plate with cadmium or zinc.

1.12 MOLDED CASE CIRCUIT BREAKER

A. Manufacturers:

1. Eaton Electrical/Cutler-Hammer, Square D, General Electric.

B. Product Description: UL 489, molded-case circuit breaker.

C. Field-Adjustable Trip Circuit Breaker: Circuit breakers with frame sizes 250 amperes and larger have a field adjustable variable magnetic trip element.

D. Solid-State Circuit Breaker: Electronic sensing, timing, and tripping circuits for adjustable current settings.

1. As a minimum, the trip unit shall have the following protective functions:

a. Adjustable long time pickup.
b. Adjustable long time delay.
c. Adjustable instantaneous pickup.
d. Adjustable short time pickup.
e. Adjustable short time delay.
f. Adjustable ground fault pickup.
g. Adjustable ground fault delay.

E. Accessories: Conform to UL 489.

1. Handle Lock: Provisions for padlocking all circuit breakers

1.13 TRANSIENT VOLTAGE SUPPRESSION DEVICES

A. Product Description: IEEE C62.41, factory-mounted transient voltage surge suppressor, selected to meet requirements for low exposure and to coordinate with system circuit voltage.

1.14 POWER METERS

A. In this article, list manufacturers acceptable for this Project.

B. Edit the following descriptive specifications to identify Project requirements and to eliminate conflicts with manufacturers specified above.

C. Where indicated on the drawings, provide a separate customer metering compartment with a front facing hinged door and a UL listed microprocessor based multifunction power meter equal to Eaton PXM2280. Include current transformers wired to shorting-type terminal blocks for each meter. Provide fused potential taps as the potential source for metering as shown on the drawings.

D. The meter surge withstand shall conform to IEEE C37.90.1 and ANSI C62.41.

E. The meter shall accept a direct voltage input range of up to 576 Volts Line to Neutral, and a range of up to 721 Volts Line to Line.

F. The meter shall accept a current input of up to 10 amps continuous. Startup current for a 5A input shall be no greater than 0.005A.

G. Fault Current Withstand shall be 100 Amps for 10 seconds, 300 Amps for 3 seconds, and 500 Amps for 1 second.

H. The meter shall have an accuracy of +/- 0.1% or better for volts and amps, and 0.2% for power and energy functions. The meter shall meet the accuracy requirements of ANSI C12.20 (Class 0.2%).

I. The meter shall provide true RMS measurements of voltage, phase to neutral and phase to phase; current, per phase and neutral.

J. The meter shall provide sampling at 400+ samples per cycle on all channels measured readings simultaneously.

K. Meter shall provide per phase % THD and individual harmonic monitoring to the 40th order for current and for voltage L-N. Metered values shall include Volts, Amps, kW, kVAR, PF, kVA, Frequency, kWh, kVAh and kVARh. Provide 1 KYZ pulse output, on board meter limit exceeded alarms. Embedded web server shall support a waveform view of real time harmonic distortion and allow recording waveforms up to 64 samples per cycle. Meter shall have 768MB onboard memory for data logging.

L. The meter shall provide user configured fixed window or sliding window demand.

M. Meter shall provide a simultaneous voltage and current waveform recorder with programmable sampling rate.

N. The meter shall allow up to 1500 events to be recorded.

O. The meter shall be able to be configured and viewed from the on-board web server without the need for external software

P. The meter shall include a three-line, bright red, .56” LED display.

Q. The meter must display a % of Load Bar on the front panel to provide an analog feel. The % Load Bar shall have not less than 10 segments.

R. The meter shall support Modbus RTU, Modbus ASCII, DNP 3.0, Ethernet TCP/IP, Modbus TCP, BACnet/IP, SNMP v1 & v3 (Network), SMTP (email), HTTP and HTTPS communication.

EXECUTION

1.15 EXAMINATION

A. Verify surface is suitable for switchboard installation.

1.16 EXISTING WORK

A. Disconnect and remove abandoned switchboards.

B. Maintain access to existing switchboards and other installations remaining active.

C. Clean and repair existing switchboards to remain or to be reinstalled.

1.17 INSTALLATION

A. Install in accordance with NEMA PB 2.1.

B. Tighten accessible bus connections and mechanical fasteners after placing switchboard.

C. Install fuses in each switch and coordinate sizes with connected load.

D. Install engraved plastic nameplates.

E. Install breaker circuit directory.

F. Ground and bond switchboards.

1.18 FIELD QUALITY CONTROL

A. Inspect and test in accordance with NETA ATS, except Section 4.

B. Perform inspections and tests listed in NETA ATS, Section 7.1.

1.19 ADJUSTING

A. Adjust operating mechanisms for free mechanical movement.

B. Tighten bolted bus connections.

C. Adjust circuit breaker trip and time delay settings to values as indicated in Coordination Study.

1.20 CLEANING

A. Touch up scratched or marred surfaces to match original finish.

END OF SECTION

SECTION 26 24 16 - PANELBOARDS

PART 1 - GENERAL

1.1 CONDITIONS:

A. The Requirements of the General Conditions and Special Conditions apply to the Work of this Section as if fully repeated herein.

1.2 WORK INCLUDED:

A. Furnish all labor, materials, and equipment and perform operation required for complete installation of panelboards, individual mounted circuit breakers, and safety switches as indicated on Drawings and/or specified herein. Such Work includes, but is not limited to, furnishing and installation of power and lighting panelboards and fused safety switches.

1.3 QUALITY ASSURANCE:

A. Reference Standards:

1. FS - Federal Specification

W-C-375	Circuit Breakers, Molded Case: Branch Circuit and Service.

2. CEC - 2016 California Electrical Code:

Art. 384	Switchboards and Panelboards.

3. NEMA - National Electrical Manufacturer's Association

PB1	Panelboards.
AB	Molded Case Circuit Breakers.

4. UL - Underwriter's Laboratories, Inc. Standards

489	Molded Case Circuit Breakers and Circuit Breaker Enclosures.
67	Electric Panelboards.

1.4 SUBMITTALS:

A. Refer to Division 1 and Section 260120.

B. Test Reports: Production tests of circuit breakers when requested.

C. Show:

1. Circuit breaker numbering.
2. Circuit breaker type and short circuit rating.
3. Provisions for future addition of circuit breakers.
4. Bussing and rating of, including neutral and ground.
5. Enclosures:

a. Dimension.
b. Trim.

PART 2 - PRODUCTS

2.1 MATERIALS:

A. Panelboards: Eaton, General Electric, Square D.

1. Panelboards: Factory-assembled, dead-front, metal encased safety type; construction consisting of structural or formed steel frame carefully braced and welded into rigid structure which shall maintain its alignment and not be damaged in shipment or erection, or by stresses resulting from short circuits. Bolted housing construction with tack-welded joints will be acceptable. Frame: Completely enclosed on rear, top and sides with sheet steel covers, doors and panels, accessible from front. Cabinet: Of sufficient size to conform to both minimum dimensional requirements and minimum wiring gutter requirements of Article 373 CEC (2016). Minimum Cabinet Size: twenty inches (20") wide by five and three-quarters inches (5 3/4") deep. Stationary Portions of Steel Frame and Covers: 12-gauge minimum with concealed trim clamps. Old style screw fastener type not acceptable. Doors: Sheet metal construction with concealed hinges and equipped with flush type lock and catch. All panels shall be keyed alike. Supply two (2) keys with each lock. Distribution panels installed in outdoor locations shall be free standing in NEMA 3R enclosure. Equipped with heater(s) and thermostat. Heater(s) shall prevent condensation from forming in the inside of the panel. Set thermostat at fifty-five degrees (55º) F.
2. Busses: Hard-drawn copper, ninety-eight percent (98%) conductivity, Grade ED, ASTM B230, in accordance with NEMA Standards and as hereinafter specified.
3. Connectors: Silver plated copper.
4. Structure Housing, Bus, and Connections; Construct brace to safely withstand rated short circuit currents in conformance with UL Standard Ul-67. Connections shall be bolted or welded and laminations arranged to provide adequate contact area. All contact surfaces of copper shall be silver-plated. Copper sizes and arrangement shall be such that temperature rise of bus shall not exceed fifty degrees (50º) C. with a forty degrees (40º) C. ambient outside enclosure.
5. Provide a bare copper neutral bus on insulated bus supports and an uninsulated copper equipment ground bus bar secured to each unit frame, to provide separate, integrated, continuous, neutral and equipment ground buses. Neutral Bus: Same size as associated phase buses for 480/277 volt panels, 200% rated for 208/120 volt panels. Ground Bus: Arranged to ground panelboard's non-current-carrying parts, provided with brazed or approved pressure connector terminations for feeder ground conductors.
6. Panelboard Main and Branch Circuit Protection: Bolt-on type, molded case circuit breakers with sizes as shown. Individual panelboards shall be constructed to have short circuit rating consistent with circuit breaker being installed.
7. Circuit Breakers:

    a. Circuit breakers shall be single pole and multi-pole. Single pole circuit breakers shall be full module size; two poles shall not be installed in a single module. Multi-pole circuit breakers shall be of the internally common trip type having a single operating handle. For sizes of 50 amperes of less, breakers may consist of a single pole factory assembled into a permanent multi-pole unit. Short circuit interrupting rating of circuit breakers shall be as indicated on Drawings.
    b. Circuit breakers: Thermal-magnetic type unit construction with manual operating handle indicating "ON-OFF" and "TRIPPED" positions.
    c. All circuit breakers shall be tested in accordance with NEMA STANDARDS Publication No. AB1.

d. Circuit breakers used for switches in fluorescent lighting circuits shall be approved for switching duty and marked “SWD”.

8. Provide panel matching full skirt to floor for surface mounted panelboards.
9. Finish:

a. Panelboards: Epoxy electro-static dry paint. Interior metal surfaces, zinc plated. Equipment shall be cleaned, primed, and finish painted in accordance with the Standard Specifications.
b. Finish Color: ANSI Z55.1, Color Chip No. 61 (light gray).

10. Circuit Identification: Inside door with framed-In holder behind protective covering for mounting circuit identification.

B. Safety Switches: Enclosed, FS W-S-865C, Type HD with externally operated handle. NEMA 3R enclosure for outdoor locations including under canopies. Enclosure: NEMA 1, unless specifically shown or specified otherwise.

C. Molded-Case Circuit Breaker: NEMA AB1, FS W-C-375. NEMA 3R enclosure for outdoor locations including under canopies. Enclosure: NEMA 1, unless specifically shown or specified otherwise.

D. Elevator Disconnecting Means:

1. Enclosed, FS W-S-865C, Type HD with externally operated handle arranged to be locked in the open position. Furnish dual-element Class J fuses.
2. The fuses shall be selectively coordinated with all other supply side over current protective devices.

PART 3 - EXECUTION

3.1 INSTALLATION:

A. Anchor panelboards, circuit breakers and safety switches to wall. Provide supports between studs as required. Anchor distribution panels to concrete pad.

B. Mount panelboards, circuit breakers and switches level and plumb.

C. Install flush mounted panel backbox front edges flush with finished wall. Where flush panel backbox is deeper than wall depth, install closing trim of wood or metal to provide a finished trim.

D. After installation, make all feeder connections to load side lugs of circuit breakers, disconnect switches and incoming secondary feeders.

E. Install in accordance with manufacturer’s specifications and recommendations.

F. Fill out panelboard circuit identification card, typewritten, with list of circuits in use. Identification shall be specific with room designation and other information as necessary. For distribution panelboards, use engraved laminated phenolic plate showing load served and trip rating.

G. Where panelboard is flush in wall, provide one (1) three-quarters inch (3/4”) conduit stub into accessible ceiling space for each five (5) spare circuit breaker spaces.

H. Provide identification for panelboard, individually mounted circuit breakers and switches as specified under Identification for electrical systems Section.

END OF SECTION

SECTION 26 27 26 – WIRING DEVICES

PART 1 - GENERAL

1.1 CONDITIONS:

A. The Requirements of the General Conditions and Special Conditions apply to the Work of this Section as if fully repeated herein.

1.2 WORK INCLUDED:

A. Furnishing and complete installation of electrical materials for construction of Work as shown and/or specified herein. Such Work includes, but is not limited to, wiring devices.

1.3 QUALITY ASSURANCE:

A. Reference Standards:

1. NEMA - National Electrical Manufacturer's Association:

WD 1 – General Purpose Wiring Devices.
WD 6 – Specific Purpose Wiring Devices.

2. UL - Underwriter's Laboratories, Inc.:

20 – Switches, Snap, General-Use.

3. FS - Federal Specifications.

WC – 596
WS - 896

PART 2 - PRODUCTS

2.1 WIRING DEVICES:

A. Wall Switches:

1. Specification grade, quiet, A.C. rated, mechanical, snap type with silver alloy contacts.
2. Rating: 20 ampere, 120/277 volts, unless otherwise shown.
3. Local switches: White finish.

Manufacturer	Single Pole	3-Way
A & H	1991	1993
Eagle	2221	2223
Hubbell, Leviton	1221-2	1223-2

P & S 20AC1
20AC3

4. Screw type terminals shall accommodate wire up to 10 gauge.

B. Receptacles:

1. Specification grade, NEMA 5-20R configuration.
2. White color for types shown. Bodies phenolic with terminals to accommodate 10 gauge conductors.
3. Grounding type duplex 120V AC receptacles.

Duplex 3-Wire Groundable

Manufacturer	20A
Hubbell	5362
Eagle	5352
General Electric, Arrow Hart, P & S	5362
General Electric	GFR5342
Leviton (GFI)	6898
Hubbell (GFI)	GF5362

4. Special-purpose or heavy duty receptacles shall be of type and of rating and number of poles indicated or required for the anticipated purpose.

C. Plates:

1. 0.040 satin finished stainless steel, UL listed, with number of openings required for location.
2. Galvanized, raised type for exposed boxes.
3. Die-cast copper-free aluminum gasketed raintight cover for outdoor use or as shown or specified.
4. Attach plates with matching screws.

D. Nameplates and Inscriptions:

1. Receptacle Identification: Engrave receptacle plates indicating the panel and circuit number of the branch circuit feeding the outlet. “Dymo” Type embossed labels shall not be used. Inscriptions shall be made with a lettering device, with terminology approved by the Architect.

PART 3 - EXECUTION

3.1 INSTALLATION:

A. Small scale Electrical Drawings are general diagrammatic and indicate only general character and approximate location and extent of Work. All Work shall be installed complete, including minor details necessary to perform function shown or indicated. Actual locations of electrical outlets and devices shall be coordinated with building features as indicated on electrical layout Drawings.

B. Mount and align devices and coverplates level and plumb. Insure coverplates fit flat against wall and tight against device without strain on plate.

C. Outlet boxes on opposite sides of wall requiring protected openings shall be separated by a horizontal distance of twenty-four (24”) inches. Title 24 Part 2, 709.7.

END OF SECTION

SECTION 26 32 13 - GENERATOR

PART 1 - GENERAL

A. DESCRIPTION OF SYSTEM & SITE

1. Provide a 400 kW standby power system to supply electrical power at 480 Volts, 60 Hertz, 3 Phase. The system will utilize generators rated 400 kW. The generator shall consist of a liquid cooled, natural gas, propane or duel fuel gaseous driven engine, a synchronous AC alternator and system controls with all necessary accessories for a complete operating system, including but not limited to the items as specified hereinafter.

2. The site is an NEC ordinary location with no specific harsh environment requirements.
3. The genset shall be applied at the listed ambient and elevation. Bidders to submit the generators rated power output at 105 ambient (˚F) and 2500 elevation (Ft).
4. Bidders are to submit the genset's sound level in dBA at 23 ft based on the configuration specified.
5. The on-site gas pressure is _____ inches of water column.

B. REQUIREMENTS OF REGULATORY AGENCIES

1. An electric generating system, consisting of a prime mover, generator, governor, coupling and all controls, must have been tested, as a complete unit, on a representative engineering prototype model of the equipment to be sold.

2. The generator set must conform to applicable NFPA requirements.

3. The generator set must be available with the Underwriters Laboratories listing (UL2200) for a stationary engine generator assembly.

4. The generator set must be pre-certified to meet EPA federal emission requirements for stationary standby. On-site emission testing & certification will not be acceptable for standby applications.

C. MANUFACTURER QUALIFICATIONS

1. This system shall be supplied by an original equipment manufacturer (OEM) who has been regularly engaged in the production of engine-alternator sets, automatic transfer switches, and associated controls for a minimum of 25 years, thereby identifying one source of supply and responsibility. Approved suppliers are Generac Industrial Power or an approved equal.

2. The manufacturer shall have printed literature and brochures describing the standard series specified, not a one of a kind fabrication. Custom designed solutions using site specific PLC programs and site specific schematics are not acceptable.

3. Manufacturer's authorized service representative shall meet the following criteria:
   a. Certified, factory trained, industrial generator technicians
   b. Service support 24/7
   c. Service location within 200 miles
   d. Response time of 4 hours
   e. Service & repair parts in-stock at performance level of 95%

D. SUBMITTALS

1. Engine Generator specification sheet

2. Controls specification sheet(s)
3. Installation / Layout dimensional drawing
4. Wiring schematic
5. Sound data
6. Emission certification

5.1 ENGINE

A. Engine Rating and Performance

1. The prime mover shall be a liquid cooled, spark-ignited, 4-cycle engine. It will have adequate horsepower to achieve rated kW output.

2. The engine shall support a 100% load step.

3. The system shall be sized and sequenced to allow emergency system loads as defined by NEC 700 to be transferred onto the generator(s) within 10 seconds. Non-emergency system loads will be sequenced onto the generator(s) as generator capacity comes on-line.

B. ENGINE OIL SYSTEM

1. Full pressure lubrication shall be supplied by a positive displacement lube oil pump. The engine shall have a replaceable oil filter(s) with internal bypass and replaceable element(s).

2. The engine shall operate on mineral based oil. Synthetic oils shall not be required.The oil shall be cooled by an oil cooler which is integrated into the engine system.

C. ENGINE COOLING SYSTEM

1. The engine is to be cooled with a unit mounted radiator, fan, water pump, and closed coolant recovery system. The coolant system shall include a coolant fill box which will provide visual means to determine if the system has adequate coolant level. The radiator shall be designed for operation in 122 degrees F, (50 degrees C) ambient temperature.

2. The engine shall have (a) unit mounted, thermostatically controlled water jacket heater(s) to aid in quick starting. The wattage shall be as recommended by the manufacturer.

3. Engine coolant and oil drain extensions, equipped with pipe plugs and shut-off valves, must be provided to the outside of the mounting base for cleaner and more convenient engine servicing.

4. A radiator fan guard must be installed for personnel safety that meets UL and OSHA safety requirements.

D. ENGINE STARTING SYSTEM

1. Starting shall be by a solenoid shift, DC starting system.

2. The engine’s cranking batteries shall be lead acid. The batteries shall be sized per the manufacturer’s recommendations. The batteries supplied shall meet NFPA 110 cranking requirements of 90 seconds of total crank time. Battery specifications (type, amp-hour rating, cold cranking amps) to be provided in the submittal.

3. The genset shall have an engine driven, battery charging alternator with integrated voltage regulation.

4. The genset shall have an automatic dual rate, float equalize, 10 amp battery charger. The charger must be protected against a reverse polarity connection. The chargers charging current shall be monitored within the generator controller to support remote monitoring and diagnostics. The battery charger is to be factory installed on the generator set. Due to line voltage drop concerns, a battery charger mounted in the transfer switch will be unacceptable.

E. ENGINE FUEL SYSTEM

A. The engine shall be configured to operate on pipe line grade natural gas.

B. The engine shall utilize a fuel system inclusive of carburetor, gas regulator, , low gas pressure switch, and fuel shut-off solenoid. Generators larger than 80 kW are to include air-fuel-ratio control.

The engines internal fuel connections shall be terminated to the generator frame via an NPT fitting for easy installation

F. ENGINE CONTROLS

1. Engine speed shall be controlled with an integrated isochronous governor function with no change in alternator frequency from no load to full load. Steady state regulation is to be 0.25%.

2. To support EPA emission requirements, gensets larger than 80 kW will incorporate an active air-fuel-ratio controller. The air-fuel-ratio controller shall be integrated into the generator controller to ensure security of settings and to support monitoring and remote diagnostics. External air-fuel-ratio controllers are not acceptable.

3. Engine sensors used for monitoring and control are to be conditioned to a 4-20ma signal level to enhance noise immunity.

4. All engine sensor connections shall be sealed to prevent corrosion and improve reliability.

G. ENGINE EXHAUST & INTAKE

1. The engine exhaust emissions shall meet the EPA emission requirements for stationary emergency power generation.

2. For generators larger than 80 kW, the engine will incorporate a 3-way catalytic convertor to meet EPA emission requirements.

3. The manufacturer shall supply its recommended stainless steel, flexible connector to couple the engine exhaust manifold to the exhaust system. A rain cap will terminate the exhaust pipe after the silencer. All components must be properly sized to assure operation without excessive back pressure when installed.

4. The manufacturer shall supply a critical grade exhaust silencer as standard. For applications with site specific sound requirements (reference section 1.1), the silencer shall be selected to achieve site sound levels.

5. For gensets in a weather or sound attenuated enclosure, all exhaust piping from the turbo-charger discharge to the silencer shall be thermally wrapped to minimize heat dissipation inside the enclosure.

6. The engine intake air is to be filtered with engine mounted, replaceable, dry element filters.

H. ALTERNATOR

1. The alternator shall be the voltage and phase configuration as specified in section A, 1.

2. The alternator shall be a 4-pole, revolving field, stationary armature, synchronous machine. The excitation system shall utilize a brushless exciter with a three phase full wave rectifier assembly protected against abnormal transient conditions by a surge protector. Photo-sensitive components will not be permitted in the rotating exciter.

3. The alternator shall include a permanent magnet generator (PMG) for excitation support. The system shall supply a minimum short circuit support current of 300% of the rating (250% for 50Hz operation) for 10 seconds.

4. The alternator shall support 581 skVA with a maximum voltage dip of 15 %.

5. Three phase alternators shall be 12 lead, broad range capable of supporting voltage reconnection. Single phase alternators shall be four lead and dedicated voltage designs (600v) shall be six lead. All leads must be extended into a NEMA 1 connection box for easy termination. A fully rated, isolated neutral connection must be included by the generator set manufacturer.

6. The alternator shall use a single, sealed bearing design. The rotor shall be connected to the engine flywheel using flexible drive disks. The stator shall be direct connected to the engine to ensure permanent alignment.

7. The alternator shall meet temperature rise standards of UL2200 (120 degrees C). The insulation system material shall be class "H" capable of withstanding 150 degrees C temperature rise.
The alternator shall be protected against overloads and short circuit conditions by advanced control panel protective functions. The control panel is to provide a time current algorithm that protects the alternator against short circuits. To ensure precision protection and repeatable trip characteristics, these functions must be implemented electronically in the generator control panel -- thermal magnetic breaker implementation are not acceptable.

9. An alternator strip heater shall be installed to prevent moisture condensation from forming on the alternator windings. A tropical coating shall also be applied to the alternator windings to provide additional protection against the entrance of moisture.

I. CONTROLS

1. The generator control system shall be a fully integrated microprocessor based control system for standby emergency engine generators meeting all requirements of NFPA 110 level 1.

2. The generator control system shall be a fully integrated control system enabling remote diagnostics and easy building management integration of all generator functions. The generator controller shall provide integrated and digital control over all generator functions including: bi-fuel control, engine protection, alternator protection, speed governing, voltage regulation and all related generator operations. The generator controller must also provide seamless digital integration with the engine’s electronic engine control module (ECM) if so equipped. Generator controller’s that utilize separate voltage regulators and speed governors or do not provide seamless integration with the engine management system are considered less desirable.

3. Communications shall be supported with building automation via the Modbus protocol without network cards. Optional internet and intranet connectivity shall be available.

4. The control system shall provide an environmentally sealed design including encapsulated circuit boards and sealed automotive style plugs for all sensors and circuit board connections. The use of non-encapsulated boards, edge cards, and pc ribbon cable connections are considered unacceptable.

5. Circuit boards shall utilize surface mount technology to provide vibration durability. Circuit boards that utilize large capacitors or heat sinks must utilize encapsulation methods to securely support these components.

6. A predictive maintenance algorithm that alarms when maintenance is required. The controller shall have the capability to call out to the local servicing dealer when maintenance is required.

7. Diagnostic capabilities should include time-stamped event and alarm logs, ability to capture operational parameters during events, simultaneous monitoring of all input or output parameters, callout capabilities, support for multi-channel digital strip chart functionality and .2 msec data logging capabilities.

8. In addition to standard NFPA 110 alarms, the application loads should also be protected through instantaneous and steady state protective settings on system voltage, frequency, and power levels.

9. The control system shall provide pre-wired customer use I/O: 4 relay outputs (user definable functions), communications support via RS232 and RS485. Additional I/O must be an available option.

10. Customer I/O shall be software configurable providing full access to all alarm, event, data logging, and shutdown functionality. In addition, custom ladder logic functionality inside the generator controller shall be supported to provide application support flexibility. The ladder logic function shall have access to all the controller inputs and customer assignable outputs.

11. The control panel will display all user pertinent unit parameters including: engine and alternator operating conditions; oil pressure and optional oil temperature; coolant temperature and level alarm; fuel level (where applicable); engine speed; DC battery voltage; run time hours; generator voltages, amps, frequency, kilowatts, and power factor; alarm status and current alarm(s) condition per NFPA 110 level 1.

J. ENGINE / ALTERNATOR PACKAGING

1. The engine/alternator shall be isolated from the generator frame with rubber isolators. The packaging shall not require the addition of external spring isolators.
2. A mainline, thermal magnetic circuit breaker carrying the UL mark shall be factory installed. The breaker shall rated between 100 to 125% of the rated ampacity of the genset.
3. The generator shall include a unit mounted auxiliary power load center. All ancillary AC devices (block heater, battery charger, alternator strip heater, etc) shall have a dedicated breaker within the load center.Enclosure

   a. The genset shall be packaged with a sound attenuating enclosure.

   b. The enclosure shall be completely lined with sound deadening material. This material must be of a self extinguishing design with a reflective surface for enhanced serviceability.

   c. The enclosure shall be made of aluminum with a minimum thickness of 16 gauge. The enclosure is to have hinged, removable doors to allow access to the engine, alternator and control panel. The hinges shall allow for door fit adjustment. Hinges and all exposed fasteners will be stainless steel or Sermagard coated. The use of pop-rivets weakens the paint system and not allowed on external painted surfaces. Each door will have lockable hardware with identical keys.

   d. The enclosure shall be coated with electrostatic applied powder paint, baked and finished to manufacturer's specifications. The color will be manufacturer’s standard.
   The enclosure shall utilize an upward discharging radiator hood. Due to concerns relative to radiator damage, circulating exhaust, and prevailing winds, equipment without a radiator discharge hood will not be acceptable.

   f. The genset silencer shall be mounted on the discharge hood of the enclosure. Due to architectural

concerns, silencers mounted on the top of the generator enclosure are not acceptable. Gensets with silencers mounted inside the main generator compartment are acceptable only if the silencer is thermally wrapped to minimize heat stress on the surrounding components.

K. LOOSE ITEMS
Supplier to itemize loose parts that require site mounting and installation. Preference will be shown for gensets that factory mount items like mufflers, battery chargers, etc.

1. Spare Parts:
   a. Fuses: One spare set
   b. Filters One spare set (air, fuel, oil)

L. ADDITIONAL PROJECT REQUIREMENTS

1. Factory testing

   a. Before shipment of the equipment, the engine-generator set shall be tested under rated load for performance and proper functioning of control and interfacing circuits. Tests shall include:

      1) Verify voltage & frequency stability.
      2) Verify transient voltage & frequency dip response.
      3) Load test the generator for 30 minutes.

2. Manuals

   a. Three (3) sets of owner's manuals specific to the product supplied must accompany delivery of the equipment. General operating instruction, preventive maintenance, wiring diagrams, schematics and parts exploded views specific to this model must be included.

3. Installation

   a. Contractor shall install the complete electrical generating system including all external fuel connections in accordance with requirements of NEC, NFPA, and the manufacturer's recommendations as reviewed by the Engineer.

4. Service

   a. Supplier of the genset and associated items shall have permanent service facilities in this trade area. These facilities shall comprise a permanent force of factory trained service personnel on 24 hour call, experienced in servicing this type of equipment, providing warranty and routine maintenance service to afford the owner maximum protection. Delegation of this service responsibility for any of the equipment listed herein will not be considered fulfillment of these specifications. Service contracts shall also be available.

5. Warranty

   a. The standby electric generating system components, complete genset and instrumentation panel shall be warranted by the manufacturer against defective materials and factory workmanship for a period of five (5) years. Such defective parts shall be repaired or replaced at the manufacturer's option, free of charge for parts, labor and travel.

   b. The warranty period shall commence when the standby power system is first placed into service. Multiple warranties for individual components (engine, alternator, controls, etc.) will not be acceptable. Satisfactory warranty documents must be provided. Also, in the judgment of the specifying authority, the

manufacturer supplying the warranty for the complete system must have the necessary financial strength and technical expertise with all components supplied to provide adequate warranty support.

6. Startup and Commissioning

   a. The supplier of the electric generating plant and associated items covered herein shall provide factory trained technicians to checkout the completed installation and to perform an initial startup inspection to include:

      1) Ensuring the engine starts (both hot and cold) within the specified time.

      2) Verification of engine parameters within specification.

      3) Verify no load frequency and voltage, adjusting if required.

      4) Test all automatic shutdowns of the engine-generator.

      5) Perform a load test of the electric plant, ensuring full load frequency and voltage are within specification by using building load.

7. Training

   a. Training is to be supplied by the start-up technician for the end-user during commissioning. The training should cover basic generator operation and common generator issues that can be managed by the end-user.

   b. Training is to include manual operation of system.

SECTION 26 36 13 - ENCLOSED TRANSFER SWITCHES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes transfer switches in individual enclosures.

1.2 REFERENCES

A. National Electrical Manufacturers Association:

1. NEMA ICS 10 - Industrial Control and Systems: AC Transfer Switch Equipment.

B. International Electrical Testing Association:

1. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.

C. Underwriters Laboratories Inc.:

1. UL 1008 - Transfer Switch Equipment.

1.3 SUBMITTALS

A. Product Data: Submit catalog sheets showing voltage, switch size, ratings and size of switching and overcurrent protective devices, operating logic, short circuit ratings, dimensions, and enclosure details.

1.4 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of enclosed transfer switches.

B. Operation and Maintenance Data: Submit routine preventative maintenance and lubrication schedule. List special tools, maintenance materials, and replacement parts.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience, and with service facilities within 100 miles of Project.

B. Supplier: Authorized distributor of specified manufacturer with minimum three years documented experience.

1.6 MAINTENANCE SERVICE

A. Furnish service and maintenance of transfer switches for one year from Date of Substantial Completion.

PART 2 - PRODUCTS

2.1 AUTOMATIC TRANSFER SWITCH

A. Configuration: Electrically operated, mechanically held transfer switch.
1. The transfer switch unit shall be electrically operated and mechanically held. The electrical operator shall be a single-solenoid mechanism, momentarily energized. Main operators which include over current disconnect devices will not be accepted. The switch shall be mechanically interlocked to ensure only one of two possible positions, normal or emergency.
2. The switch shall be positively locked and unaffected by momentary outages so that contact pressure is maintained at a constant value and temperature rise at the contacts is minimized for maximum reliability and operating life.
3. All main contacts shall be silver composition. Switches rated 800 amperes and above shall have segmented blow-on construction for high withstand current capability and be protected by separate arcing contacts.
4. Inspection of all contacts shall be possible from the front of the switch without disassembly of operating linkages and without disconnection of power conductors. A manual operating handle shall be provided for maintenance purposes. The handle shall permit the operator to manually stop the contacts at any point throughout their entire travel to inspect and service the contacts when required.
5. Designs utilizing components of molded-case circuit breakers, contactors, or parts thereof which are not intended for continuous duty, repetitive switching or transfer between two active power sources are not acceptable
6. Provided with fully- rated neutral transfer contacts.
7. A neutral terminal plate with fully-rated AL-CU pressure connectors shall be provided.

B. Group ‘G’ Controller with Integrated User Interface Panel
1. The controller shall be connected to the transfer switch by an interconnecting wiring harness. The harness shall include a keyed disconnect plug to enable the controller to be disconnected from the transfer switch for routine maintenance.
2. The controller shall direct the operation of the transfer switch. The controller's sensing and logic shall be controlled by a built-in microprocessor for maximum reliability, minimum maintenance, inherent serial communications capability, and the ability to communicate via the Ethernet through optional communications module.
3. A single controller shall provide single and three phase capabilities for maximum application flexibility and minimal spare part requirements. Voltage sensing shall be true RMS type and shall be accurate to ± 1% of nominal voltage. Frequency sensing shall be accurate to ± 0.1Hz. Time delay settings shall be accurate to ±0.5% of the full-scale value of the time delay. The panel shall be capable of operating over a temperature range of -20 to + 70 degrees C, and storage from -55 to + 85 degrees C.
4. The controller shall be enclosed with a protective cover and be mounted separate from the transfer switch unit for safety and ease of maintenance. Sensing and control logic shall be provided on printed circuit boards.

C. Enclosure
1. The 3ATS shall be furnished in a NEMA type 1 enclosure.
2. Provide strip heater with thermostat.
3. Controller shall be mounted on, visible, and operational through enclosure door.

D. Rating: As indicated on drawings.

E. Enclosure:

1. Enclosure: NEMA 1.
2. Finish: Manufacturer's standard gray enamel.

2.2 SOURCE QUALITY CONTROL

A. Furnish shop inspection and testing of each transfer switch.

B. Make completed transfer switch available for inspection at manufacturer's factory prior to packaging for shipment. Notify Owner at least seven days before inspection is allowed.

PART 3 - EXECUTION

3.1 EXISTING WORK

A. Disconnect and remove abandoned transfer switches.

B. Clean and repair existing transfer switches to remain or to be reinstalled.

3.2 INSTALLATION

A. Install housekeeping pads.

B. Install engraved plastic nameplates.

3.3 TESTS AND CERTIFICATION

A. Auto transfer switch shall be factory tested to ensure proper operation of the individual components and correct overall sequence of operation and to ensure that the operating transfer time, voltage, frequency and time delay settings are in compliance with the specification requirements.

3.4 FIELD QUALITY CONTROL

A. Inspect and test in accordance with NETA ATS, except Section 4.

B. Perform inspections and tests listed in NETA ATS, Section 7.22.3.

3.5 MANUFACTURER'S FIELD SERVICES

A. Check out transfer switch connections and operations and place in service.

3.6 ADJUSTING

A. Adjust control and sensing devices to achieve specified sequence of operation.

3.7 DEMONSTRATION AND TRAINING

A. Demonstrate operation of transfer switch in normal, and emergency modes.

END OF SECTION

SECTION 26 51 00 – INTERIOR LIGHTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings, general provisions of the Subcontract, and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Interior lighting fixtures, lamps, and ballasts.
2. Lighting fixture supports.

B. Related Sections:

1. Section 260923 "Lighting Control Devices" for automatic control of lighting, including time switches, photoelectric relays, occupancy sensors, and multipole lighting relays and contactors.
2. Section 262726 "Wiring Devices" for manual wall-box dimmers for incandescent lamps.

1.3 DEFINITIONS

A. BF: Ballast factor.

B. CCT: Correlated color temperature.

C. CRI: Color-rendering index.

D. HID: High-intensity discharge.

E. LER: Luminaire efficacy rating.

F. Lumen: Measured output of lamp and luminaire, or both.

G. Luminaire: Complete lighting fixture, including ballast housing if provided.

1.4 ACTION SUBMITTALS

A. Product Data: Manufacturer’s product data sheets for each type of lighting fixture, arranged in order of fixture designation. Include data on features, accessories, finishes, and the following:

1. Physical description of lighting fixture including dimensions, materials, and finishes.
2. Lamp quantity and type.
3. Voltage, input watts.
4. Accessories.
5. Photographic image of luminaire.

6. Manufacturer's data sheets for each ballast including ballast type, power factor, input voltage, input watts, and ballast factor.
7. Energy-efficiency data.
8. Life, output (lumens, CCT, and CRI), and energy-efficiency data for lamps.
9. Photometric data and adjustment factors based on laboratory tests, complying with IESNA Lighting Measurements Testing & Calculation Guides, of each lighting fixture type. The adjustment factors shall be for lamps, ballasts, and accessories identical to those indicated for the lighting fixture as applied in this Project.

    a. Testing Agency Certified Data: For indicated fixtures, photometric data shall be certified by a qualified independent testing agency. Photometric data for remaining fixtures shall be certified by manufacturer.
    b. Manufacturer Certified Data: Photometric data shall be certified by a manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products.

B. Shop Drawings: For nonstandard or custom lighting fixtures. Include plans, elevations, sections, details, and attachments to other work.

1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
2. Wiring Diagrams: For power, signal, and control wiring.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plan(s) and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Lighting fixtures.
2. Suspended ceiling components.
3. Partitions and millwork that penetrate the ceiling or extends to within 12 inches of the plane of the luminaires.
4. Ceiling-mounted projectors.
5. Structural members to which suspension systems for lighting fixtures will be attached.
6. Other items in finished ceiling including the following:

    a. Air outlets and inlets.
    b. Speakers.
    c. Sprinklers.
    d. Smoke and fire detectors.
    e. Occupancy sensors.
    f. Access panels.

B. Qualification Data: For qualified agencies providing photometric data for lighting fixtures.

C. Product Certificates: For each type of ballast for bi-level and dimmer-controlled fixtures, from manufacturer.

D. Field quality-control reports.

E. Warranty: Sample of special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For lighting equipment and fixtures to include in emergency, operation, and maintenance manuals.

1. Provide a list of all lamp types used on Project; use ANSI and manufacturers' codes.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Drivers: One for every 100 of each type and rating installed. Furnish at least one of each type.

1.8 QUALITY ASSURANCE

A. Light Emitting Diodes (LEDs):

1. All LEDs shall be from the same manufacturer.
2. All LEDs shall be +/- 200 K of each other.

B. Drivers:

1. From the same manufacturer throughout and in accordance with ANSI C82.2, Public Law 100-357, and UL 935 and 1029.
2. Occupancy Sensors shall be certified for operation with the specific drivers utilized in controlled lighting fixtures.

C. Cords: UL 62.

D. Lamp Holders and Starters: UL 496, 542, and 879.

E. Luminaires:

1. Typical Installations: UL 676, 1570, 1571, and 1572.
2. Photometric Data: Certified by an independent testing laboratory.
3. In accordance with State of California energy regulations.

F. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by manufacturers' laboratories that are accredited under the National Volunteer Laboratory Accreditation Program for Energy Efficient Lighting Products.

G. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by an independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910, complying with the IESNA Lighting Measurements Testing & Calculation Guides.

H. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

I. Comply with NFPA 70.

1.9 COORDINATION

A. Coordinate layout and installation of lighting fixtures and suspension system with other construction that penetrates ceilings or is supported by them, including HVAC equipment, fire-suppression system, and partition assemblies.

1.10 WARRANTY

A. Manufacturer's warranty that the painted reflector finish will not yellow, darken, peel, crack, or develop surface deterioration that may reduce source image reflectance.

1. Duration: [1] year from date of final acceptance.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Luminaires: Refer to the lighting fixture schedule on the drawings. Proposed substitutions of luminaires for those specified will be judged on the basis of equal or better efficiency, appearance, quality of construction, and photometric data.

B. Drivers:
1. LED Dimming Type: Advance (a division of Philips), General Electric, Osram Sylvania Quicktronic, Universal Lighting Technologies, or equal.

2.2 GENERAL REQUIREMENTS FOR LIGHTING FIXTURES AND COMPONENTS

A. Recessed Fixtures: Comply with NEMA LE 4 for ceiling compatibility for recessed fixtures.

B. Materials and Fabrication

1. Metal Parts: Free of burrs and sharp corners and edges.
2. Sheet Metal Components: Steel unless otherwise indicated. Form and support to prevent warping and sagging.
3. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.
4. Provide fastening devices of a positive locking type which do not require special tools to apply or remove them. Do not use tie wires in place of fastening devices.
5. Attach reflectors to housings by means of safety chains to prevent reflectors from falling. No part of the chain shall be visible after installation.
6. Luminaires installed in air plenums shall be enclosed and gasketed.
7. Luminaires shall be completely factory assembled, wired, and equipped with necessary lampholders, ballasts, wiring, shielding, reflectors, channels, lenses, and other parts necessary to complete the luminaire installation.
8. Luminaire hardware shall be concealed. Weld exposed metal at joints, fill with weld material, grind smooth, and make free from light leaks. Gasket incandescent luminaires with overlapping trim. Weld ballast support studs, socket saddle studs, and reflector support studs to luminaire body; self-threading screws are not acceptable. Ventilate

ballast compartments and firmly secure ballast to conducting metal surface. Luminaires shall be designed for bottom relamping, unless otherwise noted.

9. Construct luminaires with a minimum number of joints. Unexposed joints shall be welded, screwed, or bolted; soldered joints are not acceptable. Do not use self-tapping methods or rivets for fastening removable parts used to gain access to electrical components requiring service or replacement, or for fastening electrical components or their supports.
10. Cast or extruded parts of luminaires shall be close grained and free from imperfections or discolorations, rigid, true to pattern, of ample weight and thickness, and properly fitted, filed, ground, and buffed to provide finished surfaces and joints free of imperfections.
11. Housings for luminaires shall be designed to make electrical components easily accessible and replaceable, without removing the luminaire body from its mounting.

C. Finishes

1. Luminaire finishes shall provide a durable, wear-resistant surface. Surfaces shall be chemically cleaned and pretreated with corrosion-inhibiting (phosphating) material to assure positive paint adhesion.

    a. Exposed metal surfaces (brass, bronze, aluminum, and like materials) and finished castings (except chromium-plated or stainless-steel parts) shall have an even top coat of high-grade methacrylate lacquer or transparent epoxy.
    b. Zinc-plate or hot-dip zinc galvanize the following after completion of all forming, welding, and drilling operations:

        1) Sheet-steel housings
        2) Iron and steel parts not phosphated or used in exterior applications

2. Screws, bolts, nuts, and other fastening or latching hardware shall have corrosion-resistant finish.
3. Provide luminaires with a high-temperature, baked-enamel coating unless noted otherwise in LLNS-selected color and finish. Refer to subpart "Reflectors" in this Section for specific reflector finish requirements.

D. Reflectors

1. Aluminum Reflectors:

    a. Fabricate reflectors and reflecting cones or baffles from aluminum reflector sheet, minimum 0.057 inches thick.
    b. Material shall be free of tooling marks, spinning lines, and marks or indentation caused by riveting or other assembly techniques.
    c. No rivets, springs, or other hardware shall be visible after installation.

2. Painted Reflectors:

    a. Painted reflectors shall be formed before application of primer and paint.
    b. Reflectors and reflector bodies shall receive a white electrostatically applied and baked polyester or polyurethane powder finish (powder coat) with not less than 90% laboratory certified reflectance.
    c. Average reflectance shall be determined by averaging the reflectance values at 5 randomly selected points on the reflector surface. Average value shall be at least 95% of the value stated in independent testing laboratory data.

E. Lenses, Faceplates, And Trims

1. Plastic lenses shall be of UV stabilized virgin methyl methacrylate, unless otherwise indicated. Polystyrene lenses are not acceptable. Lenses shall have high resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
2. Lens Thickness: At least 0.125 inch minimum unless otherwise indicated.
3. Glass lenses shall be of annealed crystal glass unless otherwise indicated.
4. Lenses, louvers, and other light diffusing components shall be contained in frames.
5. Lenses shall be removable but positively held within the frames so that hinging or other motion of the frame will not cause the diffusing component to drop out.
6. Faceplates on incandescent recessed luminaires shall open for access to the interior of the luminaire, serve as a ceiling trim, and be positively held to the luminaire body by adjustable means that permit the faceplate to be drawn up to the ceiling as tight as necessary to ensure complete contact of faceplate with the finished ceiling.
7. Provide ceiling trims for rectangular recessed luminaires with mitered corners, continuously welded and smoothed before shop finishing. Lapping of trim metal is not acceptable.

F. Luminaire Wiring

1. Wiring channels and wireways shall be free from projections and rough or sharp edges. Provide bushings at points or edges over which conductors pass.
2. Where utilized as raceways, luminaires shall be suitable for use as raceways. Provide feed through splice boxes where necessary.
3. All luminaires shall have a suitable interior means of attaching the grounding wire to the luminaire enclosure.

G. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps and drivers. Labels shall be located where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.

1. Label shall include the following lamp and ballast characteristics:

a. "USE ONLY" and include specific lamp type.
b. ANSI driver type (M98, M57, etc.) for LED luminaires.
c. CCT and CRI for all luminaires.

H. Electromagnetic-Interference Filters: Factory installed to suppress conducted electromagnetic interference as required by MIL-STD-461E. Fabricate lighting fixtures with one filter on each ballast indicated to require a filter.

2.3 DRIVERS, GENERAL REQUIREMENTS

A. Suitable for the electrical characteristics of the supply circuits to which they are to be connected and suitable for operating the specified type and quantity of lamps.

B. Where installed outdoors or in a nonheated environment such as walk in freezers, cold food handling areas, or outside air plenums, ballasts shall be capable of lamp starting at ambient temperatures down to 20-degrees F.

C. Luminaires controlled by dimmers shall be provided with dimming type ballasts

D. Single-lamp ballasts for long fluorescent lamps shall be kept to a minimum and shall only be used for the last odd lamp in a room or space.

2.4 DRIVERS FOR LEDs

A. Description: Electronically 0-10V dimming driver, designed for type and quantity of lamps indicated. Drivers shall be designed for full light output:

1. Lamp end-of-life detection and shutdown circuit.
2. Automatic lamp starting after lamp replacement.
3. Sound Rating: Class A.
4. Total Harmonic Distortion Rating: Less than 20 percent.
5. Transient Voltage Protection: IEEE C62.41.1 and IEEE C62.41.2, Category A or better.
6. Operating Frequency: 20 kHz or higher.
7. Lamp Current Crest Factor: 1.7 or less.
8. Interference: Comply with 47 CFR 18, Ch. 1, Subpart C, for limitations on electromagnetic and radio-frequency interference for nonconsumer equipment.

2.5 LIGHTING FIXTURE SUPPORT COMPONENTS

A. Provide installation and supporting hardware including stems, plates, plaster frames, hangers, and similar items, for support of luminaires for the ceiling construction in which they shall be installed. Provide plaster frames made of nonferrous metal, or of steel that has been suitably rustproofed after fabrication.

B. Comply with Section 260529 "Hangers and Supports for Electrical Systems" for channel- and angle-iron supports and nonmetallic channel and angle supports.

C. Single-Stem Hangers: 1/2-inch steel tubing with swivel ball fittings and ceiling canopy. Finish same as fixture.

D. Twin-Stem Hangers: Two, 1/2-inch steel tubes with single canopy designed to mount a single fixture. Finish same as fixture.

E. Wires: ASTM A 641/A 641M, Class 3, soft temper, zinc-coated steel, 12 gage.

F. Rod Hangers: 3/16-inch minimum diameter, cadmium-plated, threaded steel rod.

G. Hook Hangers: Integrated assembly matched to fixture and line voltage and equipped with threaded attachment, cord, and locking-type plug.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Coordinate luminaire locations indicated on the drawings are general and approximate. Coordinate luminaire placement with installation of other equipment such as ducts, pipes, conduit, and structural elements, including required clearances. Bring conflicts to LLNS's attention and verify exact location of luminaires before proceeding with work.

B. Verify ceiling construction and furnish appropriate luminaire mounting supports, hardware, trim, and accessories for each luminaire.

C. By beginning the work of this section, the Subcontractor warrants it has examined and verified that the existing conditions are in accordance with the provisions of preceding paragraphs of subpart 3.1.

3.2 INSTALLATION

A. Lighting fixtures:

1. Set level, plumb, and square with ceilings and walls unless otherwise indicated.
2. Install lamps in each luminaire.

B. Temporary Lighting: If it is necessary, and approved by LLNS, to use permanent luminaires for temporary lighting, install and energize the minimum number of luminaires necessary. When construction is sufficiently complete, remove the temporary luminaires, disassemble, clean thoroughly, install new lamps, and reinstall.

C. Install reflector cones, aperture plates, lenses, diffusers, louvers, and decorative elements of luminaires after completion of wet work, plastering, painting, and general cleanup in the area of the luminaires.

D. Install luminaires free of light leaks, warps, dents, or other irregularities. Light leaks are not acceptable.

E. Finish visible hanging devices to match the luminaire finish, unless otherwise noted. Suspended fixtures shall hang level and aligned when installed in rows.

F. Provide fire rated enclosures around recessed luminaires installed in fire rated ceilings.

G. Connect recessed luminaires to boxes with flexible conduit and fixture wire in accordance with Section 260533 “Raceway and Boxes for Electrical Systems” and Section 260519 “Low-Voltage Electrical Power Cables and Conductors”.

H. Install equipment so that components requiring access for service and maintenance are readily accessible.

3.3 SUPPORTS AND ATTACHMENTS

A. Provide attachment devices, brackets, plaster rings, saddle hanger, and tie bars as required, made of formed, rolled, or cast-metal shapes with the requisite rigidity and strength to maintain continuous alignment and support of installed luminaires.

B. Luminaires mounted in suspended ceilings shall be attached to the main runners of the ceiling system with appropriate mounting hardware. Provide independent splayed bracing wires and hanger wires at each corner of luminaire to structure above.

C. Provide at least two supports for single luminaires. Luminaries more than 2 feet wide shall be supported with at least four hangers per luminaire. Where luminaires are continuously mounted in rows, provide supports at maximum intervals of 8 feet; closer, if necessary to prevent visible deflection.

D. Lay-in Ceiling Lighting Fixtures Supports: Use grid as a support element.

1. Install ceiling support system rods or wires, independent of the ceiling suspension devices, for each fixture. Locate not more than 6 inches from lighting fixture corners.
2. Support Clips: Fasten to lighting fixtures and to ceiling grid members at or near each fixture corner with clips that are UL listed for the application.
3. Fixtures of Sizes Less Than Ceiling Grid: Install as indicated on reflected ceiling plans or center in acoustical panel, and support fixtures independently with at least two 3/4-inch metal channels spanning and secured to ceiling tees.
4. Install at least one independent support rod or wire from structure to a tab on lighting fixture. Wire or rod shall have breaking strength of the weight of fixture at a safety factor of 3.

E. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

3.4 IDENTIFICATION

A. Install labels with panel and circuit numbers on concealed junction and outlet boxes. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.5 FIELD QUALITY CONTROL

A. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards.

3.6 ADJUSTMENT AND CLEANING

A. Adjustment:

1. Provide final focusing and adjusting of lighting equipment under LLNS supervision.
2. Replace burnt out luminaires and noisy or defective drivers.

B. Cleaning: Immediately prior to occupancy, clean reflectors, reflector cones, aperture plates, lenses, trim rings, faceplates, louvers, lamps, and decorative elements.

END OF SECTION

SECTION 27 00 00 VOICE & DATA COMMUNICATIONS

PART 1 - GENERAL

1.1 SUMMARY:

A. Scope: This Section describes the scope of work and standards for the completion of the telecommunications part of this Project. The cabling and equipment requirements consist of the following, but not limited to:

1. Outside Plant backbone cabling required for interconnect buildings.
2. Ethernet based data communications over Category 6 Unshielded Twisted Pair (UTP) cabling.
3. Ethernet based data communications over Category 6A Unshielded Twisted Pair (UTP) cabling for all wireless access points

B. Work Included: The work covered by these Specifications includes the construction described herein and represented in the Request for Proposal, including all labor necessary to perform and complete such construction, all materials and equipment incorporated, and all services, facilities, tools and equipment necessary or used to perform and complete such construction. The scope of work includes, but is not limited to:

1. All cabling and equipment listed in part A above.
2. All termination blocks, cross connect blocks, information outlets, jacks, patch panels, patch cords, cabinets, equipment racks, etc. required to support, terminate and/or cross connect cabling in the Telecommunications Closets.
3. All physical cable management hardware, including J-hooks, D-rings and cable trays in ceiling areas and vertical and horizontal cable management systems used on backboards and equipment racks.
4. Conduit sleeve installation and fire-stopping where required.
5. Seismic bracing of all cabinets and racks provided by this work as required by code and by local governing jurisdiction.
6. Testing, labeling and documentation of all cable and hardware installed under this contract.
7. Preparation and submission of testing reports, As-built drawings and cabling documentation as described below.
8. Installation of all referenced telecommunication equipment and cabling shown on the contract documents.

C. Related Work Not Included in this Section and Specified Elsewhere, Unless Otherwise Noted:

1. Cutting, patching and painting as required to match adjacent finishes.
2. Determining telecommunications cabling pathways including location of cable trays, conduits, sleeves, pull boxes, outlet boxes, etc. where not specified.

D. Supplemental Items: The Contractor shall provide all items and work described in this Division in accordance with the conditions of the Contract. This includes all incidentals, equipment, appliances, services, hoisting, scaffolding, supports, tools, supervision, labor, consumable items, fees, licenses, etc., necessary to provide a

complete cabling system as described herein.

E. Complete System: It is the intent of the Drawings and Specifications to provide a workable communications cabling system ready for the Owners use. Any item not specifically drawn or called for in the Specifications, but normally required for a complete system, are considered to be part of the Contract.

1.2 REFERENCES AND STANDARD REQUIREMENTS:

A. Published specifications, standards, tests or recommended methods of trade, industry or government organizations apply to work of this section where cited by abbreviation noted below:

1.	EIA/TIA Industry	Electronic Industries Association/Telecommunication Association
2.	BICSI	Building Industry Consultant Service, International
3.	IEEE	Institute of Electrical and Electronics Engineers
4.	ISO	International Standards Organization
5.	ITU	international Telecommunications Union
6.	CCITT Telephone	Consultative Committee on International Telegraph and
7.	ANSI	American National Standards Institute
8.	TIA	Telecommunications Industry Association
9.	ASTM	American Society for Testing and Materials
10.	CEC	California Electric Code
11.	FCC	Federal Communications Commission
12.	CEA	Insulated Cable Engineers Association, Inc.
13.	IEC	International Electro technical Commission
14.	NEMA	National Electrical manufacturers Association
15.	UL	Underwriters Laboratories, Inc.
16.	IPC Circuits	The Institute for Interconnecting and Packaging Electronic
17.	NFPA	National Fire Protection Association
18.	OSHA	Occupational Safety and Health Act Standards
19.	CBC	California Building Code
20.	Title 24	State of California Code of Regulations
21.	ADA	Americans with Disabilities Act

B. The installation shall be in compliance with the following standards:

1. Commercial Building Telecommunications Wiring Standards (EIA/TIA)
2. Commercial Building Standard for Telecommunications Pathways and Spaces (ANSI/TIA/EIA).
3. The Administration Standard for the Telecommunications Infrastructure of Commercial Buildings (EIA/TIA).
4. Commercial Building Grounding and Bonding Requirements for Telecommunications (EIA/TIA).
5. BICSI Telecommunications Distribution Methods Manuals (TDMM)

1.3 SUBMITTALS:

A. Submit manufacturers data literature for each item used, describing each product, including specification, installation instructions and general recommendations.

This includes, but is not limited to, equipment, racks, cable, patch panels, information outlets, connectors, and accessories. Submittal format shall be electronic PDF's.

B. Provide Equipment Submittals at bid time. Equipment substitutions will not be accepted without prior approval. Provide product data sheets and quantities at time of bid.

C. Provide Shop Drawings. Submittal format shall be electronic PDF's.

D. Closeout Submittals: Submit as-built Communications floor plan showing all cable paths, termination points and labeling to Information Systems.

1.4 INSPECTION, TESTS AND GUARANTEES:

A. After installation is complete, in addition to the required testing specified herein, and at such times as the Owner directs, the Contractor shall be present while the Owner conducts operational test of the network electronics connected to the cabling system. The installation shall be demonstrated to be in accordance with the requirements of these specifications. Any defects revealed shall be promptly corrected, re-tested and the documentation updated at the Contractor's expense.

B. All work and all items of equipment and materials shall be guaranteed as described in the General Conditions. The Contractor shall be notified in writing of any defective items and shall repair or replace such items promptly without cost to the Owner.

PART 2 – PRODUCTS

2.1. GENERAL:

A. The Contractor shall supply the products detailed in this specification. If not specified, the Contractor can select products of suitable quality and workmanship. For any products selected by the Contractor, the Contractor is required to submit product documentation including the manufacturers original literature, product specifications and testing reports.

B. The specified cabling system provides a standardized media and layout for backbone and horizontal cabling, standard connection interfaces and a consistent and uniform network design across all buildings. The specified products are to establish a level of performance and warranty. Other cabling systems equal to the specified will be allowed and considered for approval during the submittal process. Following installation, the Contractor is required to provide a warranty certificate (with cable test report), validating that the cable installation meets performance standards.

C. Consistency: Any given item of equipment or material shall be the product of one manufacturer throughout the facility.

D. Provide Complete: Provide all auxiliary and incidental materials and equipment necessary for the operation and protection of the work of this Section as if specified in full herein.

2.2 DATA HORIZONTAL COPPER CABLING STANDARDS: All new devices shall be wired to conform to the TIA/EIA T568-C standard. The Owner requires that 4-pair Category 6 UTP be used in all new data cabling. Horizontal cabling systems shall meet ANSI/TIA-568-C, ISO/IEC 11801:2002 CLASS EA, exceeds ANSI/TIA-568-C.2, and ISO/IEC 11801:2002 category 6 electrical characteristics. Conductors #23 awg solid bare copper insulated, assembled into four tightly twisted pairs, with a core separator, with a ripcord under a jacket with descending footage markers from 1000 to 0 on each 1000ft reel.

A. Horizontal Data Cabling: For horizontal data cabling within walls, ceilings, attic spaces the following cable is required:

1. Cable from patch panels to data outlets shall be solid annealed copper, four-pair individual twisted pairs. Overall jacket color shall be blue for data. Type CM or CMG for general use and CMP for plenum space per NEC specification. Data cable shall be TIA/EIA Category 6, Berk-Tek LANmark 2000 #10033822 or approved equal. Alternative color may be requested from time to time in order to uniquely identify the installed cable.

2. For wireless access points only, Category 6A, 23 AWG copper conductors, color yellow. PANDUIT CORP. PUP6AM04BU-UG. The TX6A™ 10GIG™ UTP Copper Cable with MaTriX Technology shall meet or exceed both channel and component compliant standards (ANSI/EIA/TIA-568-B.2-10, IEC/ISO 11801 Class EA (channel) and IEC 61156-6 (component) standards). Category 6A UTP 4-pair copper cable shall be constructed of 23 AWG conductors. The insulated conductors shall be twisted in pairs and all four pairs shall be covered by a flame retardant PVC, FEP, or PE jacket depending on cable flame rating. The copper conductors shall be twisted in pairs and separated by a crossweb. All four pairs shall be surrounded by Matrix Tape and flame retardant jacket. The patent pending Matrix Tape shall suppress the effects of alien crosstalk allowing 10Gb/s transmission. This innovative cable design shall provide installation flexibility as cables can be routed in tight bundles through pathways and spaces. The TX6A™ 10GIG™ UTP Copper Cable with MaTriX Technology must be installed as part of a complete TX6A™ 10GIG™ Copper Cabling System in order to achieve 10GBASE-T certified performance.

All cable shall conform to the requirements for communications circuits defined by the National Electrical Code (Article 800) and the Canadian Building Code. Cable listed to NEC Article 800-51(a) will be used for “Plenum” installations.

Cable listed to NEC Article 800-51(b) shall be installed in vertical runs penetrating more than one floor.

1. Where cabling is routed through plenum spaces, the Contractor is expected to evaluate and select as necessary to suit conditions.
2. The contractor shall ensure that the cable is installed with 18 inches of slack at the end.

B. Data Patch Cords: Patch cords within the wiring closets will conform to the specified structured cabling system specifications. The Contractor shall provide sufficient Cat 6 / 6A patch cords to connect 110% of all data jacks to be installed.

Patch Cords shall be a minimum of six feet in length. Patch cords will be blue (Cat 6), yellow (Cat 6A), as specified for the horizontal cabling with factory terminated connectors.

C. UTP Cat 6 jack modules: Mini-com® tx-6™ TG modules shall be Category 6 modules featuring Giga-TX™ technology. The eight position modules shall be used in all work areas and shall exceed the connector requirements of the TIA/EIA Category 6 standard. Termination shall be accomplished by use of a forward motion termination cap and shall not require the use of a punch down tool. The termination cap shall provide strain relief on the cable jacket, ensure cable twists are maintained to within 1/8" (3.18 mm) and include a wiring scheme label. The wiring scheme label shall be available with both T568A and T568B wiring schemes. All terminations for this project shall use the T568B (b) wiring scheme. The modules shall terminate 4 pair 23 100-ohm solid unshielded twisted pair cable. The modules shall be universal in design, including complying with the intermateability standard IEC 60603-7 for backward compatibility. Category 6 modules shall have UL and CSA approval. the modules shall have ETL verified Category 6 performance and ISO class E performance (as defined in ISO/IEC 11801) in both the basic and channel links. They shall be universal in design, accepting 2, 3, or 4 pair modular plugs without damage to the outer jack contacts. the modules shall be able to be re-terminated a minimum of 10 times and be available in 11 standard colors for color-coding purposes. The jack shall snap into all mini-com outlets and patch panels. The module shall include a black base to signify Category 6, 400 mhz performance.

Part number	Style	Category	Colors
CJ688TG WH**	RJ-45	6	11

**To designate a color, add suffix IW (Off White), EI (Electric Ivory), IG (Int'l Gray), WH (White), BL (Black), OR (Orange), RD (Red), BU (Blue), GR (Green), YL (Yellow) or VL.

C. UTP Cat 6A Jack Modules: MINI-COM® TX6A™ 10GIG™ UTP Jack Modules shall be Category 6A modules featuring MaTriX Technology. The eight position modules shall terminate unshielded twisted 4 pair, 22 – 26 AWG, 100 ohm cable and shall not require the use of a punch down tool. Jack module shall use Enhanced Giga-TX™ Technology with forward motion termination to optimize performance by maintaining cable pair geometry and eliminating conductor untwist. The termination cap shall provide strain relief on the cable jacket, ensure cable twists are maintained to within 1/8" (3.18 mm) and include a wiring scheme label. The blue module base shall signify Category 6A performance and shall include a universal label representing T568A and T568B wiring schemes. The MINI-COM® TX6A™ Jack Modules include MaTriX Tape on the external portion of the jack module, which assists in suppressing alien crosstalk. The jack modules shall be universal in design, including complying with the intermateability standard IEC 60603-7 for backward compatibility. Category 6A jack modules shall be UL and CSA approved and RoHS compliant.

The jack modules shall be ETL verified to ANSI/TIA/EIA Category 6A and IEC/ISO 11801Class EA channel performance. They shall be universal in design, accepting 2, 3, or 4 pair modular plugs without damage to the outer jack contacts.

The jack modules shall be able to be re-terminated a minimum of 20 times and be available in 11 standard colors for color-coding purposes. The jack module shall snap into all MINI-COM® outlets, patch panels and surface mount boxes.

The MINI-COM® TX6A™ 10GIG™ Jack Module must be installed as part of a complete TX6A™ 10GIG™ Copper Cabling System with MaTriX Technology in order to achieve 10GBASE-Tcertified performance.

Part number	Style	Category	Colors
CJ6X88TG WH**	RJ-45	6A	11

**To designate a color, add suffix IW (Off White), EI (Electric Ivory), IG (Int'l Gray), WH (White), BL (Black), OR (Orange), RD (Red), BU (Blue), GR (Green), YL (Yellow) or VL.

1. All copper Category 6 & 6A terminations should be the T568B pin-out.
2. Refer to the "Appendix A - Materials" for specific cable part numbers.

E. Data Patch Panels: All horizontal station cables will terminate on Category 6 / 6A patch panels that are wiring compliant with the Category 6 / 6A standards. Patch panels will be rack-mountable with front facing T568-C configured RJ-45 modular jacks and rear facing 110 IDC punch-downs. Patch panel material and finish shall be black anodized aluminum.

F. Faceplates: Panduit #CFPE module space, white, single-gang faceplates in office areas, minimum. Use Panduit #CFFPA2BL snap-on modular furniture faceplate for modular furniture.

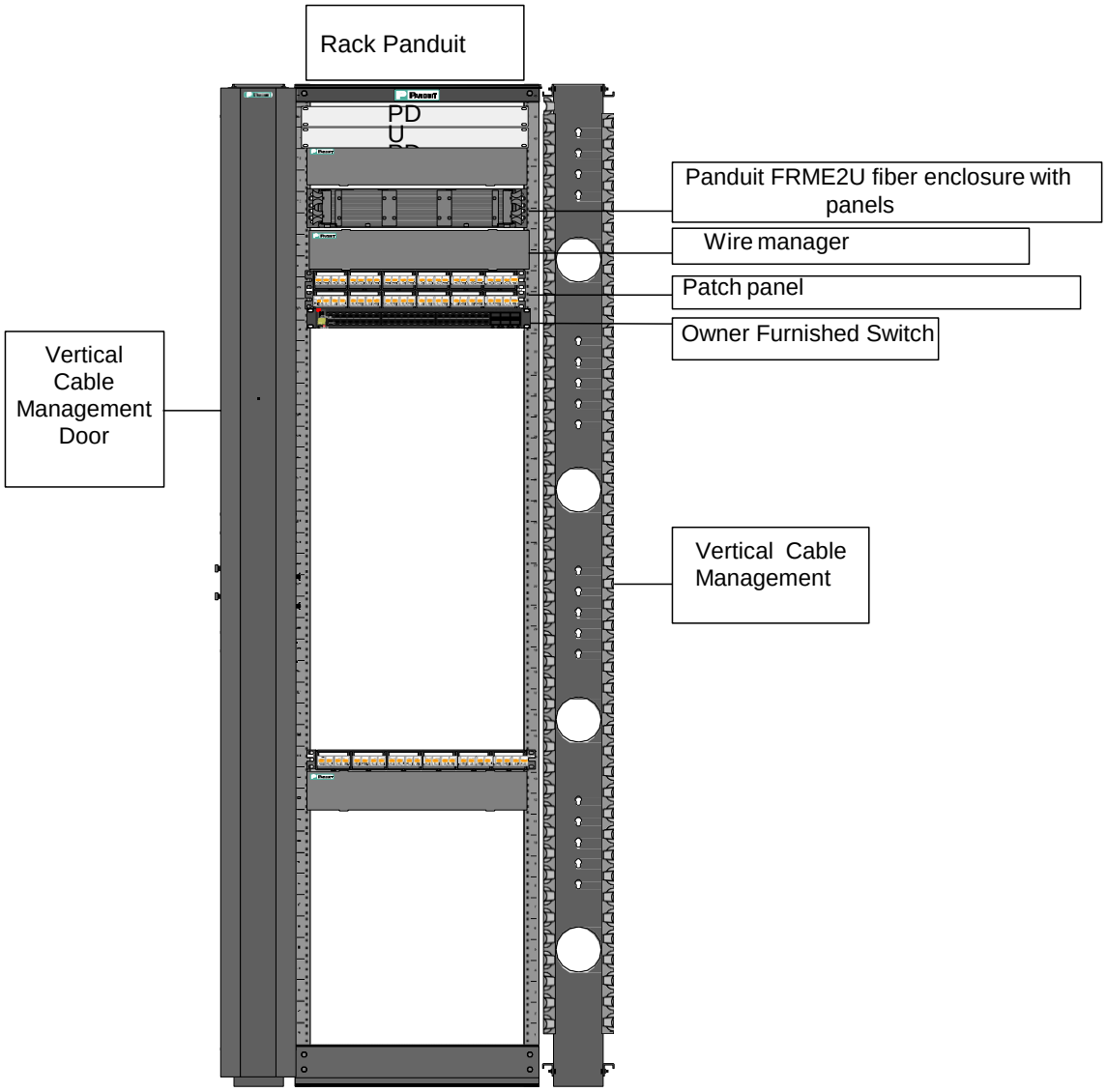
G. Equipment Racks: The Contractor shall provide and install standard free-standing equipment racks at each telecommunication closet as indicated on the plans. Panduit #R2PS, two post steel rack, 19” wide system width, 84” height, black color.

H. Use Panduit #CP48BL 48-Port Modular Patch Panels for communication closet termination. Typical Rack Configuration for Switches:

1. CAT 6 / 6A Horizontal UTP cable shall be terminated on flat Cat 6 /6A modular panels as prescribed in the elevations provided in this section.
2. All patching shall be done using the “One-To-One” patching methodology demonstrated below and at: http://www.panduit.com/heiler/ProductBulletins/D-COCB20--WW-ENG-OneToOneSwitchPatchn-W.pdf. *Horizontal cable managers are NOT used in this design.*

3. All patch cords shall be Panduit Small Diameter Category 6 / 6A patch cords. These patch cords are 0.150 in, (3.8mm) nominal cable diameter and occupy less than half the space of traditional patch cords. http://www.panduit.com/en/landing-pages/small-diameter-patch-cords
4. Racks in space restricted TRs shall have integrated vertical managers on one side only. See illustrations below for another comparison of rack configurations for normal-sized and space-restricted telecommunications room.

Typical Rack Elevation For Switch Using One-To-One Patching



I. Cable Managers:

1. The Cable Management System should be used to provide a neat and efficient means for routing and protecting fiber and copper cables and patch cords on telecommunication racks and enclosures.
2. The system should be a complete cable management system comprised of vertical cable managers, horizontal cable manager and cable management accessories used throughout the cabling system. The system should protect network investment by maintaining system performance, controlling cable bend radius and providing cable strain relief.

3. Cable managers size should be selected according to projected port density when the rack is fully loaded and should not in any case exceed a 35% fill per manufacturers calculations (fill charts) upon installation.

J. Horizontal Cable Managers: The horizontal cable managers are needed only in space restrictive TRs where there is not sufficient room to use angled patch panels. If horizontal managers are needed, they should meet the following criteria:

Adjustable depth for pathway utilization or fan avoidance.

1. Manage cables on switches with vertical cards.
2. Can be used to create cable pathways for routing cable between bays.
3. Have steel hinged covers to provide easy access to the pathway.
4. Panduit PatchLink part number #PAN-WMP1E or approved equal.

K. Vertical Cable Management: approved vertical cable managers are Panduit #QPAN-WMPV45E NetRunner High Capacity or approved equal, type and should have the following properties:

1. The Vertical cable managers should include components that aid in routing, managing and organizing cable to and from patch panels and/or equipment.
2. Managers should protect network equipment by controlling cable bend radius and providing cable strain relief.
3. Managers should be a universal design mounting to EIA racks. The manager should be constructed with a base that possesses pass through holes and molded cable management fingers.
4. The fingers should incorporate integral bend radius control and be spaced so that the gaps between them align with the EIA rack spaces.
5. The vertical manager should have a dual hinged cover that can be opened to the left or right to allow easy access to the pathway speeding moves, adds and changes.
6. High density minimizes area required for network layout, freeing up valuable floor space.
7. Allows mounting of many standard EIA 19" accessories, such as patch panels, vertically in the manager.
8. Ventilated side walls provide maximum airflow for equipment cooling.
9. Snap on finger sections can be removed to improve airflow, and break away fingers allow routing of large cable bundles.
10. Large finger spacing accommodates up to 48 Cat 6 / 6A cables.
11. Optional "sure close" dual hinged metal doors provide easy access to vertical pathway and provide visual and audible feedback on closure.
12. Available in 7 foot version.

2.3 FIBER ENCLOSURES

Owner approved fiber enclosures are Panduit FRME type. All fiber terminations should be contained in these rack mount enclosures built to that purpose and having the following properties:

A. Mount to standard 19" or 23" EIA rack or cabinet • Hold QuickNet ™ or Opticom ® Fiber Adapter Panels.

B. Have front and rear access on all models via durable molded-hinge doors.

C. Have integral bend radius control and cable management for fiber patch cords.

D. Have multiple trunk cable entry locations.

E. Include fiber optic cable routing kit (grommets, cable ties, saddle clips, strain relief bracket, and ID/caution labels) for various cable management solutions.

2.4 MULTI-MODE FIBER ADAPTER PANELS

OM3 multi-mode fiber adapter panels should be SC with 12 duplex fiber ports per FAP and meeting the following:

A. SC 10Gig™ FAP loaded with 12 LC 10Gig™ Duplex Multimode Fiber Optic Adapters (Aqua).

B. Have zirconia ceramic split sleeves.

C. Panduit part number (FAP12WAQDLCZ)

2.5 FIBER TERMINATIONS

All fiber terminations shall be SC-type connectors (not APC) mounted inside standard rack-mount fiber termination enclosure.

2.6 FIBER PATCH CORDS

Multimode fiber patch cords should be manufactured by Panduit and meet the following conditions:

1. Be terminated in duplex SC connections.
2. Be available in both singlemode and OM4 multimode.
3. Available in riser (OFNR) or plenum (OFNP) flame ratings.
4. Be 100% pre-tested for insertion and return loss.
5. Support speeds up to 10 Gb/s for link lengths up to 300 (OM4) meters with an 850nm source per IEEE 802.3ae 10 GbE standard.
6. Pass all TIA/EIA-568-B.3 performance requirements.
7. SC connector housing and boot colors follow TIA/EIA-568-C.3 suggested color identification scheme.
8. Insertion loss per connection: 0.10dB typical; 0.30dB maximum for OM3.

9. Be terminated in duplex SC connections. All cable terminations (copper or fiber) will be documented consistently as to uniquely match each end of the cable.
10. Cable labeling will be easily readable and permanent affixed, using a contrasting black-on-white label. Permanent indelible ink is not acceptable.
11. All cable terminations will be documented based on numbering plan approved by Information Systems. Contact Information Systems for numbering scheme.
12. See Appendix A - Materials for fiber jumper part numbers.

2.5 COMMUNICATIONS STRUCTURED GROUNDING

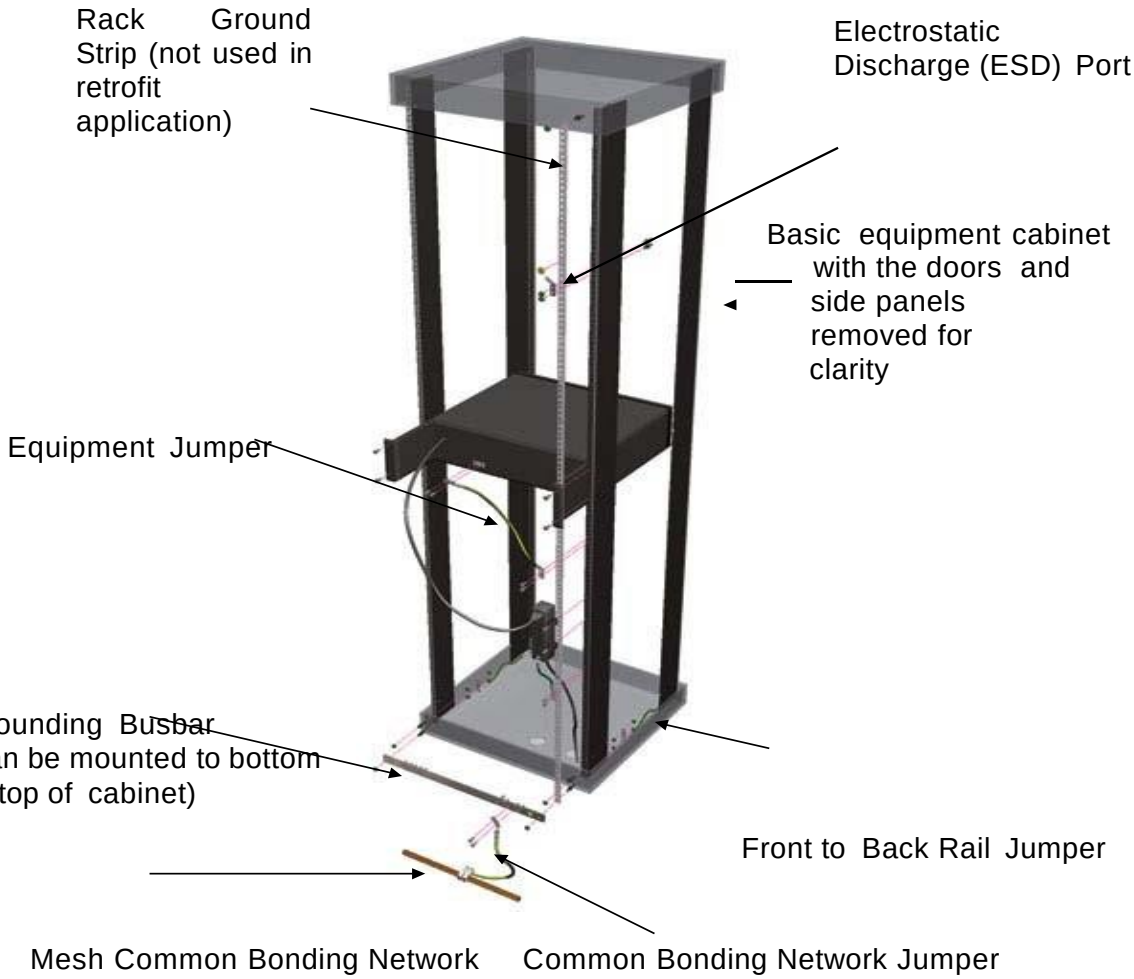
A. General

Contractor is responsible for bonding to ground all newly placed equipment and installed racks or cabinets per the TIA 607-B Standard.

B. Details

1. All newly installed racks and cabinets should have installed a vertical busbar mounted along one equipment rail to serve as a clean, low-resistance bonding place for any equipment not equipped with a designated grounding pad.
2. Smaller equipment without an integrated grounding pad should be bonded to the vertical busbar through the use of a thread-forming grounding screw that is anodized green and includes serrations under the head to cut through oxidation or paint on the equipment flange.
3. Larger equipment (chassis switches) with a designated grounding terminal should be bonded to the vertical busbar with and EBC (equipment bonding conductor) kit built to that purpose.
4. Contractor should take care to clean (wire brush, scotchbrite pads) any metallic surface to be bonded down to bare metal and apply a film of anti-oxidation paste to the surfaces prior to effecting the bond.
5. All bonding lugs on racks and busbars should be of two-hole irreversible compression type. Mechanical lugs and single-hole lugs will not be accepted and should be removed and replaced at Contractor's expense.
6. Every rack or cabinet should have an individual bonding conductor into the grounding network, serially connecting (daisy-chaining) of racks is expressly forbidden and will not be accepted.
7. Rack Bonding Conductors (RBC) may tap into an overhead or underfloor aisle ground, or may run to the wall-mounted grounding busbar in smaller Telecommunications rooms containing 5 racks or less
8. A minimum of every other rack or cabinet should be outfitted with a properly installed and bonded ESD (electro-static discharge) port along with a wrist strap and lead to be used by any technicians servicing network equipment. On four post racks and cabinets these ESC ports and straps should be provided on front and back to be accessible and able to reach any active equipment needing servicing.
9. Armored cables should be properly bonded to the earthing system with a kit

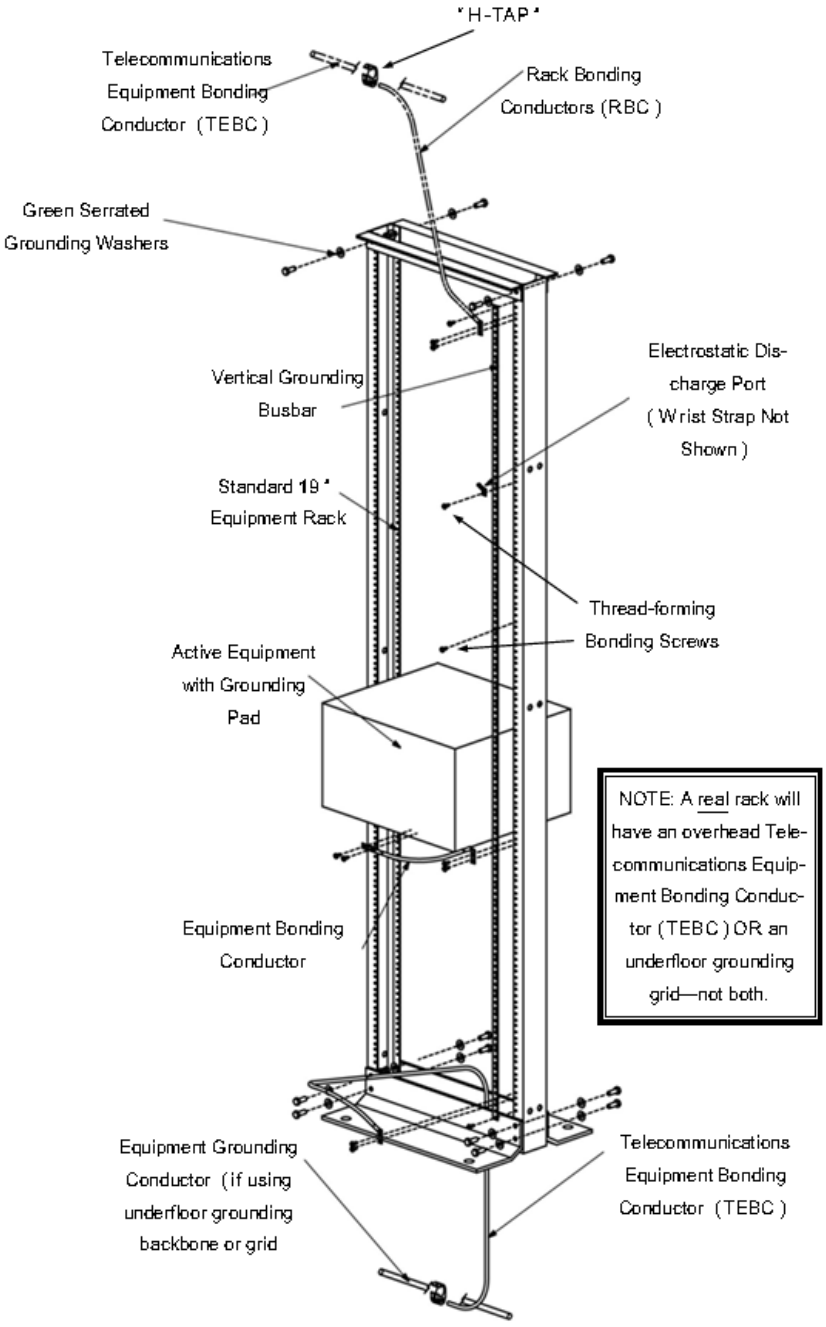
built to that purpose.



For examples of rack and cabinet grounding refer to the illustrations below:

Properly Bonded Cabinet

Properly Bonded Two-post Rack



For complete list of bonding materials see "Appendix I - Materials" at the end of this document.

PART 3 – EXECUTION

3.1 COMMUNICATIONS LABELING

A. General

Owner has adopted local naming conventions for communications circuit designation and labeling. For exact instructions of how one project will be designated, consult the attached project specifications for that job.

B. Universal Guidelines

The following are general labeling guidelines that will apply to all facilities:

1. When making additions to legacy (brownfield) systems, Contractor should adopt the circuit designation and labeling strategy of the existing systems unless instructed otherwise in project documentation.
2. In new installations (greenfield), Contractor should develop and submit for approval a labeling strategy based on the TIA 606-B Circuit Designation and Labeling Standard.
3. This labeling scheme should, at a minimum, clearly identify all components of the system: racks, cables, panels and outlets, grounding, pathways and spaces like telecommunications rooms.
4. The labeling system should designate the cable origin and destination with a unique identifier for the cable within the system.
5. Racks and patch panels should be labeled to identify the location within the cable system infrastructure.
6. All labeling information should be recorded on the as-built drawings and all test documents should reflect the appropriate labeling scheme.
7. All label printing will be machine generated by either hand-held labeling systems or computer generated using programs and materials built specifically for communications labeling.
8. Hand written labels will not be accepted and must be remedied at Contractors expense.
9. Such labels should utilize materials designed to outlast the cabling elements to which they attach. Office quality labels will not be accepted.
10. Cable labels should be self-laminating, appropriately sized to the outside diameter of the cable and placed within view at the termination point on each end.
11. Outlet, patch panel and wiring block labels should be installed on, or in, the space provided on the device.
12. All Bays should be labeled with Bay Designation at the end of Bay on side of cabinet.

13. All cabinets should be labeled on outside door and on the inside so identification can be made when door is open.
14. Labeling information will be supplied to the Communications Contractor by the Owner's Telecommunications Engineer in the project documentation.
15. All labels will be permanently affixed to cables, patch panels, racks, cabinets, and enclosures.
16. Labels should be legible and placed in a position that insures ease or visibility. Label type must be as listed in Appendix A - Materials.
17. Conduit should be marked indicating the identification of the cable within.
18. Backbone cabling should be labeled on each end designating the cable identification, FROM (origin), and TO (destination).
19. Machine-generated labels should be installed behind the clear lens or cover on any device that provides such an option.
20. All cable terminations (copper or fiber) will be documented consistently as to uniquely match each end of the cable.
21. Cable labeling will be easily readable and permanent affixed, using a contrasting black-on-white label. Permanent indelible ink is not acceptable.
22. All cable terminations will be documented based on numbering plan approved by Information Systems. Contact Information Systems for numbering scheme.

    For a complete listing of communications labeling products see Appendix A – Materials.

3.2 INSTALLATION

1. All fiber cables shall be run inside 1" single wall corrugated innerduct with pull rope - HDPE - orange color. All innerduct shall be secured along its path with nylon ties.
2. All fiber cable innerduct shall be run perpendicular and parallel to walls - no diagonal runs allowed. All cable runs shall be routed along serviceable areas, such as corridors, hallways, and away from modular office furniture, whenever possible. All cable runs above ceiling shall be suspended utilizing Caddy Clip or equivalent cable suspension system throughout.
3. Data outlets shall consist of a modular system in which cables are connected to a connector, rather than directly to a jack or other outlet device. Each outlet shall provide two jack positions in a single-gang box. The outlet system shall be Panduit Mini-Com part number PAN-CJ688TP orange color CAT6 modular jack or approved equal.
4. Alternative color may be requested from time to time in order to uniquely identify the installed modular jack.
5. All bundled cables shall be held together with Velcro® bands or equivalent, and not with nylon cable ties. All bundles shall be suspended using Caddy Clip or equivalent j-hook assembly or equivalent directly to ceiling. Maintain 18" clearance of cable bundles above drop-ceiling and lighting fixtures.

6. All twisted pair cables shall be terminated onto patch panels in wiring rack in communications closet.
7. Twisted pair distribution: Each conductor in multi-pair cables shall be tested for continuity, transpositions, shorts, grounds/FEMF (Foreign Electromotive Force). Vendor will perform Category 6 testing of all cable runs. All cable runs must meet or exceed the TIA/EIA Category 6 standards. Printed and data-disk based verification and results of this test will be submitted to Information Systems upon job completion. Cable installation including craftsmanship and materials will carry a 100% unconditional lifetime of the installing company warranty from the vendor. The installing vendor will bear the total cost of labor and materials for the failed component(s). Exclusions are normal wear and tear, or misuse.
8. All cable runs will be installed based on the TIA/EIA 568B wiring scheme. Modular jacks shall be Panduit Mini-Com PAN-CJ688TP orange color CAT6 modular jack or approved equal. Cables will be terminated to a Panduit jack wired as a T568B wiring scheme at each end. Cable sheaths must extend 1/8 inch or more into strain relief area of Panduit Mini-Jack module. All terminations must meet or exceed TIA/EIA Category 6 and County of Nevada specifications.
9. All cables shall be run perpendicular and parallel to walls - no diagonal runs allowed. All cable runs shall be routed along serviceable areas, such as corridors, hallways, and away from modular office furniture, whenever possible. All cable runs above ceiling shall be suspended utilizing Caddy Clip or equivalent cable suspension system throughout.

3.3 TESTING AND DOCUMENTATION

A. General

1. Contractor should test all cables and termination hardware for defects in installation and to verify cabling system performance prior to system acceptance.
2. Testing should be done in accordance with this document, the ANSI/TIA Standards, the Pan/Gen Certification Plus System Warranty guidelines and best industry practice.
3. If any of these are in conflict, the Contractor should bring any discrepancies to the attention of Owner’s Project Manager for clarification and resolution.
4. Any defect in the cabling system performance or installation including but not limited to cable, connectors, feed through couplers, patch panels, and connector blocks should be repaired or replaced in order to ensure 100% useable conductors or fibers in all cables installed.
5. Contractor is responsible for supplying all of the required test equipment used to conduct acceptance tests.
6. Owner reserves the right to be present during any or all of testing.
7. All cabling not tested strictly in accordance with these procedures should be re-tested at no cost to Owner.
8. All fiber cable runs will be installed based on the TIA/EIA-568-B.3 Optical Fiber Cabling Components Standard. Printed and data-disk based verification and results of this test will be submitted to Information Systems upon job completion. Cable installation including craftsmanship and materials will carry a 100% unconditional lifetime of the installing company warranty from the

vendor. The installing vendor will bear the total cost of labor and materials for the failed component(s). Exclusions are normal wear and tear, or misuse

B. COPPER TESTING

1. All twisted-pair copper cable links should be tested in compliance to the requirements in ANSI/TIA 1152 and ANSI/TIA 568-C.2 for Category 6 & 6A compliance using a test unit meeting a minimum IEC level of accuracy.All testers used must have been factory calibrated by the manufacturer within one year of use or according to factory calibration recommendations, whichever is the more stringent.
2. Contractor should set references according to manufacturer's recommendation prior to each day's testing and reset references anytime tester is left unused for more than two hours.

C. FIBER TESTING

1. All installed fiber should be tested for link-loss in accordance with ANSI/TIA 568-C.0 and should be within limits specified within ANSI/TIA 568-C.3
2. For horizontal cabling system using multimode optical fiber, attenuation should be measured in one direction at either 850 nanometer (nm) or 1300 nm using a light source and power meter.
3. Backbone multimode fiber cabling should be tested at both 850 nm and 1300 nm (or 1310 and 1550 nm for single mode) in both directions.
4. Test set-up and performance should be conducted in accordance with ANSI/568-C.0 Standard, Method B.
5. Attenuation testing should be performed with a stable launch condition using two-meter reference grade fiber test leads (jumpers) to attach the test equipment to the cable plant.
6. The light source should be left in place after calibration and the power meter moved to the far end to take measurements.
7. Contractor should use reference grade fiber test leads built and sold specifically for fiber testing. Testing performed with standard fiber jumpers will not be accepted.
8. Where links are combined to complete a circuit between devices, the Contractor should test each link from end to end to ensure the performance of the system. Only basic link loss testing is required.
9. The values for calculating acceptable loss should be those defined in the ANSI/TIA 568-C.3 Standard.
10. Owner reserves the right to conduct, using Communications Contractor equipment and labor, a random re-test of up to five (5) percent of the cable plant to confirm documented results.
11. Random re-testing, if performed, should be at the expense of owner, using standard labor rates. Any failing cabling should be re-tested and restored to a passing condition.

D. In the event more than two (2) percent of the cable plant fails during a re-test, the entire cable plant should be re-tested and restored to a passing condition at no additional cost to Owner.

E. DOCUMENTATION

1. Test reports may be submitted in hardcopy or electronic format. Hand-written test reports are not acceptable.
2. Invoice will not be paid until final test results and as-built drawing(s) are received.
3. Hardcopy reports are to be submitted in labeled 3 ring binders and signed off by the Communications Contractor's Project Manager, verifying passing execution of all tests. For large installations electronic reports with hardcopy summaries are preferred.
4. Hardcopy summary reports should contain the following information on each row of the report: circuit ID, test specification used, length, date of test, and pass/fail result.
5. Electronic documentation should be submitted in tester native format (not Excel). This is inclusive of all test results and draft as-built drawings.
6. Draft drawings may include annotations done by hand. Machine generated (final) copies of all drawings should be submitted within 30 working days of the completion of each testing phase.
7. At the request of owner, the telecommunications Contractor should provide additional copies of the original test results.
8. The all report media should be clearly marked on the outside front cover with the words "Project Test Documentation", the project name, and the date of completion (month and year).
9. Test results should include the date of testing, a record of test frequencies (or wavelengths), cable type, conductor pair (or fiber strand if fiber) and cable (or outlet) I.D., measurement direction, reference setup, and crew member name(s).
10. The test equipment name, manufacturer, model number, serial number, software version and last calibration date should also be provided at the end of the document.
11. Unless the manufacturer specifies a more frequent calibration cycle, an annual calibration cycle is anticipated on all test equipment used for this installation.
12. The test document should further detail the test method used and the specific settings of the equipment during the test.
13. When repairs and re-tests are performed, the problem found and corrective action taken should be noted, and both the failed and passed test data should be documented.
14. The As-Built drawings are to include cable routes and outlet locations. Their sequential number as defined elsewhere in this document should identify outlet locations.
15. Numbering, icons, and drawing conventions used should be consistent throughout all documentation provided. Owner will provide floor plans in paper and electronic

(DWG, AutoCAD) formats to which as-built construction information can be added.

16. The Contractor should annotate the base drawings and return a hard copy (same plot size as originals) and electronic (AutoCAD) form

F. FINAL INSPECTION AND ACCEPTANCE

1. Final project walk-though will occur within 7 working days of testing completion. The Contractor will have up to 7 days to correct any “punch item” issues identified during the walk down.
2. Once all work has been completed, test documentation has been submitted, and the Project Manager is satisfied that all work is in accordance with the Scope of Work documents, Owner should notify the Communications Contractor in writing of formal acceptance of the system.
3. Following completion and/or compliance with the requirements listed above, Owner will issue a Notice of Completion confirming that the project is complete. A 45 day Acceptance Period will begin immediately following the issuance of the Notice of Completion.

G. WARRANTY

21 Panduit ® CERTIFICATION PLUS™ System Warranty

1. A CERTIFICATION PLUS System Warranty shall provide a complete system warranty to guarantee end-to-end high performance cabling systems that meet application requirements. The guarantee shall include cable and connectivity components and have one point of contact for all cabling system issues. The system shall be warranted for a period of 25 years.

2. The Certification Plus Warranty may be applied only if the cabling channel links are comprised of Panduit connectivity and cable.
3. Upon acceptance of Warranty, Panduit will mail a notification letter to the installer and a notification letter and warranty certificate to owner.

G. Contractor Warranty Commitments

1. Installation firm must be a current certified Panduit ONE Partner in good standing and should include a copy of the company Panduit ONE Partner certification with the bid.
2. Contractor should name a supervisor to serve on site as a liaison responsible to inspect and assure all terminations are compliant to factory methods taught in Panduit Technician Certification Training and according to all Standards cited in the Regulatory References section of this document.
3. Contractor liaison should have a current, up-to-date Panduit ONE Partner Certified Technician (PCT) certificate in both copper and fiber. Copies of the copper and fiber certificates of the Panduit liaison should be submitted with the

bid.

4. Contractor agrees all components comprising active links should be of the same copper Category or fiber OM designation as the system being installed. Contractor should under no circumstances mix different Categories or OM classes of cable or termination devices (connectors) within the same link or system.
5. Contractor should install all racking and support structures according to cited TIA Standards in such fashion as to maintain both Standards and Manufacturer recommendations for uniform support and protection, segregation of different cable types, maintenance of maximum pulling tensions, minimum bend radius, approved termination methods as well as adhering to industry accepted practices of good workmanship.
6. Contractor is responsible for understanding and submitting to Panduit all documents required prior to project start to apply for this warranty. These include but are not limited to the project information form and SCS warranty agreement.
7. Contractor is responsible for understanding and submitting to Panduit all documents required at project end. These include completed warranty forms, passing test reports and drawings of floor plans showing locations of links tested.
8. Test results should be delivered in the tester native format (not Excel) and represent the full test report. Summaries should not be accepted. Contact Panduit for a current list of approved testers, test leads and latest operating systems.
9. The Communications Contractor will correct any problems and malfunctions that are warranty-related issues without additional charge to Owner for the entire warranty period. The warranty period should commence following the acceptance of the project by Owner and written confirmation of Warranty from Panduit.

3.4 CONTRACTOR QUALIFICATIONS

The following guidelines must be adhered to when work is bid to outside Contractors.

General

1. Contactor should be a current Panduit Certified Installer. A copy of corporate certificate must be included with quote.
2. At least 30 percent of the technicians on the job must have a current Panduit Certified Copper Technicians certificate to install Panduit Copper Distribution Systems.
3. At least 30 percent of the technicians installing any Fiber Distribution Systems must have a current Panduit Certified Fiber Technicians certificate to install Fiber Distribution Systems.

4. Contractor should employ at least one BICSI Registered Communication Distribution Designer (RCDD). A copy of the RCDD certificate must be attached to the proposal.
5. Contractor should design and provide all materials in order to install a complete structure cabling solution supporting voice and data. Only one Contractor (no subs) should be responsible for providing a complete and functional infrastructure including the procurement of products, installation of cabling infrastructure, pathways and spaces, bonding and grounding, fire stopping, verification of performance, and documentation.
6. Contractor must possess a valid C-7 California State Contractor's license. This license must have been issued 5-years prior to the date of the bid.
7. Contactor must have been in telecommunications business for a period of at least 2 years. Contractor must submit at least 3 project references (of similar size and scope to this project).
8. This installation must provide a 25-year extended warranty on the UTP cabling solutions by Panduit and General Cable. The extended warranty should include (but not limited to), product, performance, and application guarantees.
9. Contractor should visit the work site before their proposal will be accepted. No allowances should be made to the Contractor for any extra expense, due to failure or neglect to discover unforeseen conditions affecting the work.
10. Contractor employees should act in a professional manner, and be dressed appropriately for the task. No person should bring alcoholic beverages, controlled substances, firearms, or animals to the job site.
11. Contractor should clear the work area every evening. If available space exists, Contractor equipment and materials may be stored at the facility with approval of owner. All packing material should be disposed of at the end of each day. Owner will not be responsible for the loss, theft, or damage of any equipment or material.
12. Contractor should follow the security policies and procedures defined by Owner. This may include providing key access, creating access badges, and escorts for restricted areas.
13. Contractor should take all precautions necessary to protect existing structures and furniture. Any items that are damaged during the course of the work should be repaired or replaced by the Contractor at no cost to Owner.
14. Owner will provide the Contractor with reasonable access to the job site Monday-Friday 8-5 (Federal / State holidays excluded). Owner must approve
15. any work that requires access outside of these parameters.
16. Contractor will provide a high-level project plan. This project plan should identify the tasks, timelines, and a completion date. Any changes to the schedule will be emailed to Owner weekly. Attached files can be formatted in Adobe Acrobat.
17. Contractor should assign a Project Manager. The Project Manager should email a weekly update status report to the project team members. A central off-hours emergency contact number should also be available for evenings and weekends.
18. Contractor should take special precautions to ensure a safe work environment for

the employees, contractors, and visitors.

19. Contractor will make a reasonable effort to not be disruptive to other Contractors, or working staff at the job site.
20. Contractor will install only material that is new and undamaged. Refurbished or used material is not acceptable.
21. Contractor will dispose of all removed copper cable at a licensed Recycling Service facility.
22. Owner expects the workmanship to be of high quality. All equipment should be plumb and true with the structure. All materials should be firmly secured in place, adequately supported, and permanent.
23. Install and coordinate this work in cooperation with other trades installing interrelated work. Before installation, make proper provisions to avoid interferences in a manner accepted by the General Contractor/Engineer.
24. All repairs or changes required in the work of the Contractor, caused by his/her neglect, should be made by the Contractor at his own expense.
25. The locations of ladder racks and other equipment indicated on the drawings or the specification are approximately correct and are understood to be subject to such revision as may be found necessary or desirable at the time the work is installed. Detailed information is to be discussed and agreed upon by the Contractor, or Contractor's representative, and Owner Engineer and/or Project Manager.
26. Exercise particular caution with respect to the location of cable termination frames, and have precise and definite locations accepted by Owner/Engineer before proceeding with the installation.
27. Keep all items protected before and after installation. Clean up all debris daily.
28. If in the event the Contractor and Owner disagree technically during the execution of this project, both parties agree to be bound by the decision of a 3rd party. This person should be an RCDD in good standing with BICSI. He/she should be retained by Owner, and should not be an employee. A decision will be provided within 2-business days.
29. Owner will consider the project complete when all work has been completed when all stipulations in the Testing and Acceptance section of this document have been satisfied and signed-off on.
30. Contractor agrees to replace or repair within 2 business days, any defective work or materials identified by Owner within 12 months of final payment.

3.5 BID GUIDELINES

General

The bid specification will allow for up to a +/- 10% variance to the total cable counts before a change order and/or scope revision is required.

A. Labor

a. Labor costs to install, terminate and test all vertical and/or horizontal cabling specified by the project scope document.

B. Prevailing Wage

a. Contractor will pay wages to the Contractor employees which meets or exceed prevailing wages. Prevailing wages should be as defined by California Labor Code Part 7, Chapter 1, Article 2 Section 1770, 1773, and 1773.1.

C. Material

a. Contractor will provide unit cost details, including materials list, for the project including an addendum for changes or additions to the original job scope.

b. Total project cost with the following cost breakdowns:

c. Total material costs with detailed material list with all parts and estimated quantities identified

d. Total labor costs with estimated man-hours for project completion

e. Cost per additional station with one Cat 6 cable pulled to the station 100 feet from the communications room.

Appendix A. Materials Lists

COPPER CONNECTIVITY

Part Number	Description
PUP6004BU-W	TX6000™ Enhanced Category 6 U/UTP Copper Cable, CMP, Blue
PUP6AM04BU-UG	TX6A™ 10Gig™ UTP Copper Cable with Advanced MaTriX Technology,CMP, Blue
CJ6X88TGxx	Mini-Com TX6A UTP Jack Module
CJ688TGxx	Mini-Com TX6 UTP Jack Module
DPA246X88TGY	24-port, angled, Category 6A, patch panel with 24 RJ45, 8-position, 8-wire ports
DPA486X88TGY	48-port, angled, Category 6A, patch panel with 48 RJ45, 8-position, 8-wire ports
DPA24688TGY	24-port, angled, Category 6, patch panel with 24 RJ45, 8-position, 8-wire ports
DPA48688TGY	48-port, angled, Category 6, patch panel with 48 RJ45, 8-position, 8-wire ports
DP12688TGY	12-port, Category 6, patch panel with twelve RJ45, 8-position, 8-wire ports. Mounts to 89D wall mount bracket.
DP246X88TGY	24-port, Category 6A, patch panel with 24 RJ45, 8-position, 8-wire ports
DP486X88TGY	48-port, Category 6A, patch panel with 48 RJ45, 8-position, 8-wire ports
DP24688TGY	24-port, Category 6, patch panel with 24 RJ45, 8-position, 8-wire ports
DP48688TGY	48-port, Category 6, patch panel with 48 RJ45, 8-position, 8-wire ports
UTP28X*xx	Category 6A/Class E, UTP, small diameter patch cords should be constructed of 28 AWG, unshielded, twisted pair, stranded copper cable with high performance modular plugs. * = length xx = color
UTP28SP*xx	Category 6/Class E, UTP, small diameter patch cords should be constructed of 28 AWG, unshielded, twisted pair, stranded copper cable with high performance modular plugs. * = length xx = color
CJS6X88TGY	Category 6A, RJ45, 8-position, 8-wire universal shielded module with integral shield
CJS688TGY	Category 6, RJ45, 8-position, 8-wire universal shielded module with integral shield
UICMPPA24BLY	24-port angled patch panel with six UICPPL4BL Mini-Com® Ultimate ID® Faceplates
UICMPPA48BLY	48-port angled patch panel with six UICPPL4BL Mini-Com® Ultimate ID® Faceplates
UICMPP24BLY	24-port patch panel with six UICPPL4BL Mini-Com®Ultimate ID® Faceplates UICMPP24BLY
UICMPP48BLY	48-port patch panel with twelve UICPPL4BL Mini-Com® Ultimate ID® Faceplates
SRBWCY	Strain relief bar with integrated adjustable clips; supports, manages, and provides proper bend radius protection for up to 24 cables.
CFPL4IWxxY	4 Port Single gang, vertical faceplate accepts four Mini-Com® Modules
CBXJ2IW-A	Mini-Com® 2-port surface mount box accepts up to two Mini-Com® Modules. Includes built-in removable blank to add a second module.

CBXC4IW-A	Mini-Com® surface mount box accepts four Mini-Com® Modules
CMBxx-X	Mini-Com® 1-port blank module, reserves space for future use xx = color
*	*For lengths 1 to 20 feet (increments of one foot), and 25, 30, 35, 40, 45, 50 feet, change the length designation in the part number to the desired length.
xx	To designate color, add suffix IW (Off White), replace IW suffix with EI (Electric Ivory), IG (International Gray), AW (Arctic White), BL (Black), BU (Blue), RD (Red),YL(Yellow), GR (Green), OR (Orange), or VL (Violet). BL (Black), BU (Blue),RD (Red), YL (Yellow), GR (Green), or OR (Orange

FIBER CONNECTIVITY

Part Number	Description
BL0121ANU.BK	General Cable Indoor / Outdoor 12 strand tight buffer Multimode 50/125um / OM4 distribution interlock armored plenum cable.
BL0241ANU.BK	General Cable Indoor / Outdoor 24 strand tight buffer Multimode 50/125um / OM4 distribution interlock armored plenum cable.
BL0481ANU.BK	General Cable Indoor / Outdoor 48 strand tight buffer Multimode 50/125um / OM4 distribution interlock armored plenum cable.
FRME1U	Rack Mount Enclosure 1 RU, Holds up to three FAP or FMP adapter panels or FOSM splice modules. Bidirectional sliding drawers provides front and rear access to fibers. Dimensions: 1.74"H x 17.00"W x 14.20"D (44.0mm x 432.0mm x 361.0mm)
FRME2U	Rack Mount Fiber Enclosure 2 RU, Holds up to six FAP or FMP adapter panels or FOSM splice modules. Bidirectional sliding drawers provides front and rear access to fibers. Dimensions: 3.48"H x 17.00"W x 14.20"D (88.0mm x 432.0mm x 361.0mm)
FWME4	Opticom Wall Mount Fiber Enclosure. Good for containing Fan-out transitions from outdoor loose-tube cable to indoor-type tight-buffered cable. Holds up to four QuickNet™ Cassettes, FAP, or FMP panels. Dimensions: 16.11"W x 12.25"H x 3.52"D. (409.2mm x 311.0mm x 89.4mm). For sizes holding 2 or 8 adapter panel, replace "4" in part number with 2 or 8.
FAPB	Blank fiber adapter panel for filling space in fiber enclosures for future use.
FWME4	Opti-com wall mount fiber enclosure. Holds up to four QuickNet™ Cassettes, FAP, or FMP panels. Dimensions: 16.11"W x 12.25"H x 3.52"D (409.2mm x 311.0mm x 89.4mm). For containing outdoor/indoor fiber fan-out transitions in entrance facilities.
FAP12WAQDLC	SC 10Gig™ FAP loaded with 12 SC 10Gig™ Duplex Multimode Fiber Optic Adapters (Aqua) with phosphor bronze split sleeves.
FZ2ERLNLNSNMxxx	SC multimode duplex patch cord, 1.6mm jacketed cable (two duplex SC connectors on each end) – 10Gig™ 50/125µm. 1 meter length. Patch cords are available in 1 – 10 meter lengths in 1 meter increments, and 15, 20, 25 and 30 meter lengths. For other lengths, replace the "1" in part number with

	desired length. M = 001 – 003 meters

RACKS, CABINETS AND CABLE MANAGERS

Part Number	Description
R2P	19" EIA rack, aluminum. Dimensions: 84.0"H x 20.3"W x 3.0"D (2134mm x 514mm x 76mm).
PRV8	Vertical cable manager, includes four PRSP7 slack spools. Dimensions: 83.9"H x 8.0"W x 16.4"D (2131mm x 203mm x 417mm)
PRD8	Vertical Dual Hinge, 8" wide Door
QPANWMPV45E	Waterfall Trough for 2 Post Rack and NetRunner ™ High Capacity Vertical Cable Managers. Use on top each 2 post rack for high interbay pathway.
CMUT19	Cable Management Cable Trough. Placed at bottom of racks for lower interbay pathway. Not needed end of row.
PAN-WMP1E	Horizontal Cable Manager High Capacity Front Only 4 Rack Units. Place in middle of racks for mid-level interbay pathway. Not needed on end of row unless shown on elevations.
NM2	Horizontal Cable Manager High Capacity Front and Rear 2 rack spaces.
EWMW242825	Hoffman 24” High AcessPlus II Double-Hinge Wall Mount Cabinet with Window Door / 12 Rack Units
EWMW362825	Hoffman 36” High AcessPlus II Double-Hinge Wall Mount Cabinet with Window Door / 19Rack Units
EWMW482825	Hoffman 48” High AcessPlus II Double-Hinge Wall Mount Cabinet with Window Door / 29 Rack Units
E19SWM12U20	Hoffman 25” High Swing-Out Wall Mount Rack / 12 Rack Units
E19SWM20U20	Hoffman 40” High Swing-Out Wall Mount Rack / 20 Rack Units
E19SWM25U20	Hoffman 48” High Swing-Out Wall Mount Rack / 25 Rack Units
E19SWM32U20	Hoffman 60” High Swing-Out Wall Mount Rack / 32 Rack Units

PATHWAYS AND CABLE

Part Number	Description
Fiber Runner	Panduit 4X4" and 6X4"FiberRunner fiber channel. Mounts alongside ladder rack. See Panduit website or catalog for fittings and mounting hardware.
LD5EI8-A	LD5 Raceway - 8 foot sections - for surface mounting work area cable where concealed routing not possible only.
LD10EI8-A	LD10 Raceway - 8 foot sections - for surface mounting work area cable where concealed routing not possible only.
PLT2S-C702Y	Red (Maroon) plenum cable ties for use in ceiling spaces - 7.4"
PLT3S-C702Y	Red (Maroon) plenum cable ties for use in ceiling spaces - 11.6"
HLS-75R6	75 foot continuous roll *blue* hook and loop ties - to be used on cable bundles in telecom rooms

EZ Path Series 22	Low cable volumes
EZ Path Series 33	Moderate cable
EZ Path Series 44+	High cable volume

BONDING AND GROUNDING

Part Number	Description
LCC series	Panduit two-hole compressing lugs for code conductors in BICSI hole spacing.
HTCT series	Panduit HTAPs. Must be selected according AWG size of run and tap conductors.
CLRCVR series	Panduit clear covers for HTAPs. Must be selected according to HTAP being covered.
RGS134-1Y	Grounding strip (vertical busbar) for newly installed racks or cabinets with screw rails. 78.65" (2m) length; .67" (17mm) width; .05" (1.27mm) thickness; provided with .16 oz. (5cc) of antioxidant, one grounding sticker and three each #12-24 x 1/2" and M6 x 12mm thread-forming screws.
RGS134B-1	Grounding strip for newly installed racks or cabinets with cage nut rails: 78.70" (2m) length; .67" (17mm) width; .05" (1.27mm) thickness; provided with .16 oz. (5cc) of antioxidant, one grounding sticker, three cage nut bonding studs, eight #12-24 bonding nuts and three strip clips.
RGCBNJ660P22	Jumper kit for bonding individual racks or cabinets into grounding backbone. #6 AWG (16mm²) jumper; 60" (1.52m) length; 45° bent lug on grounding strip side; provided with .16 oz. (5cc) of antioxidant, two each #12-24 x 1/2", M6 x 12mm, #10-32 x 1/2" and M5 x 12mm thread forming screws and a copper compression HTAP* for connecting to a #6 to #2 awg sized bonding backbone.
RGCBNJ660PY	Jumper kit for bonding individual racks or cabinets into grounding backbone. #6 AWG (16mm²) jumper; 60" (1.52m) length; 45° bent lug on grounding strip side; provided with .16 oz. (5cc) of antioxidant, two each #12-24 x 1/2", M6 x 12mm, #10-32 x 1/2" and M5 x 12mm thread forming screws and a copper compression HTAP* for connecting to a #2 awg to 250 kcmil bonding backbone.
GJ672UH	Rack jumper (and cabinet) kits for smaller TR (5 bays or less) to bond individual rack or cabinet directly back to wall mounted busbar. One 72" length #6 AWG green wire with yellow horizontal stripe. Jumper is pre-terminated on one end with LCC6-14JAWH-L and the other end with LCC6-14JAW-L. This rack grounding jumper is 72" long. For other lengths replace the "72" in the part number. Available lengths are 72, 96, 120, 144, 168, 192, 216, 240, 264 and 288 inches.
RGESD2-1	Two-hole ESD port with 5/8" hole spacing; provided with an ESD protection sticker, .16 oz. (5cc) of antioxidant, and two each #12-24 x 1/2" and M6 x 12mm thread-forming screws.
RGESDWS	Adjustable fabric ESD wrist strap with 6' coil cord, banana plug, 1 megaohm resistor and 4mm snap.
RGTBSG-C	Green thread-forming bonding screws for use to mount equipment that does not have a built-in grounding pad (terminal).
CNB4K	Green bonding cage nut, includes 4 #12-24 bonding cage nuts (.06 – .11 thick panel) and 4 #12-24 x 1/2" bonding screws with #2 Phillips/slotted combo hex head (use 5/16" or 8mm socket). Ideal for patch panel applications and bonding smaller equipment not equipped with a built-in grounding terminal.

CNBK	Green bonding cage nut, includes 50 #12-24 bonding cage nuts (.06 – .11 thick panel) and 50 #12-24 x 1/2" bonding screws with #2 Phillips/slotted combo hex head (use 5/16" or 8mm socket).
	thick panel) and 50 #12-24 x 1/2" bonding screws with #2 Phillips/slotted combo hex head (use 5/16" or 8mm socket).
RGW-100-1Y	100 paint piercing bonding washers for 3/8" (M8) stud size; .875" (22.2mm) O.D.; provided with .16 oz. (5cc) of antioxidant. NOTE: Panduit racks come supplied with these. This is needed to construct non-Panduit racks.
RGEJ1024PHY	24" long pre-terminated equipment grounding jumper#10 AWG (6mm²) jumper; bent lug on grounding strip side to straight lug on equipment; provided with .16 oz. (5cc) of antioxidant and two each #12-24 x 1/2", M6 x 12mm, #10-32 x 1/2" and M5 x 12mm thread-forming screws.
RGEJ1036PFY	36" long pre-terminated equipment grounding jumper#10 AWG (6mm²) jumper; bent lug on grounding strip side to straight lug on equipment; provided with .16 oz. (5cc) of antioxidant and two each #12-24 x 1/2", M6 x 12mm, #10-32 x 1/2" and M5 x 12mm thread-forming screws.
GB2B0514TPI-1	Wall mounted telecommunications busbar suitable for small telecom room. Pre-assembled with BICSI/TIA-607-B hole spacing. Bar is 1/4" x 2" x 24" in size.
GB4B1028TPI-1	Wall mounted telecommunications busbar suitable for larger telecom room. Pre-assembled with BICSI/TIA-607-B hole spacing. Bar is 1/4" x 4" x 24" in size.
ACGK	Armored cable grounding kit. Contains one grounding terminal for #6 AWG grounding conductor, and one #10 mechanical clamp for cable diameters in 9/16" – 1 1/16" diameter range.
ACG24K-500	#6 AWG (16mm2) jumper for armored cable diameter 0.85" (21.3mm) to 1.03" (26.2mm); 24" (609.6mm) length; factory terminated on one end with LCC6 two-hole copper compression lug and the other end with grounding terminal; provided with two each #12-24 and M6 thread-forming screws and a black polypropylene terminal cover.
ACG24K	#6 AWG (16mm2) jumper for armored cable diameter up to 0.84" (21.3mm); 24" (609.6mm) length; factory terminated on one end with LCC6 two-hole copper compression lug and the other end with grounding terminal; provided with two each #12-24 and M6 thread-forming screws and a black polypropylene terminal cover.
LTYK	Wall mounted busbar label kit. Label kit includes printed tag and one flame retardant cable tie.

LABELS & LABELING EQUPIMENT

Part Number	Description
PROG-EM2GO	Easy-Mark Labeling Software for PC, supplied on USB Flash Drive.
LS8EQ-KIT-ACS	Panduit PanTher hand-held label printing system in kit. Includes LS8EQ printer with QWERTY keypad, one cassette of S100X150VAC self-laminating labels, six AA alkaline batteries, LS8E-ACS, LS8-CASE, LS8-PCKIT, LS8-IB, LS8-WS, quick reference card and operator's manual.
C195X040Y1J	Faceplate label for use with Easy-Mark labeling software and laser printer.
C261X035Y1J	Faceplate label for use with Easy-Mark labeling software and laser printer - horizontal sloped faceplates.
C195X040Y1C	Faceplate label for use with PanTher LS8E hand-held printer
C261X035Y1J	Component Labels for Mini-Com® Modular Faceplate Patch Panels for use with Easy-Mark software and laser printer.
C261X035Y1C	Component Labels for Mini-Com® Modular Faceplate Patch Panels for use with PanTher LS8E hand-held printer.

S100X150YAJ	Self-laminating cable labels for Category 6A cable for use with Easy-Mark software and laser printer.
S100X150YAJ	Cable label for indoor non-armored 6 or 12 strand fiber cable. For use with Easy-Mark software and laser/inkjet printer.
S100X150VAC	Cable label for indoor non-armored 6 or 12 strand fiber cable. For use with PanTher™ LS8E Hand-Held Label Printer
S100X150VAC	Self-laminating cable labels for Category 6A cable for use with PanTher LS8E hand-held printer.
S100X650YAJ	Label for indoor armored 12 and 24 str cable - for use with Easy-Mark software and laser printer.
S100X650VAC	Label for indoor armored 12 and 24 str cable - for use with PanTher LS8E handheld printer.
S100X400YAJ	Label for outdoor armored 24 str cable - for use with Easy-Mark software and laser printer.
S100X400VAC	Label for outdoor armored 24 str cable - for use with PanTher LS8E handheld printer.
S100X220YAJ and NWSLC-7Y	Laser printable fiber jumper self-laminating labels with rotating sleeve for FZD/FXD jumpers.
S100X220VAC and NWSLC-7Y	Fiber jumper self-laminating labels with rotating sleeve for FZD/FXD jumpers for PanTher LS8E handheld printer.
S100X150YAJ	Label for copper patch cords for use with laser printer.
S100X150VAC	Label for copper patch cords for use with PanTher hand-held labeler.
T100X000VPC-BK	1" high, continuous black on white, vinyl tape labels for labeling racks and cabinets with PanTher LS8E handheld labeler.
C400X100YJT	1" by 4" white, polyester label for labeling racks and cabinets that prints from laser printer using Easy-Mark software.

END OF SECTION

SECTION 27 05 26 - GROUNDING & BONDING FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SCOPE

A. This section includes product and execution requirements for Grounding and Bonding that are unique to communications systems and not included in Division 26 sections.

1.3 DESCRIPTION

A. Grounding and Bonding infrastructure for communications includes Cabling, Busbars and Connectors.

1.4 RELATED WORK

A. Related Specification Sections include:
1. Division 27 Section "Grounding and Bonding for Communications Systems"
2. Division 26 Section "Hangers and Supports for Electrical Systems"
3. Division 26 Section "Conduit, Fittings & Supports"
4. Division 27 Section "Voice & Data Communications"
5. Division 26 Section “Cable Trays”

1.5 REFERENCES AND STANDARDS

A. Refer to Division 27 General Section which identifies pertinent References and Standards.

B. In addition, the following apply:
1. IEEE/ANSI 142 - Recommended Practice for Grounding of Industrial and Commercial Power Systems.
2. IEEE 837 - Standard for Qualifying Permanent Connections Used in Substation Grounding.
3. UL 467 Electrical Grounding and Bonding Equipment.
4. ANSI J-STD-607-A - Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications.

1.6 DEFINITIONS

A. Refer to Division 27 “General” Section which provides information on Definitions used in this and related sections.

B. Additional definitions (per referenced standards)
   1. Telecommunications Main Grounding Busbar: Busbar placed in convenient and accessible location and bonded by means of bonding conductor for telecommunications to building service equipment (power) ground.
   2. Telecommunications Grounding Busbar: Interface to building tele-communications grounding system generally located in telecommunications room. Common point of connection for telecommunications system and equipment bonding to ground, and located in telecommunications room or equipment room.
   3. Telecommunications Bonding Conductor: Conductor that interconnects telecommunications bonding infrastructure to building's service equipment (power) ground.
   4. Telecommunications Bonding Backbone: Conductor that interconnects tele-communications main grounding busbar to telecommunications grounding busbar.
   5. Grounding Equalizer: Conductor that interconnects elements of tele-communications grounding infrastructure.
   6. Exothermic Weld: Method of permanently bonding two metals together by controlled heat reaction resulting in molecular bond.
   7. Irreversible Compression: Permanent mechanical bond between conductors or conductor and connector using mechanical or hydraulic tool.

1.7 ABBREVIATIONS AND ACRONYMS

A. Refer to Division 27 “General” Section which provides information on Abbreviations and Acronyms used in this and related sections.

B. Additional abbreviations and acronyms (per referenced standards)
   1. Telecommunications Main Grounding Busbar - TMGB.
   2. Telecommunications Grounding Busbar - TGB.
   3. Telecommunications Bonding Backbone - TBB.
   4. Grounding Equalizer - GE.

1.8 WORK BY OWNER

A. Refer to Division 27 “General” Section which identifies Work by Owner affecting sub-system(s) covered by this section.

1.9 SUBMITTALS

A. Refer to Division 27 “General” Section which provides general guidelines for product or installation information to be submitted by Contractor.

1.10 QUALITY ASSURANCE

A. Refer to Division 27 “General” Section which identifies general quality assurance requirements for the Project.

1.11 GUARANTEE

A. Refer to Division 01 Section "General Conditions, and General Requirements" - Guarantee Documents for general warranty requirements.

PART 2 - PRODUCTS

2.1 TELECOMMUNICATIONS BUSBARS

A. Material: Copper (aluminum not permitted).
   1. 1/4" thick.

B. Pre-drilled:
   1. 3/8" Diameter.
   2. Hole spacing per ANSI Joint Standard J-STD-607-A.
   3. Hole pattern shall accommodate two-hole lugs.

C. Insulators and stand-off brackets shall electrically isolate busbar from wall or other mounting surface.

D. Busbars shall be listed by nationally recognized testing laboratory.

E. Size:
   1. Telecommunications Main Ground Busbar (TMGB) - 20" x 4" (minimum).
   2. Telecommunications Grounding Busbar (TGB) - 12" x 2" (minimum).

2.2 CONDUCTORS

A. Material: Stranded copper (aluminum not permitted).

B. Bonding Conductors shall be insulated.
   1. Green Jacket or Black Jacket marked with Green Tape or Green adhesive labels per NEC Guidelines.

C. Size:
   1. Telecommunications Bonding Conductor (TMGB to Grounding Electrode): As indicated on Project Drawings.

D. Telecommunications Bonding Backbone (TBB; TMGB to TGB): As indicated on Project Drawings.

2.3 CONNECTIONS

A. Mechanical Connectors:
   1. Connector Body shall:
      a. Be high-strength, high-conductivity cast copper alloy.
      b. Be 2 bolt type.
   2. Bolts, nuts, washers and lock-washers: Silicon Bronze.
      a. Shall be supplied as part of connector body.
      b. Split bolt connector types are not allowed.
   3. Connector shall:
      a. Meet or exceed UL 467.
      b. Be clearly marked with catalog number, conductor size and manufacturer.

B. Compression Connectors:
   1. Connector Body: Pure wrought copper.
      a. Conductivity shall be no less than 99% by IACS standards.
   2. Connector shall:
      a. Meet or exceed performance requirements of IEEE 837, latest revision.
      b. Be factory filled with an oxide-inhibiting compound.

c. Be clearly marked with manufacturer, catalog number, conductor size and required compression tool settings.

3. Connection shall be irreversible.

C. Exothermic Weld Connections:

1. Not Allowed.

PART 3 - EXECUTION

3.1 SEQUENCING AND SCHEDULING

A. Permanently attach communications grounds prior to energizing communications equipment.

3.2 TOPOLOGY

A. Refer to the project drawings.

3.3 INSTALLATION

A. Provide required elements and miscellaneous hardware necessary to establish Telecommunication Grounding infrastructure as specified.

B. Install Products in accordance with manufacturer's instructions.

1. Install Compression Connectors with compression, tool and die system, as recommended by manufacturer of connectors.

C. Grounding connections shall be tight and shall be made with UL listed grounding devices, fittings, bushings, etc.

D. On the Telecommunications Bonding Conductor, Telecommunications Bonding Backbone (TBB) and Grounding Equalizer (GE) all connections shall be Compression or Exothermic type.

E. Locate TGBs and TMGB per drawings.

F. Telecommunications Bonding Backbone (TBB) shall be continuous and not interrupted by Telecommunications Grounding Busbars (TGB).

1. TGBs shall be bonded to TBB via tap off of TBB.
   a. Exception is "last" TGB on TBB (e.g. furthest from TMGB).
2. Grounding Equalizer(s) (GE) shall connect to TGBs to be interconnected.

G. Insulate Busbars from their support.

H. Connections shall be bare metal to bare metal contact.

1. Clean surfaces of paint, dirt, oil, etc.

I. Connections shall be exposed and visible for inspection at all times.

1. Do not install insulation over ground connections.

J. Terminate each grounding conductor on its own terminal lug.

1. Multiple conductors on single lug not permitted.

3.4 FIELD QUALITY CONTROL

A. Inspect grounding and bonding system conductors and connections for tightness and proper installation.

B. Test resistance of each TGB to ground.
   1. Maximum resistance to ground shall be less than 5 Ohms.

3.5 DOCUMENTATION

A. Accurately record actual locations of grounding electrode(s), busbars and backbone grounding conductors.

END OF SECTION 27 0526

SECTION 28 05 00 - COMMON WORK RESULTS FOR ELECTRONIC SECURITY

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specifications, apply to this Section.

B. RELATED SECTIONS

1. 280560 Electronic Components
2. 281300 Access Control System
3. 282300 Video Surveillance System
4. 285116 Public Address System

1.02 SUMMARY

A. Part 1 Includes:

1. Related Documents
2. Summary and related sections
3. References
4. Definitions
5. System Description and General Responsibilities
6. Coordination
7. Quality Assurance
8. Submittals
9. Delivery, Storage, and Handling
10. Sequencing and Scheduling
11. Warranty
12. Extra Materials

B. Part 2 Includes:

1. Product Options and Substitutions
2. Materials and Equipment
3. Equipment Modification
4. Fabrication
5. Source Quality Control
6. Firestopping/Sealant Materials

C. Part 3 Includes:

1. Examination
2. Installation
3. Field Quality Control
4. Cleaning
5. Training

D. Related Sections:

1. 270500 General Communications Requirements
2. 280513 Conductors and Cables
3. 280528 Pathways for Security Systems
4. 280560 Electronic Components
5. 281300 Access Control System
6. 282300 Video Surveillance System

1.03 REFERENCES

A. Codes compliance - Comply with the established project edition of the following codes as applicable:

1. California Electrical Code (NFPA 70)	CEC
2. National Fire Alarm Codes (NFPA 72)	NFAC
3. California Building Code	CBC
4. All State or County codes and ordinances	

B. Standards Compliance - Comply with the following standards as applicable:

1. American National Standards Institute	ANSI
2. American Society for Testing and Materials	ASTM
3. Electronics Industry Association	EIA
4. Electrical Testing Laboratories	ETL
5. Factory Mutual	FM
6. Federal Aviation Agency	FAA
7. Federal Communications Commission	FCC
8. Institute of Elect. and Electronics Engineers	IEEE
9. National Electrical Contractors Association	NECA
10. National Electrical Manufacturers Association	NEMA
11. National Fire Protection Association	NFPA
12. Occupational Safety Health Act	OSHA
13. Underwriter's Laboratories	UL

1.04 DEFINITIONS

A. By Others or By Other Trades: By persons or parties other than Division 28. In this context the words “by others or by other trades” shall not be interpreted to mean “not in contract (NIC)”.

B. Certified: Equipment has been tested and found by a nationally recognized testing laboratory to meet nationally recognized standards and found to be safe for use in a specified manner; production is periodically inspected by a nationally recognized testing laboratory; and it bears a label, tag, or other record of certification.

C. Concealed: Not visible or readily accessible such as, embedded in masonry or other construction installed behind wall furring with double partitions or above hung ceilings, in crawl spaces, in shafts.

D. Conveniently Accessible: Capable of being serviced without climbing or crawling under or over obstacles, and with adequate working clearance both front and back.

E. Damage: Visible or invisible abuse that negatively affects performance or appearance and creates defective materials or workmanship.

F. Defective Materials or Workmanship: Operational failures, performance below minimum requirements, evidence that the system will not be reasonably maintainable, errors in documentation, abnormal operations, unsafe conditions, or similar unsatisfactory performance.

G. Contractor: Company holding the contract or agreement with the Owner or its representative. The Contractor may, when permitted, sub-contract Work described in this Section.

H. Owner: Gold Coast Transportation District or its representative.

I. OFOI: Owner furnished Owner installed.

J. Exposed: Not concealed.

K. Failure: Any deviation from intended system operation and performance, as determined by the Contract Documents and subsequent submittals and the Owner's Representative.

L. Furnish: Purchase and deliver to the Project site complete with every necessary appurtenance, support, and accessory required for operation.

M. Install: Unload at the delivery point at the site and perform every operation necessary to establish secure mounting and correct operation at the proper location in the Project.

N. Labeled: Equipment embodies a valid label, symbol, or other identifying maker of a nationally recognized testing laboratory such as Underwriters' Laboratories, Inc., the laboratory makes periodic inspections of the production of such equipment, and the labeling indicates compliance with nationally recognized standards or tests to determine safe use in a specified manner.

O. Listed: Equipment is mentioned in a list which is published by a nationally recognized laboratory which makes periodic inspection of the production of such equipment or states that such equipment meets nationally recognized standards or has been tested and found safe for use in a specified manner.

P. Nationally Recognized Testing Laboratory: A testing laboratory which is approved, in accordance with OSHA regulations, by the Secretary of Labor.

Q. Provide: Furnish and install, completely ready for use, including all accessories required for operation.

1.05 SYSTEM DESCRIPTION AND GENERAL RESPONSIBILITIES

A. The work to be performed under this contract includes the furnishing of all labor, materials, and equipment for the Electronics Controls Systems. Work shall include all provisions of new electronics controls systems, including, door/gate control and alarm monitoring, access control, intercom and paging, , duress alarm, video surveillance (CCTV), and all software development/programming.

B. Combined Prescriptive and Performance Design Requirements

1. Division 28 includes a combination of prescriptive and performance specifications. Compliance with the performance specifications, as well as coordination and integration of the prescription requirements, will require substantial design work as part of this Work.
2. The performance requirements are intended to establish overall system performance requirements, satisfy the operational requirements, and establish the inter-coordination requirements for the Division 28 systems.
3. The prescriptive requirements establish the minimum quality, characteristics, and types of components, equipment, and materials to be used to achieve the stated system performance requirements. The prescriptive specifications have not been provided to satisfy all of the specified performance requirements.
4. Carefully consider all of the requirements for each of the Division 28 systems when preparing its bid. Any questions regarding the intent of these requirements, the scope of the systems or their coordination requirements must be submitted in writing prior to bidding in accordance with the Instructions to Bidders. Claims will not be permitted for extra compensation or extra time based on not understanding the scope or the requirements of the Division 28 work, and/or the coordination requirements of the Division 28 work with the work of the other Divisions.
5. Provide all equipment, wiring, raceways, and programming necessary to meet the operational performance as described under this division regardless if such entities

are not specifically identified in the Drawings and Specifications herein. Any conflicts in performance requirements to other Specification Sections and Drawings shall be brought to the attention of the Owner during preparing for bid, otherwise the most stringent (most costly) requirement will take precedence.

6. Compliance with the project requirements will be progressively monitored and adjusted through the submittal process, Shop Test, Performance Test and Continuous Operational Test.

C. Division 27 Requirements apply to Division 28 where Category 5 or higher copper or Fiber optic cabling is used. This includes the pathways for these cables.

D. Drawing Interpretation

1. The Drawings are diagrammatic and indicate the general arrangement of systems and equipment unless indicated otherwise by dimensions or detail drawings. The Drawings utilize riser, block, installation and schematic diagrams and symbols to outline the Work to be provided. These drawings do not have any dimensional significance nor do they delineate every item required for the intended Work. No interpretation shall be made from the limitations of symbols and diagrams that any elements necessary for complete Work are excluded.
2. The Work shall be provided in accordance with the intent expressed on the Drawings and Specifications, and in conformance with the actual building architectural and structural conditions. When in conflict, field conditions take precedence over the Contract Documents.
3. The meaning of abbreviations shall be the same whether in lower case letters or without periods.
4. The use of words in the singular shall not be considered as singular where other indications denote that more than one item is referred to.
5. Details that appear on the Contract Documents which are specific with regard to the dimensioning and positioning of the Work, are intended only for the purpose of establishing general feasibility. They do not replace engineering or field coordination required to be performed by the Work of this Division.

E. Provide all parts and equipment for a complete and operational system for the Work of Division 28 as described herein and shown on the drawings.

F. Furnish and install all trenching and backfill, duct banks, conduits, raceways, sleeves, boxes, gutters, shelves, enclosures, shelf and enclosure supports, backboards, pull ropes (in unused or spare conduits) required to make all systems fully operational, including components not shown on the Drawings, but necessary for fully operational systems.

G. Furnish, install, terminate, test, dress, and identify all wire and cable required to make systems fully operational, including all wire and cabling not shown on the Drawings, but necessary for fully operational systems.

H. Recognize that the Work entails a considerable amount of custom integration between individual systems, as well as the design and implementation of many system and component interfaces. Take full responsibility for the complete design, installation, and performance of the total integrated system, including integration between systems and various interfaces, in order to achieve the specified operational features and system performance requirements.

I. Recognize that the Work entails a considerable amount of custom-written and custom-tailored software, both high-level language applications and hardware-specific drivers.

Take full responsibility for the performance of the total software suite, including the software embedded in manufactured equipment, in order to achieve the specified operational features and system performance requirements.

J. Fully test the systems, demonstrate their satisfactory operation, and train maintenance and operating personnel, as specified in this Section and the Sections governed by this Section.

1.06 COORDINATION

A. Coordinate with the Owner and all other trades as required to ensure that the entire Work of this Project will be carried out in an orderly, complete, and coordinated fashion.

B. Coordinate installation of lighting and ventilation in all equipment rooms and control stations to avoid any possible interference and to enhance system function.

C. Coordinate with the Work of all applicable Divisions and Drawings for the required electrical and mechanical control interfaces to the work of this section.

D. If applicable, provide coordination drawings of security device plate mounting templates and internal frame conduits to the hollow metal frame manufacturer/supplier to facilitate frame preparation for electronic devices. Rework all frames for which device mounting has not been coordinated at no expense to the Owner.

E. If applicable, obtain product data and wiring schematic information from the Division 8 and 11 Contractors/manufacturers for all approved locking and door monitoring hardware. Coordinate with the Contractors to properly wire, terminate and test all electrically controlled and monitored door/gate hardware.

1.07 QUALITY ASSURANCE

A. Division 28 requires contractors with similar work experience and specific licenses and certifications to perform the work of this section. Specific requirements are identified in the related sections and are summarized in Schedule 280500B. Contractors must be certified or licensed at the time of bid where Manufacture certification or licensure is required. Required licenses and certifications shall be submitted within 3 days of being selected as the apparent low bidder.

B. The Division 28 bidder shall have had experience in the design and installation of similar systems of similar project sizes and similar integration as this project to be considered qualified.

C. Assume all costs incurred including costs incurred by the Owner and its representatives for failure to provide the experience and key personnel as specified.

1. Deductive change orders may be issued as a result of the failure to properly engineer the work prior to construction or improperly installed work that results in costs incurred to the Owner. Examples of incurred costs are rejection of submittals for failure to follow specifications or failure to properly engineer the work; re-inspection of rejected work.

D. Maintain a local service center with qualified service technicians for the duration of the Warranty.

E. The Division 28 Installer shall have a California Contractors License C-10 or C-7 for the respective work.

F. Key Project Personnel must have work experience with projects of similar size and complexity. Systems experience shall be demonstrated for the Key Project Personnel. Résumés of prospective key personal shall be submitted as part of the Pre-Qualification package.

1. Project Manager Qualifications

    a. Bachelors of Science Degree from ABET accredited college in Construction Management or related engineering field or,
    b. Five years of experience with projects of similar size and complexity.

2. Project Engineer Qualifications

    a. Licensed Professional Electrical Engineer or,
    b. Bachelors of Science Degree from ABET accredited college in Electronics Engineering field and two years of experience with systems to be provided, or
    c. Technical Trade School Degree, Associate of Science Degree, or Bachelor's Degree and a minimum of six years of demonstrated experience with the systems to be provided.

3. The approved Project Manager shall assume responsibility at all times in all project matters and shall be responsible for the administrative work including but not limited to, the following:

    a. Representation at all project meetings.
    b. Progress schedule and progress reporting.
    c. Payment schedule of values and pay requests.
    d. Representation and management of all employees and sub-contractors.
    e. Conduction of on-site performance and acceptance testing.

4. The approved Project Engineer shall be qualified and shall be responsible for technical work including but not limited to, the following:

    a. Preparation and signature of all engineering, shop drawings, and product data submittals.
    b. System fabrication, field installation work, and testing.

5. Consider all qualification and experience materials submitted as binding. Obtain the Owner's approval in writing prior to any deviations from the minimum requirements in organization, personnel, work plan, quality control plan, procurement plan or other declaration within the qualification submittal. Key project personnel substituted prior to or during the Work must meet the specification requirements and obtain the Owner's approval.

G. Regulatory Requirements and Standards:

1. References to the California Electrical Code (CEC) and California Fire Code (CFC) are a minimum installation requirement standard. Drawings and Specifications shall govern in those instances where requirements are greater than those specified in the CEC and CFC.
2. Obtain and pay for all permits and inspections required by all legal authorities and agencies having jurisdiction for the Work. The certificates of all such permits and inspections shall be delivered to the Owner.

1.08 SUBMITTALS

A. Submit under provisions of Division 1, Submittals.

B. Approval or acceptance of product data or shop drawing submittals is not a release from providing all necessary documentation per submittal requirements, nor is it a release from additional design and coordination throughout the project.

C. Work Plan

1. Submit a work plan for all work to be performed within 15 days of the Notice to Proceed.

D. CPM Schedule

1. Submit a Critical Path Method Schedule within 30 days of the Notice to Proceed.
2. At a minimum show tasks by area such as by building, by floor or other appropriate designations.
3. Include tasks that are not part of the work of this section but that may affect this section such as work by other trades or contractors or Owner review time.
4. Include tasks that are not part of the work of this section but that may affect this section such as work by other trades or contractors or Owner review time.

E. Submittal Matrix

1. Prepare a matrix of submittals by type vs. section of all submittals to be made by Division 28 within 30 days of the Notice to Proceed.
2. Utilize the list of required submittals listed at the end of this section as a starting point. Add columns for expected delivery dates and each specification section. If a listed submittal is not required for a specific section, indicate such with an “N/A” or other means in the column and row cross point.

F. Schedule of Values

1. Submit a Schedule of Values (SOV) based on the CPM schedule and Submittal Matrix that reflect the value of the systems and installation of work for this Division.
2. That approved SOV will be used as a basis for progress payments.

G. Product Data:

1. Product data is required for all materials and equipment. Include complete bill of materials for each section with the product data submittal.
2. Cross-reference submitted items to the Specifications using their related sections and paragraph numbers.
3. Submit complete product data for the all system components in a single, bound submittal of one or more volumes. Provide a table of contents and labeled divider tabs for each section. Partial submittals for individual sections will be returned without review.
4. Include descriptive literature, catalog cuts, illustrations, schematics, technical data sheets, and test data necessary for the Owner’s Representative to ascertain that proposed equipment and materials comply with specification requirements. Include manufacturer’s name, model, catalog or part numbers. Catalog cuts shall be legible and shall clearly identify equipment being submitted.
5. Include required calculations, I/O points lists, system zone schedules, and other tabular data as necessary to clarify system sizing and configuration. Do not, however, consider such submittals as a substitute for complete shop drawings.
6. Disclosure of Product Deviations: Specifically identify and tabulate any and all deviations from the contract documents including all system functions and features. Reference the corresponding specification sections and paragraph/article numbers. All

variances and deviations will be reviewed for acceptance or rejection. Assume responsibilities to comply with all other contract requirements not revealed in the disclosure of product deviations.

H. Shop Drawings:

1. Shop drawings are required for all systems and component assemblies.
2. AutoCAD ".dwg" files of the Contract Drawings may be made available upon request. These files may be used as a first step in the preparation of shop drawings. Do not consider the drawing plots from such files as a substitute for the shop drawings that are to be prepared by this Division.
3. Shop drawings will not be accepted or considered unless they are submitted as a complete package for each specification section. Partial submittals covering less than a whole system or with incomplete interfaces to other systems will be rejected.
4. Standard manufacturer's drawings may not be used as shop drawings unless specifically modified for use on this project.
5. Each drawing requires a unique drawing number and revision level. Revisions shall per be dated and referenced per submittal number. Delta numbers and clouds on the drawings shall be used in all instances where changes have been made to the pervious submittal.
6. At a minimum, include the following shop drawings:

    a. Floor Plans: Scaled drawings showing equipment and device locations in plan view. Include wire and cable types and quantities, raceway sizing and routing. Routing information shall indicate where rated assemblies are penetrated. Separate into as many plan series as needed to prevent overlapping information. These drawings shall be fully coordinated with other trades prior to submittal. Show relationships to adjacent surrounding structures.
    b. Equipment and Control Room Plans and Elevations: Scaled, dimensioned drawings showing security equipment layouts in security equipment rooms, electrical/security closets, and control rooms. Include electrical J-boxes and receptacles, power, conduit sizing and routing, metal gutters, wiring ducts, cable trays, and supports. Indicate all other non-security cabinets, enclosures, and equipment within the room.
    c. Cabinet, Enclosure, and Rack Elevations: Scaled, dimensioned drawings for each system equipment cabinet, enclosure, and rack showing component and equipment mounting, wire and cable routing and separation, connector and terminal block locations and labeling, and all necessary fabrication details.
    d. System Block Diagrams: Single line block diagrams showing the general relationship between system components and the interconnection between systems. Use these drawings as a reference for the Single line diagrams and point-to-point diagrams by cross-referencing the shop drawing number of those diagrams on these drawings.
    e. Single Line Diagrams: Interconnection diagrams for the riser and trunk wiring between equipment cabinets, enclosures racks and major components. Use the same equipment designations as the floor plans and block diagrams.
    f. Point-to-Point Diagrams: Drawings which show the wiring of each component or device of each individual system. Include details of power supply, grounding, shielding, shield grounding, surge protection, fusing, connector pin-outs, terminal assignments, and similar wiring and connection details. Use the same component and device designations as the floor plans and other shop drawings.
    g. Schematic Diagrams: Drawings which show the component wiring of a system to include but not limited to resistors, diodes, transistors, relays, etc. Required for all custom systems and modified commercial products.

h. Device Installation Diagrams: Details which show the installation and wiring termination of each field device in each individual system. Include settings for dipswitches, jumpers, addresses, port assignments, etc. of all devices.
i. All other shop drawings necessary to install, fabricate, locate, identify, test, service, and repair the systems provided.

7. Shop drawings approved by the Owner is not a release from Contract requirements as defined by the Drawings, Specifications, and governing codes and regulations.

I. Samples:

1. Field Samples:

a. Wires and Cables: Submit a one (1) foot sample length of each wire and cable type to be used with the cable identification clearly shown.
b. Submit all required samples along with the product data submittal for review and approval prior to installation.
c. If all wire samples cannot be submitted at the same time, submit samples with a complete list of all cables to be used noting samples which have been submitted. Update the list with each subsequent sample submittal.

2. Devices/Equipment:

a. Submit sample assemblies of each of the following devices or equipment along with the product data submittal for review and approval by the Owner's Representative:

1) Substituted products if requested by Owner.
2) Custom component, board, equipment or assembly.

3. Disposition: Submitted samples become property of the Owner and will not be returned.
4. Approval of any custom or modified assemblies shall be required. Submit technical information with samples.

J. Test Procedures:

1. Initial Performance Testing: Submit test procedures, forms, and checklists for point-by-point testing. Include a listing for each individual system, each control station and control panel, each equipment room, and each major system component. At a minimum, forms shall include columns for operational/non-operational status, remarks, workmanship, and date corrected. Submit a sample format for approval by the Owner's Representative a minimum of 20 days prior to testing.
2. Performance Testing: Submit test forms which are identical to or similar to the accepted Initial Performance Testing forms. Obtain approval from the Owner's Representative for any changes in test procedure or forms.
3. Continuous Operational/Functional Testing: Submit a detailed test procedure for the continuous functional testing described generally in this Section. Submit for approval by the Owner's Representative a minimum of 15 days prior to testing.

K. Test Results:

1. Initial Performance Testing: Submit completed test results for point-by-point testing to the Owner's Representative five days prior to scheduled Performance Testing.
2. Performance Testing: Submit completed test results prior to or with the request to begin the Continuous Operational Test.
3. Continuous Operational Test: Submit completed test results prior to or with the request for Substantial Completion.

L. Record (As-Built) Documents:

1. Maintain a current record set of as-built drawings on the job and as construction and installation progress, show the actual installed location of all items, material, and equipment.
2. Accurately record actual routing of all conduits including sizes and types.
3. The as-built drawings shall be available to the Owner's Representative for review and will be required for evaluation of progress payments.
4. Submit as-built shop drawings created from the approved shop drawings and up-dated from the site as-built drawing set and any other drawings required to depict the as-built conditions of the installed work.

M. Operational Manuals:

1. Submit the required quantity of identical manuals, which shall contain the Theory of Operation, start up, shut down and emergency procedures, and the manufacturer's operating instructions.
2. Subdivide the manual by section with tab dividers. Provide a table of contents which identifies each section and the contents therein.
3. Submit an electronic copy.

N. Maintenance Manuals:

1. Submit a complete set of maintenance documents as described in this Section. For documents of sizes greater than 11 x 17 inches, prints and electronic copy shall be furnished.
2. Manuals shall include the following as a minimum requirement:

    a. Technical system description.
    b. System schematics.
    c. Detailed wiring diagrams to identify cabling, termination, and routing.
    d. Panel assembly drawings to identify location of components, terminal strips, and equipment as required to correlate with system drawings.
    e. Descriptions and drawings as required to maintain equipment from the board to the component level.
    f. Description of software and user programmable functions. Procedures for user programmable functions shall be included.
    g. A complete printout of each unique system program.

3. For systems where the program resides on electronic media or other similar storage medium, furnish a copy of the media, or similar medium, to the Owner's Representative.
4. Where multiple systems are combined into a single integrated system, documentation shall include a description of the integrated system and the details of the interfaces between systems.
5. Provide a list of current telephone numbers and addresses of all material vendors and equipment manufacturers who have supplied components in this Project. Include separate service telephone list and purchasing telephone list cross-referencing with each component.

1.09 DELIVERY, STORAGE, AND HANDLING

A. Protect all materials and equipment from damage during storage at the site and throughout the construction period. Protect equipment and materials during shipment and storage against physical damage, dirt, dust, moisture, cold, rain, and any foreign substances that may damage the equipment.

B. Prevent damage from rain, dirt, sun and ground water by storing the equipment on elevated supports and covering them on all sides with securely fastened protective rigid or flexible waterproof coverings.

C. Protect conduit by storing it on elevated supports and capping the ends with suitable closure material to prevent dirt accumulation.

D. Protect all fabricated and/or installed materials and equipment against dust, dirt, moisture, physical damage, metal debris, and any foreign substances that may damage the equipment.

E. Protect painted surfaces with removable heavy Kraft paper, sheet vinyl or equal, installed at the factory and removed prior to final inspection.

1. Replace equipment determined by the Owner's Representative to be damaged. Repaint and finish damaged paint on equipment and materials with the same quality of paint and workmanship used by manufacturer so that repaired areas are not obvious.

1.10 SEQUENCING AND SCHEDULING

A. General Requirements:

1. Do not begin the project without the Owner's acceptance of proposed key project personnel for the Division 28 Work.
2. Prepare, review, and coordinate with the Owner's Representative an approved construction (CPM) work schedule. Schedule work in areas and at times that will not interfere with scheduled activities as defined by the Owner's Representative.
3. Do not procure any equipment without accepted product data submittals. Do not perform any field installation without accepted shop drawings. Do not begin any extensive software development or programming without accepted system, operational narratives, the required Owner's coordination, and user's requirements.
4. Pre-assemble control electronics, control panels, racks, and cabinets off-site as most practical.
5. Install system control equipment, control panels, cabinets, racks, and consoles only after major construction in the area in which they are to be installed has been completed and areas have been cleaned, painted, and sealed.
6. After systems installation and prior to point-by-point performance testing, thoroughly pre-test all devices and device wiring for proper performance. Then, thoroughly pre-test each system function in each state or condition under every operating mode.

1.11 WARRANTY

A. Provide a warranty of the work provided under this contract (including, but not limited to, software, hardware, and peripheral equipment) as a system, including interfaces to work by others for two years from the date of Acceptance of the Work. Specific Division 28 sections may require longer warranty periods. Divisions of work among various suppliers, vendors, installers, subcontractors, and other parties will not be recognized or accepted.

B. Extended Warranty: Provide itemized pricing for an Extended Service and Warranty for each year after the initial warranty period up to five (5) years. Describe whether all parts and labor are included in this offering.

C. Guarantee to repair and replace defective materials or workmanship during the warranty period including labor and materials.

D. An emergency maintenance (Warranty) request shall be defined as a system or portion of a system failure that affects building safety, security, and operation of critical components. Failure of a single component (i.e., smoke detector, intercom station, camera, or monitor) is not considered an emergency maintenance request.

E. Respond within four hours to an emergency maintenance request. Provide a twenty-four hour telephone contact number (24 hours per day, 365 days per year). Service response time is defined as the period between the placing of a service request and the arrival of a qualified technician capable servicing the problem on-site.

F. Maintain a sufficient parts inventory at the project during the warranty period to meet the guaranteed system repair times.

G. Repair and make operational any defective materials or workmanship resulting from an emergency maintenance request within an 8-hour period from the time of the initial arrival of service personnel at the site. Correct non-emergency defective materials or workmanship within four (4) calendar days of receiving notice of the defect.

H. Where the equipment manufacturer's warranty covers a longer time period than that required by these Specifications, the manufacturer's warranty shall govern.

1.12 EXTRA MATERIALS

A. Prior to Acceptance of the Work, deliver to the Owner all spare parts and extra materials required in each Section. All spare parts and extra materials shall be brand new in their original shipping boxes or packages and shall have one year material warranty remaining at the time of delivery. Extra materials shall be available to use as immediate replacements during the warranty period. Replace all extra materials used for the warranty requirements.

B. Special Tools:

1. Provide minimum of one of any specialty tools used.

PART 2 - PRODUCTS

2.01 PRODUCT OPTIONS AND SUBSTITUTIONS

A. Comply with the General and Supplementary Conditions and Division 1 Specifications.

B. Provide products and materials to meet the Made in America Act for this project.

C. The products described in this section and the sections governed by this section establish minimum qualities that substitutions must meet to be considered acceptable. The described products have also been used in preparing the drawings and specifications, and therefore establish the basis for equipment sizing, wire and cable design, power consumption, and other design parameters.

D. Substitution requests, if permitted, will be considered only if submitted in strict accordance with the followings:

1. Cross-reference submitted items to the Specifications using their related Section and paragraph number.
2. Submit complete product data, descriptive literature, catalog cuts, illustrations, schematics, technical data sheets, and test data necessary for the Owner's Representative to ascertain that proposed equipment and materials comply with specification requirements. Include manufacturer's name, model, catalog or part numbers. Catalog cuts shall be legible and shall clearly identify equipment being submitted.
3. Disclosure of Product Deviations: Specifically identify and tabulate any and all deviations from the contract documents including all system functions and features. Reference the corresponding specification sections and paragraph/article numbers. All variances and deviations will be reviewed for acceptance or rejection. Comply with all other contract requirements not revealed in the disclosure of product deviations.

E. Take full responsibility for all design, coordination, and cost associated with substitutions including, but not limited to:

1. Its integration into the total system including physical mounting space, electrical interconnection, signal wiring, power, quality, electromagnetic interference, communication protocols, and similar design considerations.
2. Any additional materials, equipment, components, accessories, items required for equivalent system operation and performance.
3. Any necessary changes to branch power circuits, circuit protective devices, and the Work of other trades.
4. Any modifications to wire, cable, and raceway design.

2.02 MATERIALS AND EQUIPMENT

A. All equipment and materials required for installation under these Specifications shall be new and without blemish or defect.

B. Materials and equipment furnished shall be of current production by manufacturers regularly engaged in the manufacturing of such items, for which replacement parts are available. Specifications are prepared long in advance of project construction; use the newest model of the specified products available at bid time.

C. All material and equipment shall be listed, labeled, or certified by Underwriters' Laboratories, Inc., where such standards have been established. Equipment and materials which are not covered by UL Standard will be accepted provided equipment and material is listed, labeled, certified or otherwise determined to meet safety requirements of a nationally recognized testing laboratory. Equipment of a class which no nationally recognized

testing laboratory accepts, certifies, lists, labels, or determines to be safe will be considered, if inspected or tested in accordance with national industrial standards such as NEMA or ANSI.

D. All parts of a system shall be the product of one manufacturer. When more than one unit of the same class of equipment or material is required, such units shall be the products of a single manufacturer. Constituent parts which are similar shall be the product of a single manufacturer.

E. All components of an assembled unit need not be products of the same manufacturer; however, all components must be acceptable to the Owner's Representative. Components shall be compatible with each other and with the total assembly for the intended service.

F. All computers, workstations, and servers must be from a manufacturer that has been continuously in business of manufacturing computers for a minimum of ten years.

2.03 EQUIPMENT MODIFICATIONS:

A. When standard manufactured equipment is modified from its original condition or factory options have been exercised identify the changes as noted below.

1. Clearly identify the modifications on the shop drawings.
2. Clearly identify each piece of modified equipment with a label, which states, "This unit has been modified..." and identify the modification or reference. Locate the label so that a service technician or factory service personal will be able to determine the equipment in use is non-standard and that modifications are required for service, testing and replacement.
3. Identify and describe the modifications on the Record Documents.

B. Equipment modification labels are not required for jumper or switch settings.

2.04 FABRICATION

A. Fabricate enclosures to easily accommodate interconnecting cables entering from above or below through the use of auxiliary gutters, cable trays, and conduits. Protect all metal cabinet edges where conductors cross and conduit ends with protective covering or bushing.

B. Group wires and cables by types, boards and modules, and maintain California Electrical Code clearances throughout the installation, including Class 1, Class 2, communications, and branch circuit power separations. Maintain sufficient and proper separation between microphone-level audio, line-level audio, high-level audio, and video cables.

C. Uniformly organize equipment and cable routing throughout all enclosures, racks, and cabinets. Provide wiring ducts, wireways, wire posts, D rings, wire saddles to route and secure factory and field wiring. Provide routing for all wiring from point of entry to point of termination to maintain required separation, access to all components, and general organization to the wiring. Neatly dress, route and secure wiring.

D. Mechanically fasten cabinet raceways and cable clamps to enclosure rear panels, rack members, console members, or to other system components. The use of adhesive fasteners (without mechanical fastener) is not permitted. Furnish and install cable support posts where necessary to properly support cables.

E. No splices are permitted in cabinet raceways. Exception: Splice to cable shield when within two inches of cable termination is permitted.

F. Furnish and install metal grounding type outlet strips in each equipment cabinet, enclosure, and rack. Leave a minimum of two unused receptacles at each location for future

expansion. Neatly shorten and dress power cords from individual equipment to the outlet strips.

G. Provide protection from accidental contact of all terminals or exposed conductors over 25 volts within enclosures that contain Class 2 wiring. Use non-conductive barriers, heat shrink or other acceptable methods. Tape of any kind is not permitted.

H. Provide an isolated ground bus within each equipment cabinet, enclosure, and rack for single point termination of audio and data shields and grounds.

2.05 SOURCE QUALITY CONTROL

A. Shop Inspections:

1. The Owner's Representative shall have the right at all times to inspect or otherwise evaluate the Work performed or being performed and shall have access to the premises in which the Work is being performed.
2. The Owner's Representative may verify the inspections or re-inspect any item. The Owner reserves the right to reject materials and workmanship found unacceptable during inspections.

B. Shop Test and Demonstration

1. Shop Test and Demonstration shall be a major milestone that shall commence only after all shop assembly, system integration, and software development and programming is complete. Owner's approval of the integrated shop test shall be obtained before any system components are shipped to the site for installation.
2. Provide all travel arrangements and expenses, including transportation and lodging, for up to four Owner representatives for each in-house testing over 100 miles from the project location.
3. Perform a point-by-point system demonstration of the Integrated Security System including CCTV system, Duress Alarm System, Integrated Sequences of Operation, PLC system, control panels, Video Visitation, Intercom, and Public Address system to show all systems functioning and communicating as a single integrated system.
4. Each input and output point, operational sequence, control panel, and PLC network will be tested. Provide sample field devices, approved mock up devices and jumpers to simulate actual field operation conditions. In addition, simulated system failure, response time, reset and boot up time, and other tests will be conducted as directed by the Owner.
5. Sample field devices including, but not limited to are, intercom stations, paging speakers, microphones, cameras, CCTV monitors, locks, and door position monitoring devices.
6. Notify the Owner a minimum of 15 working days prior to demonstration so that the Owner may witness the demonstration.
7. Conduct the demonstration in strict accordance with the test procedure accepted by the Owner. Demonstrate full compliance with the required operating modes and sequences of operation under all operating modes. Record demonstration/ test results on a report which shall include a list of all personnel witnessing the demonstration, test methods used, and a record of each specific test made.
8. If demonstration results are not in compliance with requirements, make necessary hardware and software changes, corrections, repairs, or adjustments at no additional cost to the Owner. If corrections cannot be made during the scheduled Shop Test and another shop test is required, pay for all transportation, lodging and expenses of the Owner's representatives' (maximum four people) attending the additional tests. This process shall continue until the systems are acceptable to the Owner.

2.06 FIRESTOPPING/SEALANT MATERIALS

A. Firestop and seal all penetrations of fire walls with minimum three hour sealant or Fire Stop Putty (FSP). This includes but is not limited to all raceway, conductor, sleeve and cable tray penetrations where penetrating device does not completely seal the hole.

B. Accepted Products: International Protective Coatings Corp. FlameSafe FSP 1100, Nelson FSP, Domtar Fire-Halt or approved equal from other manufacturers.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Carefully inspect the installed Work by other trades and verify that all such Work is complete to the point where installation of the Work of this division may properly commence.

B. In the event of discrepancy, immediately notify the Owner's Representative. Do not proceed with installation in areas of discrepancy until such discrepancies have been fully resolved.

C. Install all equipment in accordance with all pertinent codes and regulations, the accepted design, and the referenced standards.

3.02 INSTALLATION

A. Equipment Identification:

1. Install a nameplate on each individual equipment rack, enclosure, boxes, cabinet, and significant equipment item.
2. Use identifiers and abbreviations defined in the Drawings whenever possible. Use plan designation for labeling, unless indicated otherwise.
3. Nameplates shall be laminated black phonemic resin with a white core and engraved lettering, a minimum of 1/4" high. Use fasteners to install nameplates. Do not fasten with adhesives.
4. Engrave using upper case letters of uniform height; centered on device, cover plate, or enclosure; with all characters made clearly and distinctly.
5. All equipment shall have the manufacturer's name, address, model number and rating on a name plate securely affixed in a conspicuous place. All equipment shall bear labels attesting to Underwriters Laboratories approval where subject to Underwriters Laboratories label service.
6. Identify all field terminals and relays with device identification. Lettering shall be 3/16" high minimum.

B. Equipment Installation:

1. Install all equipment in accordance with the manufacturer's recommendations, and accepted shop drawings.
2. Install all equipment in compliance with CEC requirements, NECA's "Standard of Installation", and recognized industry practices.
3. If requested, submit structural and seismic mounting load calculations demonstrating adequate support and bracing for seismic zone 4.
4. Do not attach electrical materials to roof decking, removable or knockout panels, or temporary walls and partitions unless indicated otherwise. Use hangers and other supports to support the equipment and materials, intended for this purpose.
5. Locate equipment as close as practical to the locations shown on the Drawings.
6. Maintain minimum 3-foot working clearances on each side of equipment or equipment racks where access is required to inspect, service or adjust.

7. Check equipment against available mounting space indicated on the drawings. Coordinate location of equipment with other trades to minimize interference. Bring all conflicts or clearance problems to the attention of the Owner's Representative during the preparation of shop drawings.
8. Where the Owner's Representative determines that equipment installation is not conveniently accessible for operation and maintenance, remove and reinstall equipment in a conveniently accessible manner at no extra cost.

C. Grounding and Shielding:

1. Comply with Section 270526.

3.03 FIELD QUALITY CONTROL

A. Initial Performance Testing:

1. Perform and record Initial Performance Testing.
2. Point-by-point testing shall include the sequential operation of each system and control function in each of its operating modes. All tests are to be conducted and recorded per the accepted procedure and test forms.
3. Notify the Owner's Representative five days in advance that this activity will be occurring.

B. Performance Testing:

1. Conduct Performance Testing to be witnessed by the Owner's Representative.
2. Schedule point-by-point performance testing only after Initial Testing has been satisfactorily completed and all necessary corrections have been made. Provide the Owner's Representative with a minimum of 5 working days notice with a request to schedule Performance Testing. Submit Initial Performance Test records prior to the scheduled Performance Test. Failure to submit test results as specified shall be cause to re-schedule testing.
3. Point-by-point testing shall include the sequential operation of each function in each of its operating modes, in addition to completion of all required performance testing and measurement.
4. Conduct point-by-point testing in the presence of Owner's Representative. Record test results on the accepted test checklist which shall include a list of all personnel witnessing the tests. If test results are not in compliance with requirements, make necessary changes or adjustments at no additional cost, and arrange for another test. This process shall continue until the systems are acceptable to the Owner's Representative.
5. Failure of any part of the system which precludes completion of system testing, which cannot be repaired in four (4) hours, shall be cause for terminating the test. Repeated failures which result in a cumulative time of eight (8) hours to effect repairs, shall cause the system test to be declared unacceptable. Retesting of the entire system shall be rescheduled at the convenience of the Owner.
6. Performance Testing will also include inspections for contract document compliance, codes and standards compliance, and workmanship.

C. Continuous Functional/Operational Testing:

1. After completion and Owner Representative's approval of the Performance Testing, conduct a 14-day operational test in order to demonstrate continuous system performance. The systems will not be accepted until they operate for 15 continuous days without a system failure. Restart the test period from the beginning after every confirmed system failure.

2. Provide staff to man and operate all control points during continuous operational testing. Provide test personnel to simulate staff movement, generate alarms, and otherwise randomly operate as many functions as practical on a nearly continuous, 8-hour-shift basis. Provide jumpers and simulation programs to test alarms and other conditions that cannot be readily performed by test personnel. The test staff will record all suspected problems and provide these reports to the test committee.
3. The Owner's Representative will make the final determination for all disputed problems.
4. System failure is defined as any portion of the system that fails to operate as intended and cannot be corrected within 24 hours of the failure. Individual device failure such as a single camera or a single intercom station will not be a cause for system failure.

3.04 CLEANING

A. Comply with Division 1 requirements.

B. Protect equipment during installation against entry of foreign matter on the inside. Vacuum clean all equipment both inside and outside before testing, operating and painting. Clean electrical connections with a suitable solvent prior to assembly.

C. Remove from the premises and dispose of all packing material and debris on a daily basis.

D. Upon completion of the Work, remove excess debris, materials, equipment, apparatus, tools and the like and leave the premises clean, neat and orderly.

E. Thoroughly polish all bright metal or plated Work and remove any pasted labels, dirt or stains from the equipment.

3.05 TRAINING

A. Provide on-site, project-specific training sessions for system operations, maintenance, and programming with designated total hours as follows:

	Operational	Maintenance	Programming
1. Electronic Components	0	1	0
2. Video Surveillance (CCTV) System	4	8	8
3. Duress Alarm System	0.5	1	0
4. Access Control System	1	4	4
5. Intercom and Paging System	1	4	4

B. All classroom training is to occur on site at a location provided by the Owner.

C. All training is to review the systems as they apply to the equipment and systems provided under this contract. All personnel being trained are expected to have basic experience for the systems.

D. Operational Training:

1. Train security staff in the operation of the System. Operational training shall include how to monitor and control the systems provided under this contract and how to respond to system events.

E. Maintenance Training:

1. Train Owner's personnel in the basic user level maintenance and troubleshooting of the System. Structure training to identify the equipment and systems that can be

serviced or reset by the on duty building engineer, how to identify systems that have failed or not working, and emergency shutdown procedures.

2. Provide a combination of classroom sessions supported by audio/visual aids, and field sessions with personnel participating in hands-on preventative, corrective maintenance and reactive maintenance.

F. Programming Training:

1. Train Owner's personnel in the site-specific programming and software trouble shooting of the System. Training will also include all user programmable features. Conduct training sessions using instructors who have been actively involved through-out construction and who are certified in writing by the manufacturers of the specific systems.
2. Provide a combination of classroom sessions supported by audio/visual aids, and field sessions with personnel participating in hands-on for programming changes, software uploading/downloading, trouble shooting, etc.

G. Submit an estimated training schedule 15 days prior to training for approval by the Owner's Representative. Estimate classroom and hands-on hours required for all three types of training (operational, maintenance, and programming). Include a syllabus for each class session. Provide video recording, minimum 720p, of the training sessions in series of DVD or Blu-ray format discs.

H. All training materials including Operational and Maintenance (O&M) Manuals shall be reviewed and approved prior to conducting the specific training.

END OF SECTION 28 05 00

SCHEDULE 28 050 0A

SAMPLE LIST OF DIVISION 28 SUBMITTALS

1. CPM Schedule
2. Submittal Matrix
3. Schedule of Values (SOV)
4. Licenses and certifications
5. Key Project Personnel
6. Product Data
7. Shop Drawings
    a. Floor Plans
    b. Enlarged Control / Equipment Rooms and Elevations
    c. Rack and Cabinet Elevations
    d. Block Diagrams
    e. Single Line Diagrams
    f. Point- to-Point Diagrams
    g. Schematic Diagrams
    h. Installation Diagrams and Details
8. Calculations; UPS, Data
9. Sequence of Operations
10. Samples
11. Test Procedures
12. Test Results
13. Record Documents
    a. Drawings
    b. O&M Manuals
    c. Warranty
14. Extra Materials

SCHEDULE 28 05 00 B

SUMMARY OF REQUIRED LICENSES AND CERTIFICATIONS

This list is provided for the convenience only.

A. Section 280500 Integrated Systems Contractors

1. California State Contractor's License C-10 (high voltage) or
2. California State Contractor's License C-7 (low voltage)
3. Key Personnel Degree or equal

SECTION 28 05 60 - ELECTRONIC COMPONENTS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specifications, apply to this Section.

B. Related Sections:

1. 280500 Common Work Results for Electronic Security
2. 281300 Access Control System
3. 282300 Video Surveillance System
4. 285116 Public Address System

1.02 SUMMARY

A. Section Includes

1. Door/Gate Monitoring and Control
2. Power Supplies
3. Uninterruptible Power Supplies (UPS)
4. Terminal Blocks, Fuses, and Snubbers
5. Relays
6. Call Made Light
7. Intercom/Pedestal
8. Connectors
9. Intercom/Camera/Card Reader Pedestal
10. Intercom System

1.03 SYSTEM DESCRIPTION

A. Door/Gate Position Alarm Monitoring

1. Provide low voltage power to door/gate position and latch monitoring switches as indicated on the Drawings. All door position and bolt monitoring switches at each door are to be connected in series such that an open at any one of the switch contacts shall break the circuit to the control electronics and provide an unsecured door indication on the designated operator interface. Losing the indicating signal power by cutting the circuit (circuit failure) shall also initiate an unsecured door.

B. Power Supplies

a. Provide power supplies as required for each system.
b. Low voltage systems shall operate on 24 VDC or 24 VAC or as determined by each section. Size all power supplies to maintain Class 2 ratings and operation of each system at 150% of the maximum loaded condition.
c. Provide remotely controlled operating power to all electric locks, deadbolt locks, electro-mechanical locks, electric deadbolts and door/gate operating devices as indicated on the Drawings.
d. Unless otherwise indicated, 24 volt door hardware including locks, strikes, and latches shall be supplied by external power supplies with over-voltage and short circuit protection.

C. Uninterruptible Power Supply (UPS)

1. Provide UPS for all Security Electronics, and security work stations for 2 hours operation. Exception: Equipment in MDF to be connected to Owner provided UPS.
2. Submit UPS power calculations indicating power consumption by each major equipment component.

D. Terminal blocks, Fuses and Snubbers

1. Provide DIN mounted terminal blocks for field and miscellaneous wiring.
2. Provide fused terminal blocks for power distribution circuit protection.
3. Provide circuit snubbers at all electric strike door locks for EMF protection.

E. Relays

1. Provide relays for use as interposing relays, timer relays, audio relay, one shots, or other applications as needed or shown on the plans.
2. Provide EMF circuit protection diode across all relay coils.

F. Intercom/Card Reader Pedestal

1. Provide a pedestal for the card reader and intercom as shown on the drawings.

G. Intercom System

1. Provide an intercom system for two-voice communications between the intercom station and Security Work Stations.
2. Intercom stations and call requests shall be selected from the Security Work Station GUI.

H. Provide all necessary interconnecting wiring and terminations including, but not limited to, junction boxes, terminal strips, lead wires, internal contacts, connectors, etc., from new or existing terminations to the new terminations in the control electronics cabinets.

1.04 SUBMITTALS

A. Comply with Section 280500, General Requirements.

B. Calculations

1. DC power supply sizing.
2. AC power supply sizing.
3. UPS system load and battery sizing.

C. UPS installation drawings: Design and show power source, and branch circuit and load wiring to/from UPS circuits.

1.05 QUALITY ASSURANCE

A. Comply with Section 280500, General Requirements.

1.06 EXTRA MATERIALS

A. Deliver the following spare parts:

1. DC power supply 1 each size used.
2. AC power supply 1 each size used.
3. Relays 5 each type used.

PART 2 - PRODUCTS

2.01 ACCEPTABLE PRODUCTS

A. Provide equipment and components to meet the Made in America Act for this project.

2.02 POWER SUPPLIES

A. DC and AC Power Supplies

1. Power supply outputs to integrated circuit devices shall be regulated to within +/- one percent of the rated voltage output
2. Size as required for each location with a capacity of 150 percent of the intended maximum load.
3. Class 2 power supplies shall be power limited to 100 watts with over-voltage and short circuit protection.
4. Where required provide power supply with battery backup. The power supply shall include battery-charging circuit, power loss switching circuit, low battery, trouble and power loss output contact. Size battery to accommodate calculated load for the specified time period.

B. Provide sealed lead/acid type batteries.

2.03 ELECTRICAL RELAYS

A. Rate relays appropriate for the application or as shown on plans.

B. Provide relay sockets for ease of replacement.

C. Provide mounting hardware (i.e. bracket, DIN rail, etc.) UON.

2.04 AUDIO RELAYS

A. The audio switching relays shall connect intercom stations to intercom amplifiers.

B. Relay switch contacts shall be DPDT bifurcated gold plated contacts, rated for 2 amperes inductive and operate on 24 volts DC.

C. The relays shall be rated for at least 1 million operations.

D. The relays shall be removable socket mounted on DIN rail. All field terminations shall be landed on screw terminals rated to accommodate the required field wires.

E. Provide mounting hardware (i.e. bracket for rack mount, DIN rail, etc.) UON.

2.05 TONE GENERATORS

A. Solid State Piezoelectric

B. Screw or quick connect terminals.

2.06 INTERCOM SYSTEM

A. Intercom amplifier / controller: Intercom stations and push to talk function shall be compatible with the access control system for call-in, station selection, and push to talk functions. See Audio Relay requirements.

B. Intercom station: Weather proof with call button.

C. Master Station: Desk top with push to talk button and adjustable volume.

D. Facility Front Vehicle Gate and Front door shall be able to be opened from the intercom via the access control system.

E. When the intercom station is selected, the related camera shall be displayed via the VSS.

F. AIPhone or approved equal.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Comply with Section 280500, General Requirements.

B. Comply with manufacturer's recommendations, procedures, and standards for each product.

C. All Class-1 wiring, and their conduits shall only be routed to the designated Class-1 gutter or duct. All Class-2 wiring, unless otherwise noted, and their conduits shall only be routed to the designated Class-2 gutter or duct.

D. Provide sufficient quantity of power supplies of CEC Article 725, Class 2 capacity, to power the associated equipment. Furnish power supplies with over voltage and short circuit protection.

E. Mount individual components to removable rear panels in wall-mounted cabinets using DIN rails, snap track or stand off-mounted PC boards, or properly sized mounting hardware.

F. Fuses: Provide over-current protection for control relay outputs and associated wiring.

3.02 WIRE TERMINATION, DRESSING, AND IDENTIFICATION:

A. Comply with Section 280513 and Section 280500.

3.03 FIELD QUALITY CONTROL

A. Comply with Section 280500.

3.04 TRAINING

A. Comply with Section 280500.

END OF SECTION 28 05 60

SECTION 28 13 00 - ACCESS CONTROL SYSTEM

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Access Control System.
2. Readers and Cards.
3. Door Position Sensors (DPS).
4. Security Work Stations
5. Vehicle Gate Access System

B. Related Sections:

1.	280500	Common Work Results for Electronic Security
2.	280560	Electronic Components
3.	282300	Video Surveillance System
4.	285116	Public Address System

1.02 SYSTEM DESCRIPTION

A. Access Control System:

1. Provide an access control system to restrict access to controlled areas of the facility, notably administration areas and other support buildings to persons with authorized credential. Credentials including proximity card readers at selective facility and building entrances, exits, and internal doors are to maintain separation of public, administrative, and security staff and to provide authorized access by area based on staff's security levels and classification.
2. System administrative programming functions including the addition and removal of employee cards, time schedules, activity reports, etc. will be restricted to password protected access and specific computer locations. Multiple levels of programming access and programming locations will be provided based on areas of responsibility.
3. The Access Control System will be interfaced to the video surveillance system and intercom system.
4. Provide ability to control all Access Control System functions from an iOS and Android smart phone application
5. Photo ID key cards (ID badges) will be created and enrolled through a dedicated computer station with photo badging software, photo ID camera, printer, and card reader.
6. Include 150 proximity smart cards as part of the Access Control system.
7. Uninterruptible power supply shall be provided where the building UPS circuits are not provided, and the equipment does not have internal battery backup. The uninterruptible power supply shall be fed by the building's back-up generator.
8. Coordinate lock power requirements with Section 280560 and lock hardware contractor. Vehicle gate lock power by electrical.

B. Door/Gate Position Status and Alarms:

1. Provide Door Position Sensors (DPS) at each swing and roll up door. Vehicle gate DPS provided by gate contractor and monitored at gate controller.
2. Provide low voltage power to the various switches which combine to indicate the secure or non-secure status of position monitored doors/gates (i.e., hinge position, latch position, bolt position, limiting switches, etc.).

3. Provide door/gate position and latch monitoring as indicated on the Drawings. If the DPS or latch monitor becomes unsecured, electronically indicate door status and/or alarm at the HMI in each staff control station. Wire door position switches (DPS) and all other alarm detection devices to, and monitor them with, system inputs at their designated access control panels.
4. All door position/bolt monitoring switches in a hardware group shall be connected in series with each other so that an open at any one of the switch contacts shall break the circuit to the monitoring electronics and provide a real time unsecured door status and/or alarm indication on the designated Access Control computers. Losing the indicating signal power by cutting the circuit (circuit failure) shall indicate an unsecured door and/or initiate a door alarm.

C. User Programming Functions

1. The system operation shall be completely programmable by the Owner for service and maintenance. Programming shall be possible from the Access Control System Server, Owner provided workstations, or a stand-alone computer with the proper access codes. Database partitioning on a single server will be possible. Access Control System shall have ability to provide status and alarms notification immediately upon occurrence through email and phone texting via VOIP.

D. Vehicle Gates

1. Vehicle Gates shall be electronically operated and controlled.
2. The gate controller provided by the gate contractor shall control the operation of the gates. Dry contact signals from the access control system, Knox key switch and wireless receivers provided by this section, when active, shall signal the gate controller to open the gate. The gate shall remain open while the signal is active.
3. Safety devices (loop detectors or light beam) and egress loop detectors shall be provided by the gate contractor and directly operate the gates.
4. Knox Key Switch
   a. Provide a Knox Key Switch where shown on plans for Fire Department access to meet County Fire Department requirements.

E. Security Work Station

1. Each work station shall have a Graphics User Interface (GUI) depicting the site as the home page. Each building on the home page shall be an active icon that when selected shall display the respective building. The home page shall display all vehicle, pedestrian gates, and all building perimeter doors in real time status. Each door and intercom shall be directly selectable from the home page to unlock/open or establish two-way communication.
2. Each building graphic shall display the security devices related to the respective building with real time active icons as applicable.
3. When a device is selected on the GUI the related camera shall display on the Video Surveillance Call-up Monitor.
4. Each work station shall include a photo ID badge printer, camera, enrollment reader, mouse, and key board where shown on the drawings.

1.03 SUBMITTALS

A. Comply with Section 280500.

B. Shop Drawings: Submit manufacturer’s wiring schematics integrated with all related security control and monitoring functions for each door/lock position hardware and other electric hardware device showing all terminal and connector pin assignments.

C. Submit proposed Security Work Station Graphics for Owner approval. Meet with the Owner representative to develop acceptable graphics.

1.04 QUALITY ASSURANCE

A. Comply with Section 280500.

B. CEC Compliance: Comply with Article 725 (Class 2 Power-limited Circuits).

1.05 COORDINATION

A. Obtain hardware information and coordinate all technical requirements, interfaces, installation, and testing with the door/gate hardware suppliers.

B. Coordinate all door frame/jamb device rough-in, mounting, and wiring requirements with door frame Supplier.

C. Coordinate with the Owner for all programmable system functions and features using matrix forms to gather user's inputs. Make all necessary program changes at no additional cost prior to final acceptance.

1.06 EXTRA MATERIALS

A. Deliver the following spare parts to the Owner at a location to be designated:

1. (1) card readers.
2. (1) door position switches.
3. (1) of each type of system modules used (single RIM, ISC, ICM, OCM).
4. (1) power supplies.
5. (2) of each type of relays.
6. (2) of each type of fuses and fused terminals.

B. Number in parenthesis denotes quantity required.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Provide product from firms regularly engaged in the design and manufacture of Access Control and Alarm Monitoring System's components and accessories, of types, sizes, capacities and characteristics required, whose products have been in satisfactory use in similar service for not less than 5 years.

B. Provide products to meet the Made in America requirements of this project.

2.02 PROXIMITY CARD READER

A. The card reader reads the encoded data from the access card and transmits the data back to the host panel, giving an audible and visual indication of a properly read card.

2.03 PROXIMITY CREDENTIAL (CARD)

A. The proximity card shall be an RF programmable smart card with customer-specified ID and facility numbers.

2.04 FIRE DEPARTMENT VEHICLE GATE KNOX KEY SWITCH

A. Key switch shall comply with local fire department requirements

B. Manufacturer shall be Knox. Purchase of key switch requires Knox Company Application/Order form signed by the County Fire Department.

2.05 CONTROLLERS

A. Door controllers for card readers, door locks, request to exit, DPS, and other functions shall be installed in the IT room unless otherwise approved.

B. IP type device controllers may be mounted at the door location.

C. Each controller shall have battery backup for continuous operation for 8 hours or be connected to the building UPS system if so equipped.

2.06 SECURITY WORK STATION (SWS)

A. Provide a Security Work Station to perform the functions described herein and meets the requirements of the access control software and hardware used. The work station shall be compatible with and meet the requirements for the interface of the Video Surveillance System and Intercom System.

B. Photo Badging

1. Provide photo badging equipment where shown on the drawings with all necessary components to print photo ID proximity cards, including but not limited to the following:
   a. Camera
   b. Photo Badging Printer
   c. Diffused soft white light fixture mounted at 3 to 4 feet AFF for up lighting of photo subject.

C. The camera shall be mobile so that pictures may be taken and then downloaded to create the photo ID.

D. Enrollment Proximity Card Reader for read and testing of credential to be entered, edited, or deleted.

2.07 DOOR POSITION SWITCH (DPS)

A. Provide concealed magnetic door position switches for hollow metal frame or wood frame/door. Surface mounted not permitted.

1. Securitron, SDC or equal.

B. Provide magnetic door position switches for overhead roll up doors.

1. Interlogix 2205A, SDC or equal.

C. DPS to provide normally open contacts with closed-circuit signal when door is closed.

2.08 SOURCE QUALITY CONTROL

A. Comply with Section 280500.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Comply with Section 280500.

B. Comply with manufacturer's recommendations, procedures and standards for the assembly and operation of the Access Control system. Wire to wire-nut leads, terminal strips, connector plugs, or other termination methods equally acceptable to the Owner.

C. All door hardware field conductors are classified as Class-1 wiring, and their conduits shall only be routed to the designated Class-1 gutter. All other field device conductors

under other Sections are classified as Class-2 wiring, unless otherwise noted, and their conduits shall only be routed to the designated Class-2 gutter.

D. Provide sufficient quantity of power supplies of CEC, Class 2 capacity, to power all door monitoring switches, and dry contact interfaces between relay output modules and their associated equipment. Furnish power supplies with over voltage and short circuit protection.

E. Install and adjust components permanently with proper alignment, sufficient ventilation and cooling, and adequate access for maintenance. Layout cabinet with consideration given to equipment placement so that card access controller and modules are not place near or immediately over power supplies. Data equipment shall be located away from interference sources. Heavy and bulky equipment shall be located at the bottom of the cabinet. Terminals shall be located at a height that shall be convenient for maintenance personnel to use.

F. Mount individual components to removable rear panels in access control cabinets or field interface panels using DIN rails, snap track or stand off-mounted PC boards, or properly sized mounting hardware.

G. Provide relay output modules and interposing relays for gate control of sufficient rating, capacity, and quantity to control all required functions. Relay output modules shall provide contact closures for controlling electric door hardware.

H. The card access host computer/CPU and workstation terminal shall be powered by the IT UPS system.

3.02 DOOR HARDWARE COORDINATION

A. Coordinate with door hardware specifications and contractor.

B. Finalize design of connections to door hardware, power supplies, DPS, and gate control.

C. Program each door function as described in Door Hardware Section and related Division 8 sections and as related to the hardware provided.

3.03 ACCESS GATE HARDWARE COORDINATION

A. Coordinate with gate hardware specifications and contractor.

3.04 DOOR OPERATION, GENERAL

A. For card reader locations, presenting a valid credential at the proximity card reader shall allow access through the door for a programmable time initially set for four seconds and then relock.

B. Upon valid credential access or request to exit signal, alarm signals shall be shunted. The alarm shunt shall be a programmable time initially set for thirty seconds or when the door is secured.

C. When the door closes the lock shall automatically relock.

D. Locks shall unlock and remain unlocked when the unlock input signal is active.

E. Selective electrified doors in egress pathways shall unlock and remain unlocked during a fire alarm. Coordinate and obtain a signal from the fire alarm contractor.

F. Doors shall remain unlocked when automatically scheduled or manually activated at the Security Work Station.

G. Doors with local open buttons shall unlock when the button is active. Local button unlock status shall be indicated on the Security Work Station.

3.05 GATE OPERATION, GENERAL

A. Gates shall normally be in the closed position unless opened by loop detector, valid card read, access control system operator, Knox key switch.

B. The detection or reception of a valid signal at the receiving unit shall allow access through the vehicle gate for a programmable time.

1. For applicable gates, the programmed time shall be sufficient to accommodate large vehicles such as busses, trucks, tractors.

C. Automatic exit loop shall be provided by gate contractor for the egress side of the gate.

3.06 TESTING PROCEDURES

A. After installation of the Access Control system's equipment, and prior to point-by-point performance testing, functionally test all card readers, locks, strikes, door monitoring switches and other hardware interconnections, and all interfaces to other systems, including video surveillance alarm functions. Fully coordinate with door hardware suppliers to adjust all magnetic switches, limit switches and all other door hardware components for proper operation.

1. Initial Performance Testing:
   a. Perform a thorough, device-by-device operational test including system integration to all related systems and interfaces. Demonstrate system operations and performance in accordance with Owner's requirements and all previous Owner's review comments. Demonstrate complete functionality of all controls, door alarms, and other system functions.
   b. If test results are not in compliance with requirements, make necessary changes, corrections, repairs or adjustments at no additional cost and arrange for another point-by-point performance test. This process shall continue until the systems are acceptable to the Owner.

2. Performance Testing:
   a. Comply with Section 280500.
   b. Coordinate with the County Fire Department to test Knox key switches.
   c. Coordinate with NCOC to test the NCOC wireless receivers.

3. Continuous Operational/Functional Testing:
   a. Comply with Section 280500.

3.07 TRAINING

A. Provide training in accordance with Section 280500.

END OF SECTION 28 13 00

SECTION 28 23 00 - VIDEO SURVEILLANCE SYSTEM

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specifications, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Cameras, Lenses and Enclosures
2. Programming Server
3. Programmable Keyboard Controller
4. Network Video Recording System
5. Camera Power Supply

B. Related Sections:

1. 280500 Common Work Results for Electronic Security
2. 280560 Electronic Components
3. 281300 Access Control System
4. 285116 Public Address System

1.03 REFERENCES

A. ANSI/EIA-170, Electrical Performance Standards - Monochrome Television Studio Facilities A (“RS-170”): Standards for picture quality.

B. ANSI/EIA-330, Electrical Performance Standards for Closed Circuit Television Camera 525/60 Interlaced 2:1 (“RS-330”): Standards for Picture quality.

1.04 SYSTEM DESCRIPTION

A. Scope of Work Summary:

1. Provide a high resolution, low light level, color Video Surveillance System (VSS) to monitor, display, and record critical areas of the facility as indicated on the drawings.
2. Provide a Network Video Recorder (NVR) system.
3. Interface to the intercom system.
4. Specific camera call up, display, and playback of recorded video will be performed at each video workstation.
5. Video recording shall be video motion detection (VMD) activated with a minimum FPS recording at all times (24/7). VMD triggers shall be based on programable target areas with programable percent of target area pixel change triggering alarm.
6. All cameras shall be mounted in secure enclosures, outdoor cameras in secure and weatherproof enclosures, and placed with owner approved viewing angles and locations.
7. Program all video pictures with its respective location, time, and date.

B. System Components:

1. The system shall consist of, but not limited to, color cameras, monitors, camera enclosures, housing mounts, POE network switch, power supplies, and all necessary interfacing components for a fully functional system.

C. Monitoring and Display System

1. Cameras to be monitored at the VSS workstations and may be viewed in single or multi-camera or sequenced displays as selected by the operator.
2. Real time viewing of cameras shall be independent of system servers. Cameras shall be viewable from any computer on the security network or access to the network.
3. Real time viewing may use M-PEG streamed video codex at 720p to reduce VSS workstation CPU load.

D. Video Recording

1. Record all cameras at a minimum of 1FPS.
2. Record VMD or other alarmed cameras with a minimum of 10 second pre and post alarm video at 30 FPS.
3. Recorded video shall use H.264 codex at 1080p.
4. Provide 60 days of recorded video.
5. Estimate video memory for 60 days at 33% activity over 24 hours per camera.
6. Provide a DVD-RW drive with the network video recorder for extracting video from storage archive and transferring onto a removable media.

E. Future

1. Provide minimum 10% spare camera input capacity per network switch (not storage capacity), which includes software licensing and at each workstation.

1.05 SUBMITTALS

A. Comply with Section 280500.

B. Submit a camera schedule with camera information including, but not limited to: Camera number, IP address, camera user name, device port, switch name, switch port type, device model, lens type, mounting type/orientation, programming/settings group, ID and password, Serial number

C. Submit a programming/settings schedule with settings information including, but not limited to: Group name/designation, frame rate, resolution, compression format, storage server designation

D. Performance Measurements: Record and submit all performance measurements in a complete test report.

1.06 COORDINATION

A. Coordinate with the Owner exact mounting location of all cameras prior to installation.

B. Demonstrate to the Owner camera field of views using variable focal lens at each camera location prior to installation. Select and obtain approval of proper lens size or focal setting at each camera location to provide the required video coverage. If the desired view or coverage is unobtainable due to physical obstructions or limitation of lens, perform minor adjustment of the camera physical location (up to 10 ft.) at no additional cost to the Owner.

1.07 EXTRA MATERIALS

A. Deliver the following spare parts to the Owner at a location to be designated (quantities to be determined):

1. (2) Fixed Cameras
2. (2) each type of Hard Drive

1.08 QUALITY ASSURANCE

A. Comply with Section 280500.

B. CEC Compliance: Comply with applicable requirements.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Provide products to meet the following minimum requirements or manufacturer minimum requirements of system components, whichever is greater, for a complete operational system.

2.02 CAMERAS

A. Indoor Fixed Cameras:

1. Provide IP based, POE, HD, low light, high resolution, color cameras with vari-focal, auto-iris lenses.
2. The cameras shall be installed in security smoked dome housings so that the direction of camera is concealed.
3. Mounting types shall include ceiling, corner and wall as specified on the drawings.
4. H.264 codex
5. Minimum 3 MP / HD at 1080p resolution.
6. Multi-streaming to meet project requirements.

B. Outdoor Cameras:

1. Same as indoor cameras with the following additional features:
2. Provide dome cameras with weatherproof enclosure
3. Cameras shall have Day/Night IR filter
4. Provide internal or external fiber optic transceivers and power supply for cameras that exceed 90 meter cable length from camera to switch.
5. Pole Mounted Cameras: Pole mount accessories.
6. Provide all necessary sun-shields, heaters, blowers and weatherproof accessories for a complete installation.

2.03 SWITCHES

A. Copper Based

1. Rack mounted, POE equipped, Class rated for POE devices used.

B. Fiber Optic Based

1. Rack mounted,
2. Fiber Optic inputs for type fiber used SM or MM.
3. Alternately, fiber transceiver may be used and routed to copper based switch.

2.04 VIDEO MANAGEMENT SOFTWARE (VMS)

A. The product provided shall be a software program that provides the installation, administration, and operation of video surveillance systems. The system shall be able to process video using H.264 and M-JPEG video compression technology. The software scans the network and displays all the available installed video server and decoder devices and network video recorders, including their IP addresses and additional proper-

ties, in a window tree display. Video from any of the installed devices may then be displayed by dragging the device symbol into a workspace software monitor window. Video may be displayed in full screen mode or 2x2 and 3x3 multiscreen formats.

B. Direct Live camera video shall be possible at VSS work stations without the need of a server or other central management device.

C. VMS and all associated software shall be of the latest version available 90 days prior to Substantial Completions. This may require purchasing manufacturer upgrade options to ensure delivery of the most current software at no additional cost to the contract.

D. Alarm Handling Capability

1. The VMS specified shall handle alarms generated from the alarm interfaces of the video servers that have been integrated into the network with the video management system. In addition, the VMS is capable of combining the alarms generated from the alarm interfaces of the video servers with AND, NAND, OR, or NOR internal gating functions of the software to create new triggers that cause the VMS to react according to preprogrammed alarm scenarios. Internal and weekly timers may be programmed to determine exactly when alarms can be active.
2. The VMS shall accept input alarm triggers and then place them into an alarm stack to either be acknowledged or the input alarm may automatically trigger a series of system operations (scenarios).
3. Alarm trigger inputs to the VMS may be caused by any of the following conditions at the remote video servers:

    a. Contact input
    b. Motion detection
    c. Video signal loss

4. Record, recall and view recorded video and transfer selected recorded video to a portable device (flash drive, DVR) with imbedded video viewing software.

E. The VMS shall provide, but not be limited to, the following functions:

1. Provide a digital matrix function by allowing any camera to be connected to any monitor using a drag and drop function.
2. Display several simultaneous live picture connections from cameras in the network.
3. Provide a configuration tool that allows the creation of site maps with camera locations and monitor placement and also allows interactive operation including PTZ control.
4. Programming of alarm-triggered events.
5. Programming of automatic video recording to network connected video recorders.
6. Retrieve and playback the archived video from remote hard drives or Compact Flash memory of compatible devices or from network video recorders.
7. Provides a bidirectional audio function to allow communication between remote camera sites and main control location. Full and half duplex audio communication modes are selectable.
8. Provide ability to control all VMS functions from an iOS and Android smart phone application.

2.05 VSS WORKSTATION

A. The workstation shall meet or exceed the following minimum requirements:

1. Workstation software and hardware shall be provided to meet or exceed the minimum requirements to operate the VMS and view live video, process video compression, and video recording at no more than 50% of utility capacity i.e. CPU, disk, or network time.
2. Workstation shall be capable of viewing and playback of video at no less resolution and speed than of the original video.
3. Meet all VMS manufacturer recommendations.

2.06 KEYBOARD/MONITOR/MOUSE

A. Provide a rack mounted pull out keyboard / monitor / mouse unit for connection to the video network server.

2.07 VIDEO SURGE SUPPRESSERS (FOR EXTERIOR CAMERAS ONLY)

A. Ethernet Surge Suppressor for camera power (POE) and signal.

B. 10/100 and 1000 Mbps data rate

C. Discharge capability of 10KA

D. Protects all 4 pairs

E. High insulation resistance

F. Cast aluminum construction

2.08 CAMERA / TRANSCEIVER POWER SUPPLY

A. Unit shall be capable of powering a camera and transceiver.

B. Unit shall incorporate a green LED indicator for incoming AC power.

C. Unit shall be housed in a metal enclosure with vents for heat dissipation.

D. Unit shall be UL listed.

2.09 SOURCE QUALITY CONTROL

A. Comply with Section 280500.

PART 3 - EXECUTION

3.01 DEMONSTRATION

A. Prior to system design, propose and demonstrate sample products to be used for each application.

B. Based on Owner's acceptance of proposed products complete the VSS design.

C. Prior to installation, submit the Camera and Programming Schedules based on the completed VSS design.

3.02 INSTALLATION

A. Comply with Section 280500.

B. Comply with manufacturer's recommendations, procedures and standards for the assembly and operation of the VSS cameras.

C. Use screw type terminals and crimped lugs for camera power cable terminations.

D. Install all exterior camera enclosures, conduits, and fittings to meet NEMA-4X and IP66 rating.

E. Coordinate with signage, lighting fixtures, etc. to install all cameras as close to the indicated locations on plans as physically possible. Notify the Owner immediately upon discovering any potential interference that may obstruct the video pictures or reduce the video quality of the devices. Ensure that the minimum distance from any lighting fixture in front of a camera is four (4) feet.

F. Provide minimum five (5) feet slack of video cable for camera location adjustments. Adjustments to camera locations shall be at no additional cost to the Owner.

G. Coordinate with the Division 26 for site camera power, light pole mounted cameras and site trenching.

3.03 FIELD QUALITY CONTROL

A. After installation of the video surveillance system, and prior to performance testing, functionally test all cameras, video equipment, and other hardware interconnections, and all interfaces to other systems. In addition, conduct the following adjustments and measurements:

1. Field-of-View Testing: After camera and lens installation, and with VSS monitoring equipment installed, demonstrate the field-of-view of each camera/lens combination to the Owner. Replace lens type and/or adjust camera positioning as needed to obtain the Owner's desired field-of-view at no additional cost.

B. Performance Testing

1. Comply with Section 280500, Performance Testing for:

a. Initial Performance Testing
b. Performance Testing.

1) Demonstrate proper alignment, adjustment, and switching, sequencing, auto-positioning and system performance for all camera locations with all required sequences of operation under all operating modes. Demonstrate proper interface with all other security electronic systems.

c. Continuous Operational/Functional Testing

3.04 TRAINING

A. Provide training in accordance with Section 280500.

B. Provide qualified technicians certified by the product manufacturers to perform the training. Submit evidence of qualifications for Owner's approval prior to training.

END OF SECTION 28 23 00

SECTION 28 31 00 - FIRE ALARM SYSTEMS

PART 1 - GENERAL

1.1 CONDITIONS:

A. The Requirements of General Conditions and Special Conditions apply to Work of this Section as if fully repeated herein.

B. The Requirements of this Section apply to all Work of Division 26.

1.2 SCOPE:

A. Furnish and install a programmable, addressable type, Low Voltage Automatic Fire Detection System as shown on Drawings and/or specified herein, together with all miscellaneous items of labor, engineering, design and materials necessary for proper operation, testing and control of systems for complete and operating systems. Any omission in specified equipment will not relieve the Contractor of the responsibility for furnishing a fully operational system.

B. The work covered by this section of the specifications is to be coordinated with the related work as specified elsewhere under the project specifications.

1.3 QUALITY ASSURANCE:

A. Latest applicable publications listed below form a part of this Specification:

CEC	2016 California Electrical Code
CFC	2016 California Fire Code
NFPA 72	National Fire Alarm Code with California Amendments, 2016
ADA	Title 3 of the Americans with Disabilities Act
CCR	Titles 19 and 24 of the California Code of Regulations
CMC	2016 Uniform Mechanical Code and 2016 California Amendments

B. The fire alarm system shall confirm to 2016 California Building Code 305.9, 2016 California Electric Code Section 760, and 2016 California Fire Code Article 10.

C. The location of the fire alarm system detectors, manual stations, audible devices and related equipment as shown on plans are only for reference and do not constitute shop drawings which are required to be submitted by the contractor for review and approval.

D. Fire Protective Signaling Equipment: Installation of fire protective signaling system shall not be started until the California Fire Marshal listing number for each component of the system, detailed plans and specifications has been submitted and approved by the State Fire Marshal.

E. Upon completion of the installation of the fire protective signaling equipment, a satisfactory test of the entire system shall be made in the presence of the enforcing fire agency. If testing results

determine fire alarm audibility does not meet 10db over ambient noise levels, additional fire alarm audible devices shall be installed.

F. Each and all items of the Fire Alarm System shall be compatible and shall bear the "U.L." label. All control equipment shall be listed under UL category UOJZ as a single control unit. Partial listing shall NOT be acceptable.

G. All control equipment must have transient protection to comply with UL864 requirements.

H. In addition to the UL-UOJZ requirement mentioned above, the system controls shall be UL listed for Power Limited Applications per 2016 CEC 760. All circuits must be marked in accordance with 201 CEC article 760-23.

I. Where fire alarm circuits leave the building, additional transient protection must be provided for each circuit. Devices must be UL listed under Standard #497B (Isolated Loop Circuit Protectors).

1.4 GENERAL REQUIREMENTS:

A. The fire alarm system shall allow for loading and editing special instructions and operating sequences as required. The system shall be capable of on site programming to accommodate system expansion and facilitate changes in operation. All software operations shall be stored in a non-volatile programmable memory within the fire alarm control panel. Loss of primary and secondary power shall not erase the instructions stored in memory.

1. Full flexibility for selective input/output control functions based on ANDing, ORing, NOTing, timing and special coded operations shall also be incorporated in the resident software programming of the system.

B. Resident software shall allow for full configuration of initiating circuits so that additional hardware shall not be necessary to accommodate changes in, for instance, sensing of normally open contact devices to sensing of normally closed contact devices, or from sensing of normally open contact devices to sensing a combination of current limited and non-current limited devices on the same circuit and being able to differentiate between the two, or changing from a non-verification circuit to a verification circuit or vice-versa.

C. Resident software shall also allow for configuration of indicating appliance and control circuits so that additional hardware shall not be necessary to accommodate changes in, for instance, changing a non-coded indicating appliance circuit to a coded circuit, or from a slow march time (20 BPM) to a fast march time (120 BPM).

D. The system shall have the capability of recalling alarms and trouble conditions in chronological order for the purpose of recreating an event history.

E. All panels and peripheral devices shall be the standard product of a single manufacturer and shall display the manufacturer's name on each component. The catalog numbers specified under this section are those of Silent Knight and constitute the type, product quality, material, and desired operating features.

1.5 QUALIFICATIONS:

A. Fabricator/Installer/Vendor shall be licensed contractor and servicing agent, as well as installer for all components and systems in this Fire Alarm System, and be acceptable to manufacturer of the major components of the system. Service personnel shall be capable of serving any and/or

all components of the Fire Alarm System. Fabricator/Installer/Vendor shall have a minimum of three (3) working sites within the area (accessible to the Building Coordinator for review and evaluation), using specified, or equal, equipment in an integrated system. Fabricator/Installer/Vendor must be able to present evidence of technical expertise, be a firm who has successfully installed projects of a similar scope to this project for a minimum of five (5) years, and shall maintain service office within 100 miles of Lincoln.

B. All equipment is to be manufactured by a firm/firms who have successfully fabricated elements/systems of a scope similar to this project for a minimum of ten (10) years.

C. Have a valid State of California Contractor's license in classification C10 - Electrical.

D. Provide authorized dealer service on-site at facility within four (4) hours of a problem being reported, with this response time available twenty-four (24) hours per day, seven (7) days per week.

E. Affirm that he maintains, or will maintain, or has access to, a stock of system spares sufficient to insure that no element of the Fire Alarm System will be out of service for more than twenty-four (24) hours due to lack of proper spares.

1.6 SUBMITTALS:

A. Shop Drawings shall be submitted and shall consist of a complete list of equipment and materials, including manufacturer's descriptive and technical literature, catalog cuts, and installation instructions.

Shop Drawings shall also contain complete wiring and schematic diagrams for equipment furnished, equipment layout, conduit and wiring layout drawings, and any other details required to demonstrate that system has been coordinated will properly function as a unit. Equipment Vendor shall check Drawing for adequacy of conductors and raceways for proposed system. Include in Bid Amount all required raceways, conductors and material necessary to suit proposed system.

B. The fire alarm system submittals and installation shall meet the following criteria:

1. The system shall conform to current California Code of Regulations (CCR) Titles 19 & 24 as applicable to this project, and National Fire Protection agency (NFPA).

2. Upon completion of the system installation, the system shall be tested in the presence of and in a manner acceptable to DSA/Project inspector. The contractor must supply necessary testing equipment including a "sound level meter" to check acceptable decibel levels of audible devices. Provide test results per the NFPA 72 "Record of Completion" to architect, DSA, project inspector, owner, and to the local fire authority. All normally occupied areas shall be provided with a fire alarm audible decibel level at 15 dba above ambient noise levels.

3. The "End of Line Resistance" for each circuit shall be tested in the presence of the project inspector and shall not exceed a maximum of 10% of the 24 volt system. Each component in the circuit shall not exceed the listed manufacturer's minimum operating voltages. See NFPA 72, loop resistance. This section requires that all initiating and indicating (notification appliance) circuits to be measured and recorded.

4. Penetrations of all fire-rated walls shall be protected in accordance with the California Building Code.

5. Provide details and design numbers of through-penetration fire stopping systems.

6. The actual fire alarm notification circuit voltage drop shall be witnessed and recored by the project inspector during the testing of the circuit under full load.

B. Spare Parts Data: After approval of list of Shop Drawings, furnish copies of spare parts data for each different item of materials and equipment specified. Data shall include a complete list of parts with current unit prices and source of supply, a list of supplies that are normally furnished at no extra cost with purchase of equipment.

C. Operating and Maintenance Instruction Manuals shall be furnished.

1. Operating Instruction Manuals outlining the step-by-step procedures required for system start-up and operations shall be furnished. The instructions shall include manufacturer's name, model number, service manual parts list, and brief description of all equipment and their basic operating features.
2. Maintenance Instruction Manuals outlining maintenance procedures shall be furnished. The manual shall include a troubleshooting guide listing possible breakdowns and repairs and a simplified connection wiring diagram for the system as installed.

D. Performance Test Reports: Upon completion of installed system, submit in booklet form all field tests performed to prove compliance with the specified performance criteria. Each test report shall indicate the final position of controls.

E. Battery Capacity Calculations: Complete battery calculation sheet showing all the electrical requirements of the entire fire alarm system, including the power consumption of the individual devices, both in alarm and supervisory modes shall be submitted.

F. Voltage Drop Calculations: Submit voltage drop calculations for all fire alarm signal circuits.

1.7 SYSTEM OPERATION:

A. The system alarm operation subsequent to the alarm activation of any manual station, automatic detection device, or sprinkler flow switch shall be as follows:

1. All audible alarm indicating appliances shall sound a continuous fire alarm signal until silenced by the alarm silence switch at the control panel.
2. All visible alarm indicating appliances shall flash continuously until the system is reset.
3. Alarm indicating appliances shall operate selectively by zone.
4. Any subsequent zone alarm shall reactivate the alarm indicating appliances.
5. A supervised signal to notify the local fire department or an approved central station shall be activated.
6. The mechanical controls shall activate the air handling systems in accordance with NFPA 90.

B. Supervised "positive feedback" inputs shall be provided to indicate true "on" and "off" status from designated contact closures in the air handling system. This positive feedback indication shall take precedence in determining true "on/off" status.

C. Upon reset of the fire alarm control panel, air handling units shall sequentially start up to minimize power demand.

D. The alarm shall be displayed on an 80 character LCD display. The top line of 40 characters shall be the point label and the second line shall be the device type identifier. The system alarm LED shall flash on the control panel until the alarm has been acknowledged. Once

acknowledged, this same LED shall latch on. A subsequent alarm received from another zone shall flash the system alarm LED on the control panel. The LCD display shall show the new alarm information.

E. A pulsing tone shall occur within the control panel until the event has been acknowledged.

F. The activation of any system smoke detector shall initiate an Alarm Verification operation whereby the panel will reset the activated detector and wait for a second alarm activation. If, within one (1) minute after resetting, a second alarm is reported from the same or any other smoke detector, the system shall process the alarm as described previously. If no second alarm occurs within one minute, the system shall resume normal operation. The Alarm Verification shall operate only on smoke detector alarms. Other activated initiating devices shall be processed immediately. The alarm verification operation shall be selectable by zone.

1. The control panel shall have the capability to display the number of times (tally) a zone has gone into a verification mode. Should this smoke verification tally reach a pre-programmed number, a trouble condition shall occur.
2. Alarm verification zones shall be able to be divided into eight separate groups whereby only verification zones from the same group will confirm the first activation and cause the alarm sequence to occur.

G. The control panel shall have a dedicated supervisory service LED and a dedicated supervisory service acknowledge switch.

1. The activation of any standpipe or sprinkler valve supervisory (tamper) switch shall activate the system supervisory service audible signal and illuminate the LED at the control panel (and the remote annunciator). Differentiation between valve tamper activation and opens and/or grounds on the initiation circuit wiring shall be provided.
2. Pressing the Supervisory Service Acknowledge Key will silence the supervisory audible signal while maintaining the Supervisory Service LED "on" indicating the off-normal condition.
3. Restoring the valve to the normal position shall cause the Supervisory Service LED to extinguish, indicating restoration to normal.

H. A manual evacuation (drill) switch shall be provided to operate the alarm indicating appliances without causing other control circuits to be activated. However, should a true alarm occur, all alarm functions would occur as described previously.

I. The system shall have a single key that will allow the operator to display all alarms, troubles, and supervisory service conditions including the time of each occurrence.

J. A voltmeter and ammeter shall be provided to indicate battery voltage and charging current.

K. The actuation of the "enable walk test" program at the control panel shall activate the "Walk Test" mode of the system which shall cause the following to occur:

1. The city circuit connection shall be bypassed.
2. Control relay functions shall be bypassed.
3. The control panel shall show a trouble condition.
4. The alarm activation of any initiation device shall cause the audible signals to activate for two seconds.
5. The panel shall automatically reset itself after signaling is complete.
6. Any momentary opening of an initiating or indicating appliance circuit wiring shall cause the audible signals to sound for 4 seconds indicating a trouble condition.
7. The system shall have the capacity of 8 distinctive work test groups. Such that only a portion of the system need be disabled during testing.

1.8 SYSTEM SUPERVISION:

A. The system shall contain Class `B' Style `Y' independently supervised initiating device circuits. The alarm activation of any initiation circuit shall not prevent the subsequent alarm operation of any other initiation circuit.

B. There shall be supervisory service initiation device circuits for connection of all sprinkler valve supervisory (tamper). Device activation shall cause a supervisory alarm at the control panel.

C. There shall be independently supervised and independently fused indicating appliance circuits for alarm horns and flashing alarm strobes. Disarrangement conditions of any circuit shall not affect the operation of other circuits.

D. Auxiliary manual controls shall be supervised so that an "off normal" position of any switch shall cause an "off normal" system trouble.

E. Each independently supervised circuit shall include a discrete LCD readout to indicate disarrangement conditions per circuit.

F. The incoming power to the system shall be supervised so that any power failure must be audibly and visually indicated at the control panel. A green "power on" LED shall be displayed continuously while incoming power is present.

G. The system batteries shall be supervised so that a low battery condition or disconnection of the battery shall be audibly and visually indicated at the control panel.

H. The System Modules shall be electrically supervised for module placement. Should a module become disconnected, the system trouble indicator shall illuminate and the audible trouble signal shall sound.

I. The system shall have provisions for disabling and enabling all circuits individually for maintenance or testing purposes.

1.9 SYSTEM POWER REQUIREMENTS:

A. The control panel shall receive 120 VAC power via a dedicated circuit.

B. The system shall be provided with sufficient battery capacity to operate the entire system upon loss of normal 120 VAC power in a normal supervisory mode for a period of twenty-four (24) hours with five (5) minutes of alarm operation at the end of this period. The system shall automatically transfer to the standby batteries upon power failure. All battery charging and recharging operations shall be automatic.

C. All external circuits requiring system operating power shall be 24 VDC and shall be individually fused at the control panel.

PART 2 - PRODUCTS

2.1 MANUFACTURER:

A. The equipment furnished shall be the standard product of the Silent Knight, Notifier, EST, or equal.

2.2 FIRE ALARM CONTROL PANEL:

A. The fire alarm control panel (FACP) shall be the Silent Knight 5820XL analog addressable control panel. The FACP must have a 6 amp power supply and be capable of expansion to a maximum of 54 total amps via bus connected expander modules that supervise low battery, loss off AC and loss of communication.

B. The FACP must have Drift Compensation sensitivity capabilities on detectors and be capable of supporting 99 detectors and 99 analog addressable modules and expandable to a maximum of 396 detectors and 396 modules. This shall be accomplished via four signaling line circuits (SLC) capable of supporting a minimum of 99 detectors and 99 addressable module devices each. The communication protocol on the SLC loop must be digital.

C. The FACP must support a minimum of six programmable “Flexputs”. The panel must have a built in 80 character LCD annunciator with the capability of having an additional eight supervised remote annunciators connected in the field.

D. The FACP must have a built in UL approved digital communicator. The communicator must allow local and remote up/downloading of system operating options, event history, and detector sensitivity data.

E. The FACP must automatically test the smoke detectors in compliance with NFPA standards to ensure that they are within listed sensitivity parameters and be listed with Underwriters Laboratories for this purpose.

F. The FACP must compensate for the accumulation of contaminants that affect detector sensitivity. The FACP must have maintenance alert feature (differentiated from trouble condition), detector sensitivity selection, auto-programming mode (Jumpstart) and the ability to upgrade the core operating software on site or over the telephone.

G. The FACP shall have a Jumpstart feature that can automatically enroll all properly connected accessories into a functional system within 60 seconds of powering up the panel. Panels that do not have these capabilities will not be accepted.

H. The main communication bus (S-Bus RS485) shall be capable of class A or class B configuration with a total Bus length of 6,000 feet.

1. Provide a dedicated 120V input circuit to the FACP.

2.3.1 SIGNAL EXTENDER PANEL:

A. Provide a signal extender panel where shown on the drawings. Panel shall be a Silent Knight 5895XL.

1. Output shall be 24 VDC with 5 amp of signal power.
2. Panel shall have 6 signal circuits with a capacity of 3.0 amp per output circuit.
3. Panel shall be capable of converting 2 output circuits to input circuits.
4. Provide (2) 12 AH batteries in each panel.
5. Provide a dedicated 120V input circuit to each power supply.

2.3.2 MANUAL FIRE ALARM STATIONS:

A. Manual Fire Alarm Stations shall be addressable, non-coded, dual action type, with a key operated test reset lock in order that they maybe tested, and so designed that after actual emergency operation, they cannot be restored to normal except by use of a key. The reset key shall be so designed that it will reset the manual Pull Station and open the FACP cabinet without use of another key. An operated station shall automatically condition itself so as to visually detected, as operated, at a minimum distance of fifty feet, front or side. Manual stations shall be constructed of 14 gauge cold rolled steel with clearly visible operating instruction on the front of the station in raised letters. Stations shall be suitable for surface mounting on matching back box, or semi-flush mounting on a standard single gang box, and shall be installed within the limits defined by the Americans with Disabilities Act (ADA) dependent on Manual Station accessibility or per local requirements.

2.3.3 ADDRESSABLE DETECTORS:

A. Addressable detectors shall be the Silent Knight Model SK-Photo Photoelectric Smoke Detector or the SK-Heat Heat Detector. The base shall be the Silent Knight model B210LP. The bases may also include the B224RB Relay Base. The addressable detector shall have a flashing status LED for visual supervision. When the detector is actuated, the flashing LED will latch on steady at full brilliance. The sensitivity of the detector shall be capable of being selected and measured by the control panel without the need for external test apparatus. The detector shall be a double EE-prom technology and be programmed using the internal programming loop located on the FACP.

2.3.4 DUCT DETECTORS:

A. All Duct Detectors shall be Silent Knight Model SK-Duct housings with relay and the Model SK-Photo smoke detectors.

2.3.5 NOTIFICATION DEVICES:

A. The audible, visible and audible/visible signal shall be Wheelock Series LSPSTR, E70, ET-1010. Each indicating appliance circuit shall be electrically supervised for opens, grounds and short circuit faults, on the circuit wiring, and shall be so arranged that a fault condition on any indicating appliance circuit or group of circuits will not cause an alarm to sound. The occurrence of any fault will light the trouble LED and sound the system trouble sounder, but will not interfere with the proper operation of any circuit which does not have a fault condition. The notification appliance (audio and audible/visible units) shall produce a peak sound output of 90dba or greater as measured in an anechoic chamber. The signaling appliance shall also have the capability to silence the audible signal while leaving the visible signal energized with the use of single par of wires. Additionally, the user shall be able to select either continuous or temporal tone output with the temporal signal having the ability to be synchronized. The visible signaling appliance shall maintain a minimum flash rate of 1Hz or greater regardless of power input voltage. The appliance shall also be capable of meeting the candela requirements of the blueprints presented by the Engineer or ADA.

The appliance shall be polarized to allow for electrical supervision of the system wiring. The unit shall be provided with terminals with barriers for input/output wiring and be able to mount a single gang or double gang box or double workbox with the use of an adapter plate. The unit shall have an input voltage range of 20 – 30 volts with either direct current or full wave rectified power.

PART 3 - EXECUTION

3.1 INSTALLATION:

A. Work shall be installed as shown on the Drawings in accordance with the manufacturer's diagrams and recommendations, except where otherwise indicated.

1. Wiring for systems shall be installed in rigid conduit, intermediate metallic conduit or electric metallic tubing as specified in Section 26; Conduit, Fittings and Supports. External wiring between control panel and stations and horns shall connect to terminal strips in accessible locked cabinets. Connections to terminal strips shall be made with terminal spade lugs or with approved type terminal blocks. Conductors for fire alarm system shall not be installed in conduits, junction boxes, or outlet boxes with conductors of lighting and power systems. All conduit shall be three-quarters inch (3/4") minimum. A three-quarters inch (3/4") empty conduit from control panel to the nearest telephone closet shall be provided. Ample gutter space to accommodate all necessary wiring shall be provided. All wiring shall be color-coded; solid copper, 600 volts, UL approved for fire alarm use; #14 AWG for detector circuit and #12 AWG for alarm circuits. All detector and alarm wires shall be identified with E-Z Code or Brady wire markers by zones, or equivalent, at each junction box, detector outlet, pull station, horn, and master terminals. All final connections shall be made by manufacturer's certified technicians.

B. Control panel shall be mounted with sufficient clearance for observation and testing.

C. All fire alarm junction boxes must be clearly marked for distinct identification.

D. Panel enclosures shall comply with the Requirements of UL 864. Enclosures having doors over forty-eight inches (48") in height shall be provided with a three (3) point catch and lock; all other doors shall contain a cabinet type cylinder lock. Inserts shall be blind fastened so that no screws show on panel front.

E. Detectors shall be installed in accordance with manufacturer's written instructions in areas as indicated on the Drawings.

1. Locate detectors with pilot light visible from floor. Do not conceal behind HVAC duct work.
2. Do not locate detectors in direct air stream from supply air outlets (minimum of four feet (4') from air grille).

F. Provide access doors in ceiling directly below above-ceiling mounted detectors. Provide laminated phenolic engraved nameplate with white letters on yellow background attached to door. To read, "Detector located above ceiling." On lay-in ceilings, provide nameplate on ceiling tile directly below detector.

3.2 TESTING AND SPECIFICATIONS:

A. Notify the Engineer thirty (30) days before performance and acceptance tests are to be conducted. Perform tests in the presence of State and the local fire marshal. Furnish all instruments and personnel required for tests. Conduct tests for following:

1. Verify that the system is free of grounds or open circuits. The central control board shall indicate when a ground or open circuit exists.
2. Verify that notification devices, pull stations, transmitters, automatic detectors and supervisory devices are functioning as specified. Criteria for testing shall be as follows:

a. Audibles shall deliver the sound pressure levels (decibels) of the specified device.
b. Pull stations shall close the circuits specified and deliver specified alarm signal.
c. Automatic detectors shall actuate the specified zones when the appropriate fire or smoke conditions are generated.

(1) Calibrate and adjust all photoelectric detectors to manufacturer's standards in place and under dynamic field operating conditions using testing equipment built by manufacturer specifically for this purpose.

d. Panels and supervisory devices shall display and control functions as specified.

B. Performed under the supervision of Fire Alarm System supplier's qualified representative.

C. Reconducted to verify correction of any defect found in initial testing.

D. Upon completion of detector installation and system tests, certified technician shall submit three (3) copies of written report on manufacturer's Inspection and Test Forms to indicate system has been fully tested in supervision, trouble and alarm modes, and is fully operational conforming to letter of these Specifications.

E. Test report shall contain, but is not limited to, the following:

1. A complete test of equipment installed and wired.
2. Indication that all equipment is properly installed.
3. Tests of individual zones as applicable.
4. Serial numbers, locations by zone and model number for each installed detector.
5. Voltage (sensitivity) settings for each photoelectric detector as measured in place with the air conditioning system operating.
6. Technician's name, certificate number, and date.

F. After completion of all tests and adjustments listed above, Contractor shall submit following information to the State:

1. As-built conduit layout diagrams including wire color code and/or tag number.
2. Complete as-built wiring diagrams on manufacturer's Title Block.
3. Detailed catalog data on all installed system components.
4. Operation and Maintenance Manuals, four (4) copies.
5. Copies of technician's certified report (as above).
6. Written certification by manufacturer stating that system and its component parts are as listed and approved by California State Fire Marshal and that installation conforms in all respects to requirements of applicable Codes.

END OF SECTION

SECTION 27 51 16 - PUBLIC ADDRESS SYSTEM

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specifications, apply to this Section.

B. Related Sections:

1. 280500 Common Work Results for Electronic Security
2. 280560 Electronic Components
3. 281300 Access Control System
4. 282300 Video Surveillance System

1.02 SUMMARY

A. Section Includes:

1. Speakers
2. Amplifiers
3. Wiring

1.03 SYSTEM DESCRIPTION

A. Provide a Public Address (PA) system to provide administrative and emergency announcements throughout the site and by specified zones. Areas with telephone instruments shall utilize the instrument as a PA speaker as provided by the Owner, other areas are covered by PA speakers where shown on the drawings.

B. System messages are originated and zones selected from the telephone system or public address microphone(s) where shown on the drawings.

C. Provide amplifiers and telephone adapter modules to interface with the telephone system.

1.04 SYSTEM DESIGN

A. The system design is a combination of prescriptive and performance requirements. Complete the design based on the information provided in the contract documents and the actual equipment provided.

B. Size equipment and quantities as stated herein and as required to create a complete and operational system following industry best practice. Best practice is defined as published industry guidelines and standards.

C. Code requirements represent the minimum acceptable standards. Specifications and standards represent the minimum system performance.

D. The specified system design may be modified or changed to accommodate the final equipment selection and system layout if the system intent is met. The system design is based on the estimated minimum system parameters shown on the drawings.

1.05 REFERENCES

A. Comply with Section 270500.

1.06 SUBMITTALS

A. Comply with the requirements of Division 1 and Section 270500 Submittal’s, in addition provide the following:

1. Submit complete design and calculations.
2. Submit mounting details for each type of speaker.

1.07 QUALITY CONTROL

A. Comply with the requirements of Division 1 and Section 270500 Quality Control.

B. Meet or exceed all referenced codes, standards, specifications, or drawing requirements, whichever is greater.

1.08 WARRANTY

A. Comply with Div. 1 Warranty requirements.

B. A one year warranty provided in writing to all telecommunication equipment as well as labor associated with the change out of any non-performing product.

PART 2 - PRODUCTS

2.01 PRODUCT SELECTION

A. Provide products to meet or exceed the equipment listed herein, to meet the requirements of the project as shown on the drawings and meet the performance requirements listed herein.

B. If the listed equipment is no longer available provide the recommended equivalent or better replacement unit.

2.02 MATERIALS

A. Manufactures: Made in America Act for this project.

B. Public Address System Characteristics:

1. Multi-zone operation.
2. All-call operation.
3. Multiple sources.
4. Telephone paging.
5. High-quality sound reproduction.

C. Public Address System Components:

1. Equipment: Solid state, rated for continuous duty.
2. Preamplifiers: Output plus 4 decibels above 1 milliwatt at matched power amplifier load, less than 1 percent total harmonic distortion, minimum two inputs, minus 55 decibels minimum below rated output noise level.
3. Power Amplifiers: Rack mounted, 25V balanced line output, output regulation less than 2 decibels from zero to full load, 50 dB or greater signal to noise ratio.
4. Volume Limiter/Compressor: For each zone, maximum one percent distortion, rated output minimum of plus 14 dBM, minimum of two inputs.
5. Telephone Paging Adapter: Paging adapter for all zones.
6. Cone Type Loudspeakers: 45 decibels axial sensitivity, minimum one inch (25 mm) coil and five ounce (140 gram) ceramic magnet, 100 degrees dispersion, 15 watts minimum rated output level.
7. Horn Type Loudspeakers: Single or double horn units with single driver, matching transformer, weatherproof.
8. Wire and Cable: Speaker circuit conductors from racks to loudspeaker outlets not smaller than 18 gauge twisted pair.

D. Amplifier, Telephone Paging

1. Used for basic PA zone amplification and telephone interface.

E. Amplifier, Dual Channel (High Wattage)

1. Used for PA zones that require more power than the TPU Series provides
2. Output can be bridged to combine multiple amplifiers
3. Telephone interface module

F. Amplifier, Modular Power Vector (Noise level monitoring)

1. Used for variable power output based on ambient noise level.
2. With:

a. Telephone interface module
b. Microphone noise level monitor module

G. Horn Loudspeakers

1. Constant Directivity Re-Entrant Horn,
2. Dispersion: 40 by 20 degrees ± 10°
3. Provide custom mounting bracket.

H. Dual Loudspeakers

1. Bi-Directional Reentrant Horn Loudspeaker.

I. Ceiling Speakers, Drop in

1. Drop in 2x2 with back can.
2. Verify color with Owner.

J. Ceiling Speakers,

1. High Fidelity

K. Wall Loudspeakers

1. Flange-Mounted Reentrant Horn Loudspeaker.
2. Surface/Flush Mount enclosure.
3. Adapter Ring.
4. Heavy Duty Grille.

L. Wall Speaker, Surface

1. Metal box surface mount speaker assembly with angled face and recessed volume control.

M. Telephone Amplifier Interface Module

1. This module shall be compatible with VoIP phone system
2. This module shall provide all features of Bogen TAM-B or approved equal

N. Paging Controller with zone Expansion Module

1. This module shall be directly compatible with Telephone Amplifier Interface Module
2. This module shall provide all features of Bogen PCM-2000 or approved equal

PART 3 - EXECUTION

3.01 WORK

A. Manufactured products, materials, equipment, and components shall be provided, conditioned, applied, installed, connected, and tested in accordance with the manufacturer's specifications and printed instructions.

B. The installation of all system components shall be carried out under the direction of qualified personnel. Appearance shall be considered as important as mechanical and electrical efficiency. Workmanship shall meet or exceed industry standards.

C. Support framing, raceways, backboards, equipment racks, and cabinets.

3.02 OUTDOOR HORN/SPEAKERS DEMONSTRATION

A. Conduct a site demonstration to evaluate the wattage settings and horn orientation of the actual horn to be used. In addition, the ambient noise level settings of the automatic amplifier outputs shall be demonstrated and set. Provide all materials to conduct demonstration including but not limited to: sample horns of each type used (i.e. single, dual), amplifier, wiring, and power. Test equipment is not required to be permanently installed or mounted, but horns must be located and positioned to simulate final locations and orientations.

B. Submit shop drawings with initial wattage settings and horn orientation as shown on the plans. Shop drawings will be modified as needed during the demonstration as directed by the Owner to indicate the desired outdoor public address audio levels and horn orientations.

C. Outdoor horns and amplifier output levels shall be installed based on the demonstration results and retested as part of the Final Test and Adjust.

D. Notify and coordinate with the Owner a minimum of 15 days prior to demonstration to allow scheduling of Owner.

3.03 OPERATION AND PROGRAMMING

A. Each amplifier upon receipt of an incoming signal from the telephone system shall activate and amplify the incoming signal. When no signals have been received for a preset time initially set for 5 minutes, the amplifier shall enter the sleep mode.

B. The noise level amplifiers shall automatically adjust the signal output to a programmable level initially set at 15dB above ambient noise. Final levels to be based on outdoor horn demonstration.

3.04 FINAL TEST AND ADJUST

A. Testing to follow operational requirements of the system.

B. Tests of yard public address to be conducted to determine if public address sound travels beyond the site. Tests to be conducted with an empty yard, full yard, daytime and nighttime. Outdoor speaker levels and direction to be modified if required to limit sound levels leaving the site.

END OF SECTION 28 51 16

SECTION 31 10 00 – SITE CLEARING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Protecting existing vegetation to remain.
2. Removing existing vegetation.
3. Clearing and grubbing.
4. Stripping and stockpiling topsoil.
5. Removing above- and below-grade site improvements.
6. Disconnecting, capping, or sealing site utilities.
7. Temporary erosion and sedimentation control.
8. Tree trimming and protection

1.02 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Nevada County Operations Center, 12350 La Barr Meadows Road, Grass Valley, CA

1.03 MATERIAL OWNERSHIP

A. Except for materials indicated to be stockpiled or otherwise remain Owner's property, cleared materials shall become Contractor's property and shall be removed from Project site.

1.04 FIELD CONDITIONS

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.

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

B. Utility Locator Service: Notify utility locator service for area where Project is located before site clearing.

C. Do not commence site clearing operations until temporary erosion- and sedimentation-control and tree-protection measures are in place.

D. Tree- and Plant-Protection Zones: Protect according to requirements in Section 015639 "Temporary Tree and Plant Protection."

1.05 REFERENCE

A. Geotechnical Report, prepared by Holdrege & Kull, dated June 28, 2017, Project No.4266A-01, Appendix B

B. *State of California, Department of Transportation (CalTrans), Standard Specifications,* latest edition as adopted by jurisdictional authority, including all amendments

C. Nevada County Road Standards, latest edition, with amendments as adopted by serving jurisdictional authority.

D. Stormwater Pollution Prevention Plan, prepared by SCO, dated August 2018.

E. Summarized mitigation measures, prepared by SCO, Appendix A

PART 2 - PRODUCTS

2.01 MATERIALS

A. Satisfactory Soil Material: Requirements for satisfactory soil material are specified in Section 312000 "Earth Moving."

1. Obtain approved borrow soil material off-site when satisfactory soil material is not available on-site.

PART 3 - EXECUTION

3.01 PREPARATION

A. Protect and maintain benchmarks and survey control points from disturbance during construction.

B. Verify that trees, shrubs, and other vegetation to remain or to be relocated have been flagged and that protection zones have been identified and enclosed according to requirements in Section 015639 "Temporary Tree and Plant Protection."

C. Protect existing site improvements to remain from damage during construction.

1. Restore damaged improvements to their original condition, as acceptable to Owner.

3.02 TEMPORARY EROSION AND SEDIMENTATION CONTROL

A. Provide temporary erosion- and sedimentation-control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to erosion- and sedimentation-control Drawings and requirements of authorities having jurisdiction.

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

C. Inspect, maintain, and repair erosion- and sedimentation-control measures during construction until permanent vegetation has been established.

D. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

E. Maintain compliance with the Construction General Permit and site-specific Stormwater Pollution Prevention Plan (SWPPP) submitted to and approved by the California State Water Resources Control Board.

F. Maintain compliance with summarized mitigation measures.

3.03 TREE AND PLANT PROTECTION

A. Protect trees and plants remaining on-site.

B. Repair or replace trees, shrubs, and other vegetation indicated to remain or be relocated that are damaged by construction operations.

C. Trim trees as required to perform the work.

D. Coordinate tree trimming and tree removal with the Tree Harvest Plan and Engineer. Trim any trees within 10 feet of high voltage power lines or obstructing the operation of construction equipment.

E. Do not remove trees between February 15 to September 1 unless you have a qualified biologist conduct a bird survey before tree removal and there are no nesting birds found. Comply with section 14-6.03 of the Cal Trans Standard Specifications.

3.04 EXISTING UTILITIES

A. Locate, identify, disconnect, and seal or cap utilities indicated to be removed or abandoned in place.

1. Arrange with utility companies to shut off indicated utilities.

B. Interrupting Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others, unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:

1. Notify Architect not less than two days in advance of proposed utility interruptions.
2. Do not proceed with utility interruptions without Architect's written permission.

C. Removal of underground utilities is included in earthwork sections; in applicable fire suppression, plumbing, HVAC, electrical, communications, electronic safety and security, and utilities sections; and in Section 024116 "Structure Demolition" and Section 024119 "Selective Demolition."

3.05 CLEARING AND GRUBBING

A. Remove obstructions, trees, shrubs, and other vegetation to permit installation of new construction.

1. Grind down stumps and remove roots larger than 3 inches in diameter, obstructions, and debris to a depth of 18 inches below exposed subgrade.
2. Use only hand methods or air spade for grubbing within protection zones.

B. Fill depressions caused by clearing and grubbing operations with satisfactory soil material unless further excavation or earthwork is indicated.

1. Place fill material in horizontal layers not exceeding a loose depth of 8 inches, and compact each layer to a density equal to adjacent original ground.

3.06 TOPSOIL STRIPPING

A. Remove sod and grass before stripping topsoil.

B. Strip topsoil to depth 6 inches in a manner to prevent intermingling with underlying subsoil or other waste materials.

3.07 SITE IMPROVEMENTS

C. Remove existing above- and below-grade improvements as indicated and necessary to facilitate new construction.

3.08 DISPOSAL OF SURPLUS AND WASTE MATERIALS

D. Remove surplus soil material, unsuitable topsoil, obstructions, demolished materials, and waste materials including trash and debris, and legally dispose of them off Owner's property.

E. Separate recyclable materials produced during site clearing from other nonrecyclable materials. Store or stockpile without intermixing with other materials, and transport them to recycling facilities. Do not interfere with other Project work.

END OF SECTION 31 10 00

SECTION 31 20 00 – EARTH MOVING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Excavating and filling for rough grading the Site.
2. Preparing subgrades for walks pavements turf and grasses and plants.
3. Excavating and backfilling for buildings and structures.
4. Drainage course for concrete slabs-on-grade.
5. Subbase course for concrete walks and pavements.
6. Subbase course and base course for asphalt paving.
7. Excavating and backfilling trenches for utilities and pits for buried utility structures.

1.02 DEFINITIONS

A. Backfill: Soil material used to fill an excavation.

1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
2. Final Backfill: Backfill placed over initial backfill to fill a trench.

B. Base Course: Aggregate layer placed between the subbase course and hot-mix asphalt paving.

C. Bedding Course: Aggregate layer placed over the excavated subgrade in a trench before laying pipe.

D. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.

E. Drainage Course: Aggregate layer supporting the slab-on-grade that also minimizes upward capillary flow of pore water.

F. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.

1. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by Architect. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.
2. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Architect. Unauthorized excavation, as well as remedial work directed by Architect, shall be without additional compensation.

G. Fill: Soil materials used to raise existing grades.

H. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.

I. Subbase Course: Aggregate layer placed between the subgrade and base course for hot-mix asphalt pavement, or aggregate layer placed between the subgrade and a cement concrete pavement or a cement concrete or hot-mix asphalt walk.

J. Subgrade: Uppermost surface of an excavation or the top surface of a fill or backfill immediately below subbase, drainage fill, drainage course, or topsoil materials.

K. Utilities: On-site underground pipes, conduits, ducts, and cables as well as underground services within buildings.

1.03 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct preexcavation conference at Nevada County Operations Center, 12350 La Barr Meadows Road, Grass Valley, CA

B. INFORMATIONAL SUBMITTALS

C. Material test reports.

1.04 FIELD CONDITIONS

A. Utility Locator Service: Notify utility locator service for area where Project is located before beginning earth-moving operations.

B. Do not commence earth-moving operations until plant-protection measures specified in Section 015639 "Temporary Tree and Plant Protection" are in place.

1.05 REFERENCES

A. Geotechnical Report, prepared by Holdrege & Kull, dated June 28, 2017, Project No.4266A-01

PART 2 - PRODUCTS

2.01 SOIL MATERIALS

A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.

B. Satisfactory Soils: Uncontaminated, predominantly granular, non-expansive native soil.

1. Import fill material, predominately granular, non-expansive, and free of deleterious or organic material shall be submitted to Holdrege & Kull for approval and laboratory analysis at least 72 hours prior to import.

C. Engineered fill Soils: Granular material, nearly free of organic debris

1. Liquid Limit: 40 or less
2. Plasticity Index: 15 or less
3. 8-inch sieve: 100 percent passing
4. No. 200 sieve: Less than 30 percent passing

D. Unsatisfactory Soils:

1. Unsatisfactory soils also include satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction.

2. Fill compacted to less than 90 percent of the maximum dry density per ASTM D1557.

E. Controlled Low Strength Materials (CLSM):
1. Self-compacting and self-leveling backfill material that is used in lieu of compacted fill.
2. Unconfined compressive strength shall be 1,200 psi or less.
3. Unconfined compressive strength shall be 150 psi or less to be excavatable by hand tool or conventional machinery.
4. Sand bedding shall be provided.

F. Subbase, Base Course, Bedding Course & Drainage Course Material: Shall comply with Nevada County Standards.

2.02 ACCESSORIES

A. Warning Tape: Acid- and alkali-resistant, polyethylene film warning tape manufactured for marking and identifying underground utilities, 6 inches wide and 4 mils thick, continuously inscribed with a description of the utility; colored to comply with local practice or requirements of authorities having jurisdiction.

B. Detectable Warning Tape: Acid- and alkali-resistant, polyethylene film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches wide and 4 mils thick, continuously inscribed with a description of the utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep; colored to comply with local practice or requirements of authorities having jurisdiction.

PART 3 - EXECUTION

3.01 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earth-moving operations.

B. Protect and maintain erosion and sedimentation controls during earth-moving operations.

C. Protect subgrades and foundation soils from freezing temperatures and frost. Remove temporary protection before placing subsequent materials.

3.02 EXCAVATION, GENERAL

A. Unclassified Excavation: Excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered. Unclassified excavated materials may include rock, soil materials, and obstructions. No changes in the Contract Sum or the Contract Time will be authorized for rock excavation or removal of obstructions.

1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.

3.03 EXCAVATION FOR STRUCTURES

A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 0.1 feet. If applicable, extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.

1. Excavations for Footings and Foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work.
2. Excavation for Underground Tanks, Basins, and Mechanical or Electrical Utility Structures: Excavate to elevations and dimensions indicated within a tolerance of plus or minus 0.1 feet. Do not disturb bottom of excavations intended as bearing surfaces.

B. Excavations at Edges of Tree- and Plant-Protection Zones:

1. Excavate by hand or with an air spade to indicated lines, cross sections, elevations, and subgrades. If excavating by hand, use narrow-tine spading forks to comb soil and expose roots. Do not break, tear, or chop exposed roots. Do not use mechanical equipment that rips, tears, or pulls roots.
2. Cut and protect roots according to requirements in Section 015639 "Temporary Tree and Plant Protection."

3.04 EXCAVATION FOR WALKS AND PAVEMENTS

A. Excavate surfaces under walks and pavements to indicated lines, cross sections, elevations, and subgrades.

3.05 EXCAVATION FOR UTILITY TRENCHES

A. Excavate trenches to indicated gradients, lines, depths, and elevations.

B. Excavate trenches to uniform widths to provide clearances that adhere to the respective utility requirements.

C. Trench Bottoms: Excavate and shape trench bottoms to provide uniform bearing and support of pipes and conduit. Shape subgrade to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits. Remove projecting stones and sharp objects along trench subgrade.

1. Excavate trenches 6 inches deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.

D. Trenches in Tree- and Plant-Protection Zones:

1. Hand-excavate to indicated lines, cross sections, elevations, and subgrades. Use narrow-tine spading forks to comb soil and expose roots. Do not break, tear, or chop exposed roots. Do not use mechanical equipment that rips, tears, or pulls roots.
2. Do not cut main lateral roots or taproots; cut only smaller roots that interfere with installation of utilities.

3. Cut and protect roots according to requirements in Section 015639 "Temporary Tree and Plant Protection."

3.06 SUBGRADE INSPECTION

A. Proof-roll subgrade pavements with a pneumatic-tired dump truck to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.

B. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Architect, without additional compensation.

3.07 UNAUTHORIZED EXCAVATION

A. Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation. Lean concrete fill, with 28-day compressive strength of 2500 psi, may be used when approved by Architect.

1. Fill unauthorized excavations under other construction, pipe, or conduit as directed by Architect.

3.08 STORAGE OF SOIL MATERIALS

A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.

1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

3.09 UTILITY TRENCH BACKFILL

A. Place backfill on subgrades free of mud, frost, snow, or ice.

B. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.

C. Trenches under Footings: Backfill trenches excavated under footings and within 18 inches of bottom of footings with satisfactory soil; fill with concrete to elevation of bottom of footings. Concrete is specified in Section 033000 "Cast-in-Place Concrete.

D. Initial Backfill: Place and compact initial backfill of satisfactory soil or subbase material, free of particles larger than 1 inch in any dimension, to a height of 12 inches over the pipe or conduit.

1. Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.

E. Final Backfill: Place and compact final backfill of satisfactory soil to final subgrade elevation.

F. Warning Tape: Install warning tape directly above utilities, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.

G. Utility trenches shall meet respective agency design requirements (i.e. PG&E, AT&T, NID).

3.10 SOIL FILL

A. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.

B. Place and compact fill material in layers to required elevations as follows:

1. Under grass and planted areas, use satisfactory soil material.
2. Under walks and pavements, use satisfactory soil material.
3. Under steps and ramps, use engineered fill.
4. Under building slabs, use engineered fill.
5. Under footings and foundations, use engineered fill.

3.11 SOIL MOISTURE CONTROL

A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 2 percent of optimum moisture content.

1. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.
2. Remove and replace, or scarify and air dry, otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.

3.12 COMPACTION OF SOIL BACKFILLS AND FILLS

A. Place backfill and fill soil materials in layers not more than 8 inches in loose depth for material compacted by heavy compaction equipment and not more than 8 inches in loose depth for material compacted by hand-operated tampers.

B. Place backfill and fill soil materials evenly on all sides of structures to required elevations and uniformly along the full length of each structure.

C. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D 1557:

1. Under structures, building slabs, steps, and pavements, scarify and recompact top 12 inches of existing subgrade and each layer of backfill or fill soil material at 95 percent.
2. Under walkways, scarify and recompact top 8 inches below subgrade and compact each layer of backfill or fill soil material at 90 percent.
3. Under turf or unpaved areas, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 90 percent.
4. For utility trenches, compact each layer of initial and final backfill soil material at 90 percent. Soil used for trench should shall be non-expansive and not contain rocks greater than 4 inches in maximum dimension. Compact each layer within 8 inches of subgrade in building, road and parking lot areas at 95 percent.

3.13 GRADING

A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.

B. Site Rough Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to elevations required to achieve indicated finish elevations, within the following subgrade tolerances:

1. Turf or Unpaved Areas: Plus or minus 0.1 foot.
2. Walks: Plus or minus 0.1 foot.
3. Pavements: Plus or minus 0.05 foot.

C. Grading inside Building Lines: Finish subgrade to a tolerance of 0.05 foot when tested with a 10-foot straightedge.

3.14 SUBBASE AND BASE COURSES UNDER PAVEMENTS AND WALKS

A. Place subbase course and base course on subgrades free of mud, frost, snow, or ice.

B. On prepared subgrade, place subbase course and base course under pavements and walks as follows:

1. Shape subbase course and base course to required crown elevations and cross-slope grades.
2. Place subbase course and base course that exceeds 8 inches in compacted thickness in layers of equal thickness, with no compacted layer more than 8 inches thick or less than 3 inches thick.
3. Compact subbase course and base course at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 95 percent of maximum dry unit weight according to ASTM D 1557.

3.15 DRAINAGE COURSE UNDER CONCRETE SLABS-ON-GRADE

A. Place drainage course on subgrades free of mud, frost, snow, or ice.

B. On prepared subgrade, place and compact drainage course under cast-in-place concrete slabs-on-grade as follows:

1. Place drainage course that exceeds 8 inches in compacted thickness in layers of equal thickness, with no compacted layer more than 8 inches thick or less than 3 inches thick.
2. Compact each layer of drainage course to required cross sections and thicknesses to not less than 95 percent of maximum dry unit weight according to ASTM D 698.

3.16 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a qualified special inspector to perform inspections:

B. Testing Agency: Owner will engage a qualified geotechnical engineering testing agency to perform tests and inspections.

C. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earth moving only after test results for previously completed work comply with requirements.

D. Footing Subgrade: At footing subgrades, at least one test of each soil stratum will be performed to verify design bearing capacities. Subsequent verification and approval of other footing subgrades may be based on a visual comparison of subgrade with tested subgrade when approved by Architect.

E. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil materials to depth required; recompact and retest until specified compaction is obtained.

3.17 PROTECTION

A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.

B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.

C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.

1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.18 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Remove surplus satisfactory soil and waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off Owner's property.

END OF SECTION 31 20 00

SECTION 31 22 19 - FINISH GRADING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division1 Specification Sections, apply to this Section.

1.02 SECTION INCLUDES

A. Weeding and finish grading of lawn and planting areas.

B. Preparing subgrades for lawns, and planting areas.

C. Excavating and backfilling trenches for buried irrigation and associated electrical utilities and pits for buried irrigation components.

1.03 MEASUREMENT AND PAYMENT

A. Payment of the various Construction Items described in the Schedule of Values shall be considered full compensation for work of this Section.

1.04 RELATED SECTIONS

A. Section 31 10 00 – Site Clearing, site stripping, grubbing, removing topsoil, and protecting trees to remain.

B. Section 31 20 00– Earth Moving, for grading.

C. Section 32 90 00 – Planting, finish grading, including placing and preparing topsoil for lawns and plantings.

1.05 DEFINITIONS

A. Backfill: Soil materials used to fill an excavation.
   1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
   2. Final Backfill: Backfill placed over initial backfill to fill a trench.

B. Bedding Course: Layer placed over the excavated subgrade in a trench before laying pipe.

C. Borrow: Satisfactory soil imported from off-site for use as fill or backfill.

D. Excavation: Removal of material encountered above subgrade elevations.
   1. Additional Excavation: Excavation below subgrade elevations as directed by Landscape Architect. Additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.
   2. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated dimensions without direction by Landscape Architect. Unauthorized excavation, as well as remedial work directed by Landscape Architect, shall be without additional compensation.

E. Fill: Soil materials used to raise existing grades.

F. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.

G. Subgrade: Surface or elevation remaining after completing excavation, or top surface of a fill or backfill immediately below subbase, drainage fill, or topsoil materials.

H. Utilities include on-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

I. Finish Grading: Finish grading shall consist of finishing surfaces by raking smoothly and evenly, removing, and disposal of extraneous matter to facilitate natural run-off water.

1.06 SUBMITTALS

A. Samples: For the following:
   1. 12-by-12-inch (300-by-300-mm) sample of separation fabric.

1.07 PROJECT CONDITIONS

A. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted in writing by Landscape Architect and then only after arranging to provide temporary utility services according to requirements indicated:
   1. Notify Landscape Architect not less than two days in advance of proposed utility interruptions.
   2. Do not proceed with utility interruptions without Landscape Architect's written permission.
   3. Contact utility-locator service for area where Project is located before excavating.

B. Demolish and completely remove from site existing underground utilities indicated to be removed. Coordinate with utility companies to shut off services if lines are active.

PART 2 - PRODUCTS

2.01 SOIL MATERIALS

A. General:
   1. Conform to the Geotechnical (Soils) Report prepared for the project.
   2. Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.

B. Satisfactory Soils: ASTM D 2487 soil classification groups GW, GP, GM, SW, SP, and SM, or a combination of these group symbols; free of rock or gravel larger than 3 inches in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.

C. Unsatisfactory Soils: ASTM D 2487 soil classification groups GC, SC, ML, MH, CL, CH, OL, OH, and PT, or a combination of these group symbols.
   1. Unsatisfactory soils also include satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction.

D. Backfill and Fill: Satisfactory soil materials.

E. Drainage Fill: Washed, narrowly graded mixture of crushed stone, or crushed or uncrushed gravel; ASTM D 448; coarse-aggregate grading Size 57; with 100 percent passing a 1-1/2- inch (38-mm) sieve and 0 to 5 percent passing a No. 8 (2.36-mm) sieve.

2.02 ACCESSORIES

A. Separation Fabric: Woven geotextile, specifically manufactured for use as a separation geotextile: made from polyolefins, polyesters, or polyamides: and with the following minimum properties determined according to ASTM D 4759 and referenced standard test methods:
   1. Grab Tensile Strength: 200 lbf (890 N); ASTM D 4632.
   2. Tear Strength: 75 lbf (333N); ASTM D 4533.
   3. Puncture Resistance: 90 lbf (400N); ASTM D 4833.
   4. Water Flow Rate: 4 gpm per sq. ft. (2.7 L/s per sq. m); ASTM D 4491.
   5. Apparent Opening Size: No. 30 (0.6 mm); ASTM D 4751.

PART 3 - EXECUTION

3.01 GENERAL

A. Conform to the Geotechnical (Soils) Report prepared for the project.

3.02 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.

B. Provide erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

3.03 EXPLOSIVES

A. Explosives: Do not use explosives.

3.04 EXCAVATION, GENERAL

A. Unclassified Excavation: Excavation to subgrade elevations regardless of the character of surface and subsurface conditioned encountered, including rock, soil materials, and obstructions.
   1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.

3.05 EXCAVATION FOR IRRIGATION TRENCHES

A. Excavate trenches to indicated gradients, lines, depths, and elevations.

B. Excavate trenches to uniform widths to provide a working clearance on each side of pipe or conduit. Excavate trench walls vertically.

C. Trench Bottoms: Excavate and shape trench bottoms to provide uniform bearing and support of pipes and conduit. Shape subgrade to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits. Remove projecting stones and sharp objects along trench subgrade.

3.06 STORAGE OF SOIL MATERIALS

A. Stockpile borrow materials and satisfactory excavated soil materials. Stockpile soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
   1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

3.07 IRRIGATION TRENCH BACKFILL

A. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.

B. Place and compact initial backfill free of particles larger than 1 inch to a height of 4 inches over the utility pipe or conduit.
   1. Carefully compact material under pipe haunches and bring backfill evenly up on both sides and along the full length of irrigation piping or conduit to avoid damage or displacement of utility system.

C. Coordinate backfilling with utilities testing.

D. Place and compact final backfill of satisfactory soil material to finish grade.

3.08 FILL AND LANDSCAPE MOUNDING

A. Preparation: Remove vegetation, topsoil, debris, unsatisfactory soil materials, obstructions, and deleterious materials from ground surface before placing fills.

B. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.

C. Place and compact fill material in layers to required elevations. Mounding to be installed in natural undulating form and to the heights and extents as indicated on the drawings. Contractor to notify Landscape Architect when mounding has been completed for review and approval of mounding.

3.09 COMPACTION OF BACKFILLS AND FILLS

A. Place backfill and fill materials in layers not more than 6 inches in loose depth for material compacted by hand-operated tampers.

B. Place backfill and fill materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.

C. Compact soil to not less than the following percentages of maximum dry unit weight according to ASTM D 698:
   1. Under structures, steps, and pavements, scarify and re-compact top 12 inches of existing subgrade and each layer of backfill or fill material at 95 percent.
   2. Under walkways, scarify and re-compact top 6 inches below subgrade and compact each layer of backfill or fill material at 92 percent.
   3. At areas to receive planted landscape, scarify and re-compact top 6 inches below subgrade and compact each layer of backfill or fill material at 85 percent.
   4. Any disturbed earth at non-paved and non-landscaped earth surfaces re-compact top 6 inches and compact each layer of backfill or fill material at 90 percent.

3.10 LANDSCAPE GRADING

A. General: Uniformly grade areas to a smooth surface, free from irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.
   1. Provide a smooth transition between adjacent existing grades and new grades.
   2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.

B. Landscape Grading: Slope grades to direct water away from buildings and to prevent ponding. Provide positive drainage swales from all buildings, walkways, etc. to drainage catch basins or site drainage swales. No ponding is to be allowed. Finish subgrades to required elevations within the following tolerances:
   1. Unpaved Areas: Plus or minus 1 inch.
   2. Walks: Plus or minus 1 inch.
   3. Pavements: Plus or minus 1/2 inch.

C. Grading for Shrubs and Ground Cover: The finish grade of shrubbery and ground cover areas shall be 1½ inches below grade of adjacent pavement, walks, curbs, or headers and 3 inches below adjacent walls, except when drainage conditions may require flush grades, as directed by Landscape Architect.

D. Immediately prior to planting operations, planting areas shall be cleaned of weeds, debris, rocks over 1 inch in diameter, and clumps of earth that will not break up. Adjust any areas disturbed by installation of sprinkler irrigation system.

3.11 PROTECTION

A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.

B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.

C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.
   1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to the greatest extent possible.

3.12 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Disposal: Remove surplus satisfactory soil and waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off Owner's property.

END OF SECTION

SECTION 31 50 00 - EXCAVATION SUPPORT AND PROTECTION

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes temporary excavation support and protection systems.

1.02 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Nevada County Operations Center, 12350 La Barr Meadows Road, Grass Valley, CA

1.03 INFORMATIONAL SUBMITTALS

A. Contractor Calculations: For excavation support and protection system. Include analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

B. Record Drawings: Identify locations and depths of capped utilities, abandoned-in-place support and protection systems, and other subsurface structural, electrical, or mechanical conditions.

1.04 FIELD CONDITIONS

A. Survey Work: Engage a qualified land surveyor or professional engineer to provide survey stakes numerous enough to accurately establish key horizontal and vertical grade lines, including top and toe of slope during excavation operations.

B. Stakes shall be maintained and/or re-staked as necessary till completion of grading operation at the contractor’s expense.

1.05 REFERENCE

A. Geotechnical Report, prepared by Holdrege & Kull, dated June 28, 2017, Project No.4266A-01

B. *State of California, Department of Transportation (CalTrans), Standard Specifications,* latest edition as adopted by jurisdictional authority, including all amendments

C. Nevada County Road Standards, latest edition, with amendments as adopted by serving jurisdictional authority.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Provide, design, monitor, and maintain excavation support and protection system capable of supporting excavation sidewalls and of resisting earth and hydrostatic pressures and superimposed and construction loads.

1. Design excavation support and protection system, including comprehensive engineering analysis by a qualified professional engineer.

PART 3 - EXECUTION

3.01 SOLDIER PILES AND LAGGING

A. Install steel soldier piles before starting excavation. Extend soldier piles below excavation grade level to depths adequate to prevent lateral movement. Space soldier piles at regular intervals not to exceed allowable flexural strength of wood lagging. Accurately align exposed faces of flanges to vary not more than 2 inches from a horizontal line and not more than 1:120 out of vertical alignment.

B. Install wood lagging within flanges of soldier piles as excavation proceeds. Trim excavation as required to install lagging. Fill voids behind lagging with soil, and compact.

C. Install wales horizontally at locations indicated on Drawings and secure to soldier piles.

3.02 TIEBACKS

A. Drill, install, grout, and tension tiebacks.

B. Test load-carrying capacity of each tieback and replace and retest deficient tiebacks.

1. Have test loading observed by a qualified professional engineer responsible for design of excavation support and protection system.

C. Maintain tiebacks in place until permanent construction is able to withstand lateral earth and hydrostatic pressures.

3.03 BRACING

A. Bracing: Locate bracing to clear columns, floor framing construction, and other permanent work. If necessary to move brace, install new bracing before removing original brace.

1. Do not place bracing where it will be cast into or included in permanent concrete work unless otherwise approved by Architect.
2. Install internal bracing if required to prevent spreading or distortion of braced frames.

3. Maintain bracing until structural elements are supported by other bracing or until permanent construction is able to withstand lateral earth and hydrostatic pressures.

3.04 REMOVAL AND REPAIRS

A. Remove excavation support and protection systems when construction has progressed sufficiently to support excavation and earth and hydrostatic pressures. Remove in stages to avoid disturbing underlying soils and rock or damaging structures, pavements, facilities, and utilities.

END OF SECTION 31 50 00

SECTION 32 01 90 - LANDSCAPE MAINTENANCE

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SECTION INCLUDES

1. Mowing
2. Edging
3. Weeding
4. Watering
5. Spraying
6. Fertilizing
7. Trash pick up

1.03 MEASUREMENT AND PAYMENT

A. Payment of the various Construction Items described in the Schedule of Values shall be considered full compensation for work of this Section.

B. Unit prices for soil preparation and for items that include backfill mixes shall be adjusted to reflect changes due to the requirements of soil lab recommendation.

1.04 RELATED SECTIONS

A. Section 32 80 00 – Irrigation.

B. Section 32 90 00 – Planting

1.05 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with all applicable codes regulations of governmental agencies having jurisdiction. Where those requirements conflict with the specifications, comply with the more stringent provision.

B. Contractor or an experienced crew chief shall be present during maintenance operations.

1.06 PROTECTION AND CLEAN UP

A. Protection of persons and property shall be provided throughout progress of work. Use temporary barricades as required. Work shall proceed in such a manner as to minimize spread of dust and flying particles and to provide safe working conditions for personnel.

B. Execute all work in an orderly and careful manner to protect new concrete walks, work of other trades, and other improvements.

C. Maintain cleanliness on paving areas and other public areas used by equipment, and be responsible for immediate removal of all spillage. Remove from the project site all rubbish and debris found thereon leaving the site in a safe and clean condition.

1.07 START AND LENGTH OF LANDSCAPE MAINTENANCE PERIOD

A. Landscape maintenance period does not start until all landscaping work has been completed, all punch list items have been corrected, and the landscape has been approved in writing by the Landscape Architect or the owner's representative.

B. All items that have been listed in the punch list as items that may be corrected during the maintenance period must be done so prior to the last day of the maintenance period. The contractor will be responsible for an extended maintenance period until all items have been addressed to the satisfaction of the Landscape Architect and/or owner's representative.

C. Landscape Maintenance period shall extend for the time period as specified on the plans or through an agreement with the owner. During this time, continually maintain all areas involved in this Contract until final acceptance by the Landscape Architect. Improper maintenance or poor condition of any plantings at the end of the maintenance period may cause postponement of the final completion date. Maintenance shall be continued until all work is accepted.

D. Final inspection at the end of the maintenance period shall include an overview with the owner new maintenance contractor.

1.08 GUARANTEE

A. Guarantee all new plant materials for a period of one year. Plants not alive or in satisfactory growing condition as determined by the Landscape Architect, shall be replaced within one week of notification without additional cost to the owner.

B. Replacement guarantee shall include all plants damaged or destroyed by any action, including but not limited to vandalism, theft, vermin, neglect, etc. All replacement shall be plants of the same kind and size and installed as specified in the plans.

PART 2 - PRODUCTS

2.01 MATERIALS

A. All materials used shall be in conformance with Sections 32 80 00 and 32 90 00, or any other applicable specification.

PART 3 - EXECUTION

3.01 IRRIGATION SYSTEM

A. Check the system weekly for proper operation. Lateral lines shall be flushed out when needed. All sprinkler heads are to be adjusted as necessary for unimpeded coverage with no overspray onto buildings and minimal overspray onto paving.

B. Set and program automatic controller for seasonal water requirements based on irrigation audit or schedule. Give owner's representative a spare key to the controller with instruction as to operation for emergency purposes.

C. Repair all damage to irrigation system at Contractor's expense and in a timely manner. Repairs are to be made within one watering period or one week, whichever is shortest.

3.02 GENERAL LANDSCAPE MAINTENANCE

A. Unclassified Excavation: Excavation to subgrade elevations regardless of the character of surface and subsurface conditioned encountered, including rock, soil materials, and obstructions.
   1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.

3.03 STORAGE OF SOIL MATERIALS

A. All planted areas shall be completely weeded and/or cultivated weekly. Sidewalks, gutters, etc. shall be cleaned weekly. Failure to comply will result in an extension of the maintenance period as determined by the Landscape Architect.

B. All planting shall be kept in a healthy growing condition by watering, weeding, cultivation, pruning, mowing, edging, spraying, fertilizing, and by performing any other necessary operation of maintenance.

C. Landscape is to be maintained to meet the desired intent of the plans. Hedges are to be pruned and trained as a hedge. Informal shrub masses, groundcovers, and grass-like plants are not to be formally pruned into individual balls or boxes. Pruning is to be done in relation to the growth pattern of the individual plant species.

3.04 GROUNCOVER, TREES, AND SHRUBS

A. Water enough so that moisture penetrates throughout the root zone and only as frequently as necessary to maintain healthy growth. Water shall not be allowed to run over sidewalk or to pool in shrub areas.

B. Construct and or remove water basins around individual plants, depending on the time of year and as directed.

C. Do not prune unless directed.

D. Re-stake and re-tie trees as needed. Reset to grade or up-right any plants that are not in their proper growing position.

E. Immediately remove any dead or dying plants and replace per this specification.

3.05 INSECT AND HERBICIDE APPLICATION

A. If needed control weeds with selective herbicides and sprays that have been approved for use by governing jurisdictions.

B. Material, timing, rate of application, and application shall be performed by a licensed Pest Control Operator.

C. Provide a monthly report to the owner of all herbicides, insecticides, and disease control chemicals used as well as the dates and rates of application.

D. Apply pre-emergent weed control at end of maintenance period.

3.06 TRASH PICK-UP

A. All trash and/or debris found in planted or paved areas shall be removed from the site on a weekly basis.

END OF SECTION

SECTION 32 12 16 - ASPHALT PAVING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Cold milling of existing asphalt pavement.

2. Hot-mix asphalt patching.

3. Hot-mix asphalt paving.

4. Hot-mix asphalt overlay.

5. Asphalt curbs.

B. Related Requirements:

1. Section 31 20 00 "Earth Moving" for subgrade preparation, fill material, separation geotextiles, unbound-aggregate subbase and base courses, and aggregate pavement shoulders.

2. Section 32 13 73 "Concrete Paving Joint Sealants" for joint sealants and fillers at pavement terminations.

1.02 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Nevada County Operations Center, 12350 La Barr Meadows Road, Grass Valley, CA

1.03 SUBMITTALS

A. Mix Design: Submit asphalt mix design prepared by a certified laboratory acceptable to Owner, for review and approval.

B. Accompanying mix design, submit materials certificates signed by material producer and Contractor, certifying that each material item complies with, or exceeds, specified requirements.

1.04 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with materials, workmanship, and other applicable requirements of the following agencies and protocols.

1. State of California, Department of Transportation (Caltrans), Standard Specifications, latest edition, as adopted by jurisdictional authority, including amendments.

2. ASTM D 1188 - Test Method for Bulk Specific Gravity and Density of Compacted Bituminous Mixtures.

3. ASTM D1557 - Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft^3).

4. ASTM D 2170 - Test Method for Kinematic Viscosity of Asphalts (Bituminous).

5. ASTM D 2172 - Test Method for Quantitative Extraction of Bitumen from Bituminous Paving Mixtures.

6. Nevada County Road Standards, latest edition, with amendments as adopted by serving jurisdictional authority.

PART 2 - PRODUCTS

2.01 AGGREGATE BASE COUSRE MATERIAL

A. Provide "Crushed Aggregate Base" per Section 26, Caltrans Standard Specifications.

2.02 ASPHALTIC CONCRETE PAVEMENT MATERIALS

A. Asphaltic Concrete Pavement Mixture:

1. Asphalt type: Provide ½" maximum medium (Type B) Aggregate with PG64-16 Asphalt Binder per *Section 39, Caltrans Standard Specifications*., with "Bonifibers" as produced by Kapejo, or an approved equal at a rate of 5 pounds per ton with an additional 0.25% of asphalt content per ton of mix in accordance with manufacturers specifications.

2. Asphaltic concrete pavement shall be produced at a commercial central mixing plant.

B. Tack Coat: Slow setting asphalt emulsion SS1H per Section 39-4.02, Caltrans Standard Specifications.

C. Tack Coat at pavement fabric: Provide PG 64-16 paving asphalt in compliance with Section 88, Caltrans Standard Specifications.

D. Herbicide: Provide approved herbicide, tinted for visual identification, non-flammable formulation, and complying with all current California and EPA environmental regulations.

E. Surface Sealer: Asphalt Emulsion, SS1-H, per Sections 37 and 94, Caltrans Standard Specifications.

2.03 PAVEMENT REINFORCING FABRIC

A. Provide Amoco or equal, available through Industrial Asphalt phone (310)-926-9422, Petromat pavement fabric complying with Section 88, Caltrans Standard Specifications.

2.04 OTHER MATERIALS

A. Provide all other materials, not specifically described but required for complete and proper installation of this work, as selected by the contractor and subject to the approval of the Architect.

2.05 DESIGN CRITERIA

A. General:

1. All improvements shall be constructed per the referenced standards, the contract documents, and as specified in this section.

2. Where criteria shown on drawings or specified in this specification exceed that of the referenced standards, the more stringent criteria shall apply.

PART 3 - EXECUTION

3.01 SURFACE CONDITIONS AND PREPARATIONS

A. INSPECTION

1. Prior to work of this section, carefully inspect previously installed work. Verify all such work is complete to the point where this installation may properly commence.

2. Verify that work of this section may be installed in strict accordance with the original design, all pertinent codes and regulations, and all pertinent portions of the referenced standards.

a. Verify subgrade is compacted as specified in Section 02310 and 02315.

3. In the event of discrepancy, immediately notify the Architect.

4. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved

B. PREPARATION

1. Provide all staking and field engineering required to implement the work as shown on the drawings.

2. Protect all stakes and benchmarks. Replace all stakes and benchmarks damaged during the course of construction at no cost to Owner.

3. Provide all equipment of such type, function and design as required to achieve specified values.

4. Proof-roll subgrade below pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.

3.02 APPLICATION OF SOIL TREATMENTS

A. Herbicide Treatment:

1. Apply in strict accordance with Manufacturer's recommendations.

2. Conform to all applicable and current regulations, including CAL-OSHA, air quality and environmental requirements.

3. Do not apply herbicide within a minimum distance of two feet from planted areas.

4. If requested by Architect, provide written certification of purchase and application of herbicide.

3.03 PLACEMENT OF AGGREGATE BASE COURSE

A. Deliver base course to site as uniform mixtures.

B. Spread each layer in one operation, free from pockets of coarse or fine material, and in compliance with *Section 26, Caltrans Standard Specifications*.

1. Where asphalt paving is installed to replace existing on-site locations, match existing base thickness.

2. Where asphalt paving is installed at public improvements, comply with base thickness required by referenced County standards.

3. Where asphalt paving is installed at areas without prior paving, provide minimum 6 inch compacted base thickness.

C. Application:

1. Where the required thickness is 0.5 foot or less, spread and compact base in one layer.

2. Where the required thickness is more than 0.5 foot, spread and compact base material in two or more layers of approximately equal thickness. The maximum compacted thickness of any one layer shall not exceed 0.5 foot, or less if compaction cannot be obtained with 0.5 lift.

D. Each layer shall be spread and compacted in a similar manner. When vibrating or other acceptable types of special compacting equipment are used, the entire course may be placed in one layer, provided the ability of such equipment to achieve acceptable compaction to the full layer depth is demonstrated.

E. No thin layers of fine materials shall be added to the top layer of the subbase or base course in order to meet the grade.

3.04 BASE COURSE COMPACTION AND PROTECTION

A. Compact base course material to not less than 95 of the maximum laboratory density, as determined by ASTM D-1557.

B. Remove damaged base course to subgrade and place, grade and compact new base course in settled, eroded, and wetted areas to specified tolerances.

C. Where completed base course areas are disturbed by subsequent construction operations or adverse weather, remove base course in damaged areas to subgrade, and place and compact new base course to required density prior to further construction.

3.05 PREPARATION FOR PAVING

A. Apply tack coat to vertical faces of existing or previously constructed bituminous pavement, curbs, gutters, slab edges, and all structures to be in actual contact with the bituminous pavement.

B. Coat surfaces of catch basin frames with oil to prevent bond with asphalt pavement. Do not tack coat these surfaces.

C. Prior to applying the tack coat, sweep or otherwise clean surface free of dust or other foreign material.

D. Protect all surfaces not required to receive tack coat from any inadvertent application.

E. Do not place tack coat when air temperature in the shade or the roadbed temperature is below 50 degrees F, or during rain, fog, or other adverse weather conditions.

F. After application of tack coat, allow sufficient time for complete separation of asphalt and water before paving operations begin. Do not leave tack coat exposed overnight. Apply tack coat to only those surfaces as will be paved in the same day.

G. Apply primer coat to base course surfaces in conformance with *Section 39, Caltrans Standard Specifications,* at rate of 0.10 to 0.25 gallons per square yard. Allow to cure prior to application of asphalt course.

H. Asphalt Pavement Crack Preparation:

1. All asphalt cracks shall be cleaned, prepared and filled prior to application of tack coat.

2. All vegetation shall be removed from cracks and blown clean with compressed air.

3. Cracks shall be treated with specified soil sterilizer prior to placement of filler material.

4. Cracks shall be completely free of any moisture before application of filler. Sufficient amount of crack filler shall be used to ensure a level surface after filler is cured.

5. Multiple coats may be required, within Manufacturer's recommendations.

6. Asphalt pavement cracks less than 1/2 inch wide shall be filled with rubberized crack filler as specified.

7. Asphalt pavement cracks 1/2 inch wide or larger shall be filled with #4 sheet mix asphalt.

I. Pavement Fabric Applications:

1. Prepare paving as recommended by fabric manufacturer, and in conformance with Section 39, Caltrans Standard Specifications.

2. Fill all joints, cracks, alligatoring and other surface defects with approved asphaltic crack filler or sealant.

3. Install minimum 1/2 inch asphalt concrete leveling coat, mix as approved by Architect.

4. Apply tack coat per Section 39, Caltrans Standard Specifications, and as recommended by manufacturer*.*

5. Install fabric per Section 39, Caltrans Standard Specifications, and as recommended by manufacturer*.*

3.06 PLACEMENT OF ASPHALTIC CONCRETE PAVEMENT

A. Conform to Section 39, Caltrans Standard Specifications.

B. Do not place asphaltic concrete paving when the air temperature in the shade or the roadbed temperature is below 50 degrees F, or during rain, when the base course surface is wet, or during other adverse weather conditions.

C. Place asphalt pavement as required to provide compacted depth as indicated on the plans, in a continuous operation. Place inaccessible and small areas by hand.

1. Provide minimum 3 inch compacted thickness or as required to match existing, whichever is greater.

2. Where asphalt paving is installed to replace existing on-site locations, install in compacted thickness to match existing paving.

3. Where asphalt paving is installed over pavement fabric, provide minimum 1-1/2 inch compacted thickness.

4. Where asphalt paving is installed at public improvements, comply with compacted paving thickness required by referenced City standards.

5. Where asphalt paving is installed at areas without prior paving, provide minimum 3 inch compacted thickness.

D. Place asphalt in single or multiple lifts per *Section 39, Caltrans Standard Specifications*.

E. Ensure joints made during paving operations are straight, clean, vertical and free of broken or loose material. Carefully make joints to ensure a continuous bond between old and new pavement, or between successive days' work. Provide a continuous bond between adjoining work.

3.07 ROLLING

A. Monitor temperatures of the asphalt concrete mixture as delivered to the site and during laydown to insure conformance with *Section 39, Caltrans Standard Specifications*.

B. Roll and compact to specified density in accordance with *Section 39, Caltrans Standard Specifications*.

C. Compact asphalt paving course to 95 percent of the maximum laboratory density, as obtained with the California Kneading Compactor, per California Test 304.

D. Perform hand tamping in areas not accessible to rolling equipment.

3.08 FIELD QUALITY CONTROL

A. Testing and inspection of asphaltic concrete mix and asphalt pavement will be performed at Contractors cost by a testing laboratory retained by the Contractor and acceptable to the Owner. The testing laboratory, except for the contract relationship required for this project, shall have no financial or fiduciary relationship with Contractor or paving installer.

B. Thickness Cores:

1. Provide 1 core test per each 5,000 square feet [or each repair area] to verify compacted thickness.

C. Density Tests:

1. Provide field density tests indicating compliance with *Section 39, Caltrans Standard Specifications,* based on use of properly calibrated nuclear asphalt testing device.

2. Provide density tests based on ASTM D 1188 for laboratory analysis of asphalt cores.

3. In the event of disputes over in-place density, conduct tests based on ASTM D 1188 with test samples taken at such frequency as directed by Architect.

D. Surface smoothness, thickness and level.

1. Maintain surface free of gouges, ridges and ruts, with a uniform and consistent finish.

2. Maintain line and profile shown to tolerance of 1/4 inch plus/minus, in any 10 feet, non-cumulative.

3. Maintain asphalt pavement free from depressions exceeding 1/8 inch when measured with a 10 foot straight-edge.

E. Flood Test:

1. Flood test paving prior to application of seal coat.

2. Where water ponds in excess of 1/8 inch in an area greater than 2 feet in any direction, repair or replace as directed by Architect to provide proper drainage.

3.09 SEAL COAT

A. Conform to Section 37, Caltrans Standard Specifications, for application.

B. Provide surface finish free of ridges, lap marks, coarse textured areas, or other appearance and performance defects.

3.10 PAINT STRIPING AND MARKING

A. Conform to requirements in section 321723 “Pavement Markings.”

3.11 PROTECTION

A. After final rolling, do not permit vehicular traffic on pavement until it has cooled to atmospheric temperature and hardened, but in no case less than 8 hours.

B. Erect barricades in accordance with requirements of Division 1 to protect paving from traffic until mixture has cooled in accordance with the specifications.

C. Do not use completed paving surface for storage of construction vehicles or construction materials.

END OF SECTION 32 12 16

SECTION 32 13 13 – CONCRETE PAVING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes Concrete Paving.

1. Concrete paving and walkways.

2. Curbing/gutters, and related concrete improvements.

3. Detectable Warning Surface Tiles.

1.02 ACTION SUBMITTALS

A. Mix Design/Materials List:

1. Submit concrete mix design prepared by a certified batch plant or laboratory, selected by Contractor and acceptable to Owner, for review and approval.

2. Accompanying mix design, submit materials certificates signed by material producer and Contractor, certifying that each material item complies with, or exceeds, specified requirements.

B. Mock-up

1. Prior to installing any concrete paving, construct, at an approved location on-site, an individual mock-up showing each concrete paving finish specified and shown on drawings. Mock-up shall include sealant joint preparation. Each finish shall be 4' x 4' minimum. Obtain Architect's approval of mock-up.

2. All concrete paving shall match approved mock-up.

3. Remove mock-up after completion of work and dispose off-site.

1.03 PUBLIC AGENCY STANDARDS

A. Perform all paving and related structures and devices indicated as public agency standards in accordance with the standard plans and specifications of that agency.

B. Where paving is constructed in public streets or rights of way, construct in accordance with the standard plans and specifications of the authority having jurisdictions and in the presence of a representative of that agency.

C. The Owner will pay for associated inspection fees.

D. Upon completion of the work, provide the Architect with written certification of acceptance of work by the governing agency having jurisdiction.

PART 2 - PRODUCTS

2.01 DESIGN CRITERIA

A. General

1. All improvements shall be constructed per the referenced standards, the contract documents, and as specified in this section.

2. Where criteria shown on drawings or specified in this specification exceed that of the referenced standards, the more stringent criteria shall apply.

2.02 CAST-IN-PLACE CONCRETE

A. General

1. All concrete shall be transit mixed, complying with ATSM C94.

2. All concrete shall be supplied from a single source, using a single cement supplier.

3. All cement shall be portland cement, Type II, low alkali per ASTM C150, and produced within the United States.

B. Product Characteristics: Paving, Flatwork, Ramps, Stairs Curbing, gutters, related drainage components.

1. Compressive Strength: 4500 psi at 28 days

2. Combined Aggregate Grading:

a. 1” max. ASTM C33 aggregates

3. Cement Content: 6.0 sacks of cement per cubic yard

4. Slump: 4 inch maximum

5. Air entrainment: 6.0% (±0.5%) entrained air by volume

6. Water cement ratio: 0.45 water/cement ratio

7. Finish: Per Drawings.

C. Product Characteristics: Paving/Flatwork:

1. Compressive Strength: 3500 psi. Minimum

2. Aggregate:

a. As supplied by San Gabriel, Combined Grading D per Sections 73 and 90, Caltrans Standard Specifications, except modified to 90-100 percent passing 3/4 inch sieve.

b. Aggregate shall be non-reactive per ASTM C 289, and shall comply with ASTM C33, Table 3, Class 4M.

c. Sand: Clean, hard washed natural sand.

D. Cement Content: 520 pounds per cubic yard concrete.

E. Slump: 3 inch maximum.

F. Finish: See 3.2 below.

G. Integral Color: L.M. Scofield Chromix, La Jolla Buff, no substitution.

H. Retarder: L.M. Scofield Lithotex Top Surface Retarder, no substitution.

2.03 CHEMICAL STAIN

A. Metallic salts in water based solution, with acidic properties; Patina Stain by QC Construction Products.

2.04 PAVING BASE

A. Where shown on drawings, provide crushed aggregate base per Section 26, Caltrans Standard Specifications.

2.05 REINFORCING STEEL

A. Deformed bar: ASTM A615, Grade 60.

B. Where deformed bar reinforcing not shown, provide welded wire fabric, flat sheet stock, 12x12-W2.8x2.8 or approved equivalent, per ASTM A-185, at all concrete paving conditions.

C. Provide polyethelene closed end sleeve or approved alternate at expansion joint dowels.

2.06 EXPANSION JOINT MATERIAL

A. Expansion Joint Material: W. R. Meadows or equal, Sealtight Fiber filler, full depth of slab, matching profile, 1/2 inch thickness or as shown on drawings.

B. Expansion Joint Material - Radius Conditions: W. R. Meadows or equal, Sealtight Ceramar flexible foam resilient filler, full depth of slab, 3/8 inch thickness or as shown on drawings.

C. Joint Cap: W. R. Meadows or equal, SealTight Snap Cap, size required for expansion material.

2.07 WEAKENED PLANE JOINTS AND SCORELINES

A. Saw- cut, Sof-Cut, or tooled joint technique, with maximum tooled radius edge of 1/8".

B. No "zip-strip joint" products and technique permitted.

C. Walks: 5ft oc spacing

D. Aprons: 10ft oc spacing

2.08 CURING and sealing COMPOUNDs

A. Curing Compound:

1. Provide Burke Aqua Resin, with fugitive dye, and complying with ASTM C309, Type 1-D at all natural color concrete curbing and non-paving applications.

2. Provide Scofield Lithochrome Colorwax curing compound, VOC compliant formulation, at all integral colored and imprinted color hardened concrete paving.

B. Cure and Sealing Compound:

1. Provide Burke Spartan-Cote WB, complying with ASTM C309, Type 1-A and B, at natural color exterior concrete paving designated as CS-1.

2.09 SEALANTS

A. Provide sealants complying with Section 07900, at locations specified or as shown on drawings.

2.10 STAIR/STEP NOSING TREATMENT

A. Where cast in place groove nosing shown on drawings, provide Wooster or equal, (Phone 800-321-4936) WP-70 slip resistant epoxy coating, contrasting color as selected by Architect from standard line.

B. Where cast in place aluminum nosing shown on drawings, provide Balco or equal, (Phone 800-767-0082) Series DXH-330, Type 1 anchor, contrasting color as selected by Architect from standard line, with factory stretch formed radius as shown on drawings.

2.11 SLIP RESISTANT FINISH

A. Provide light broom finish at locations specified or as shown on drawings.

2.12 DETECTABLE WARNING SURFACE TILES

A. Manufacturer: Engineered Plastics Inc. (www.armor-tile.com) or equal.

B. Series/Type:

1. Type 1: Armor Tile Cast-in-Place Detectable Warning Surface Tile. Vitrified polymer composite tiles with embedment flanges for casting into wet concrete.

C. Characteristics - Type 1:

1. Sizes: As indicated on Drawings.

2. Edges: Beveled.

3. Color: Yellow, conforming to Federal Color No. 33538. Color shall be homogeneous throughout product.

4. Compressive Strength: 18,000 psi per ASTM D 695.

5. Tensile Strength: 10,000 psi per ASTM D 638.

6. Slip Resistance: Minimum 0.90 combined wet/dry static coefficient of friction per ASTM C 1028 across top of domes and field area.

7. In-Line Truncated Dome Pattern: Truncated domes 0.2 inches high, 0.9 inch diameter at base, 0.4 inch diameter at top, spaced 1.70 inches on center in line, 2.35 inches on center as measured on diagonal.

8. Non-Slip Surface: Minimum 40 raised points per square inch of field area, 0.045 inches high, 90 degree angle from tile field surface.

2.13 ADMIXTURES

A. Air-Entraining Admixture: ASTM C 260.

B. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.
1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
2. Retarding Admixture: ASTM C 494/C 494M, Type B.
3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.

2.14 OTHER MATERIALS

A. Provide all other materials, not specifically described but required for complete and proper installation of this work, as selected by the contractor and subject to the approval of the Architect.

PART 3 - EXECUTION

3.01 SURFACE CONDITIONS

A. Inspection

1. Prior to all work of this section, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where this installation may properly commence.

2. Verify that concrete pavement may be installed in strict accordance with the original design, all pertinent codes and regulations, and all pertinent portions of the referenced standards.

3. In the event of discrepancy, immediately notify the Architect.

4. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.

3.02 CONCRETE PAVING INSTALLATION

A. Preparation

1. Verify sub-grade, base material, conduit, and all other embedded items are properly located in relation to concrete paving. Secure all embedded items against displacement during pour.

2. Verify all grades for pitch and fall prior to pouring pavements.

3. Verify that all cross-fall and ramp criteria comply with all accessibility regulations, including Title 24 requirements.

4. Verify compaction of existing subgrade complies with criteria specified in Section 02310 and 02315.

5. Notify inspector 48 hours prior to placing concrete. Obtain inspectors approval of subgrade, forming and embedded items prior to placing.

B. Forming:

1. Install forms in accordance with specified tolerances.

2. Stake rigidly in place at maximum intervals of 4 feet on center. Secure so as to prevent displacement during pouring and finishing process.

3. Install stretched wires or other device to provide form displacement indication.

4. Thoroughly clean forms, removing debris, coatings and foreign matter. Coat forms with approved bond breaker, suitable for use on integral colored concrete without staining or discoloration. Place sand bed over existing paving receiving new concrete paving.

C. Placement:

1. Prepare subgrade as specified.

a. Scarify subgrade to a depth of 12 inches.

b. Water, mix and aerate as necessary to moisture condition within range of 1 percent below to 3 percent above optimum moisture content.

c. Compact upper 12 inches to a minimum relative compaction of 95 percent based on ASTM D 1557-91.

d. See Sections 02315 for related compaction requirements.

e. Dampen sub-grade 24 hours prior to placing concrete.

f. Dampen forms as required to tighten joints and cracks in forming material.

2. Install concrete paving per Section 40, Caltrans Standard Specifications as specified, and as shown on drawings.

a. Install natural color concrete in separate pour from imprinted color hardened concrete.

b. Install integral color concrete per Scofield recommendations.

c. Install imprinted color hardened concrete per Bomanite recommendations.

3. Install all curbing, cross gutters, and related improvements per Section 40 and 73, Caltrans Standard Specifications, as specified, and as shown on drawings. Where

machine formed curbing is provided, tolerances and joint control specified for fixed form construction shall be met.

4. Provide reinforcing.

   a. Install deformed bar reinforcing on approved concrete or plastic supports.

   b. Drill existing concrete as shown on drawings for dowel embeds.

   c. Extend reinforcing bar at expansion joints on each side of joint. Sleeve one side.

   d. Where deformed bar reinforcing not shown, provide wire mesh reinforcing on approved concrete or plastic supports. Use of "Hook and Pull" method of reinforcing placement not acceptable. Lap all mesh minimum 12" at edges.

5. Broom Finish

   a. Float and steel trowel surface to required slopes and planes.

   b. Apply broom texture, transverse to direction of pedestrian travel, and using a stiff wire or nylon bristle broom.

   c. Unless specified otherwise, provide medium broom texture at locations shown on drawings. At ramp surfaces (surfaces exceeding 5 percent slope in direction of travel), provide heavy broom texture.

   d. Obtain approval of finish texture by Architect for various applications.

6. Miscellaneous Finish:

   a. Float and steel trowel surface to required slopes and planes.

   b. At areas within pedestrian traffic paths, apply very light uniform sack or float finish texture, sufficient to remove surface paste. Do not expose aggregate.

   c. Obtain approval of finish texture by Architect.

7. Tile Substrate Finish:

   a. At areas designated to receive mortar bed for ceramic tile detectable warning surface, float and steel trowel surface to required slopes and planes.
   b. Provide light float finish texture.

3.03 Joint Treatment

A. Provide expansion joints at locations shown on drawings, and as follows:

1. Beginning and end of curves in curbs and curbs and gutter assemblies, and at 60 feet on center.

2. Where paving is adjacent to walls, bollard or column penetrations, or footings.

3. At pavement plazas and fields, approximately 20 feet on center each way, and as necessary to limit area to a maximum of 400 square feet.

4. At 25 feet on center in linear walkways.

5. Tool all edges adjacent to expansion material with maximum 1/8 inch radius tool.

6. Remove joint cap. Provide bondbreaker tape at surface of joint material cover cap.

7. Provide sealant and backer rod assembly per Section 07900 and as shown on drawings.

8. Provide construction joints only at expansion joints.

B. Provide control (weakened plane) joints at locations shown on drawings, and as follows:

1. At curbs, curb and gutter assemblies, and cross gutters at 20 feet on center maximum. Where concrete pavement occurs adjacent to curb, align curb and pavement joints.

2. At pavement plazas and fields, approximately 10 feet on center each way, and as necessary to limit area to a maximum of 100 square feet.

3. At pavement areas at all re-entrant corners and at changes in direction.

4. Provide control (weakened plane) joints by saw cutting method, hand held jointing tools, or by use of SOF-CUT equipment. Use of zip-strip not acceptable.

5. Provide maximum 1/8 inch edge radius at all joints. Where saw-cut joint technique selected, grind cut edge to create 1/8 inch beveled edge.

6. Extend control joints a minimum of 1-1/4 inch below surface, or 1/4 the thickness of the curb or pavement, whichever is greatest. Provide hand-cutters, tooled joints or other approved tools for conditions where equipment cannot continue cutting to outside edge.

7. Schedule cutting control joints as necessary to avoid raveling edge, but as necessary to avoid shrinkage cracking of pavement.

3.04 CONCRETE CURING AND SEALING

A. General

1. Cure natural colored concrete with specified compound. Do not permit overspray onto color hardened concrete.

2. Provide wind barriers and other screening as necessary to avoid rapid drying.

3. Cure all integral color and imprinted color hardened concrete with Lithochrome curing wax, applied as directed by Scofield.

B. Alternate Method

1. All natural colored slabs may be water cured by means of fine mist spray. Maintain in damp condition for a period of seven (7) days after pouring.

3.05 FIELD QUALITY CONTROL

A. Flood Test

1. Provide flood test of all gutters and paving as directed by Architect.

2. Where ponding occurs, or where drainage rate is less than that established by original design, replace all defective concrete. Remove concrete to the nearest joint line.

B. Tolerances:

1. Level: 3/16 inch plus or minus, at any point, measured along a 10 foot straight edge.

2. Adjacent surfaces: 1/8 inch maximum difference at any point between adjacent concrete pours or between paving and adjacent paving materials.

3. Joint Alignment: 1/16 inch deviation from adjacent joint.

4. Line: 1/4 inch, plus or minus, deviation from a straight line in any 10 foot length, non-cumulative.

5. Final elevations shall comply with grades as shown on drawings, to a tolerance of plus or minus 0.25 inch.

6. Tolerances do not permit violation of dimensions or grade and slopes relationships required by code or jurisdictional authority. Adjust work as required to comply with such requirements.

C. Appearance:

1. Remove and replace concrete not matching approved mock-up, concrete not complying with specified tolerances, and concrete with the following defects.

a. Inconsistent texture.

b. Irregular or misaligned direction of texture.

c. Concrete with spalled or raveled control or expansion joints.

d. Concrete exhibiting splotching or discoloration in surface including discoloration due to "carbonation".

e. Concrete exhibiting cracking, including shrinkage cracking, where cracks are located between joint pattern.

2. Use of patching mortar for repair of edge defects is subject to acceptance of final color and texture by Architect. Use of patching mortar not acceptable for repair of defective exposed aggregate finished concrete.

END OF SECTION 32 13 13

SECTION 32 17 13 - PARKING BUMPERS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes concrete wheel stops.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples for Verification: For wheel stops, 6 inches (150 mm) long, showing color and cross section; with fasteners.

PART 2 - PRODUCTS

2.01 PARKING BUMPERS

A. Concrete Wheel Stops: Precast, steel-reinforced, air-entrained concrete, 4000-psi minimum compressive strength, 5 inches high by 9 inches wide by 72 inches long. Provide chamfered corners, transverse drainage slots on underside, and a minimum of two factory-formed or -drilled vertical holes through wheel stop for anchoring to substrate.

1. Century Group Pre-Cast Parking Bumper, or equal
2. Surface Appearance: Free of pockets, sand streaks, honeycombs, and other obvious defects. Corners shall be uniform, straight, and sharp.
3. Mounting Hardware: Galvanized-steel spike or dowel, 1/2-inch (13-mm) diameter, 10-inch (254-mm) minimum length, hardware as standard with wheel-stop manufacturer.
4. Color: White
5. Adhesive: As recommended by wheel-stop manufacturer for adhesion to pavement.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that pavement is in suitable condition to begin installation according to manufacturer's written instructions.

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

3.02 INSTALLATION

A. Install wheel stops according to manufacturer's written instructions unless otherwise indicated.

B. Securely anchor wheel stops to pavement with hardware in each preformed vertical hole in wheel stop as recommended in writing by manufacturer. Recess head of hardware beneath top of wheel stop.

END OF SECTION 32 17 13

SECTION 32 17 23 - PAVEMENT MARKINGS

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes painted markings applied to asphalt and concrete pavement.

1.02 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Nevada County Operations Center, 12350 La Barr Meadows Road, Grass Valley, CA

B. ACTION SUBMITTALS

C. Materials List/Shop Drawings:

1. Provide Complete List of proposed materials for Architect’s review.

2. Provide Shop Drawing diagrams of graphics proposed for use in pavement marking, including proposed size and location.

PART 2 - PRODUCTS

2.01 DESIGN CRITERIA

A. All improvements shall be constructed per the referenced standards, the improvement drawings, and as specified in this section.

B. Where criteria shown on drawings or specified in this specification exceed that of the referenced standards, the more stringent criteria shall apply.

2.02 PAVEMENT MARKING PAINT

A. Product Characteristics:

1. Provide paint specifically formulated for use as pavement marking in automobile, pedestrian traffic and play court areas, and as required by jurisdictional authority.

B. Provide striping in size and multiple colors as selected by Architect, and as follows:

1. At all pavement markings associated with accessibility for the disabled, provide Federal Blue 15090 per FS 595B color as defined in Title 24, Part 2, CCR, 4 inch width. Provide accessible aisle markings at 36 inches on center.

2. Provide red color at fire lane curbs as shown on the plans. Repaint all red color lane curbs damaged during construction.

3. Provide white striping at parking space markings, 4 inch width.

4. Provide directional arrows, white color, and size as shown on drawings.

5. Provide a minimum of four colors in deep saturated hues at play court paving graphics. Provide striping with 2 inch width, unless noted otherwise.

C. Paint products shall comply with Section 91, Caltrans Standard Specifications, for "rapid-dry" type paints. Paint manufacturer shall provide written certification of conformance to standard.

D. Reflectorized beading not required, except where required at public improvements.

PART 3 - EXECUTION

3.01 SURFACE CONDITIONS

A. Inspection:

1. Prior to all work of this section, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where this installation may properly commence.

2. Verify pavement may be installed in strict accordance with the original design, all pertinent codes and regulations, and all pertinent portions of the referenced standards.

3. In the event of discrepancy, immediately notify the Architect.

4. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.

3.02 PREPARATION

A. Secure the Architect's approval of graphics design and layout prior to start of application, including compliance with accessibility standards of Title 24.

B. Secure Fire Marshal approval of all striping and marking of curbs, pavement, and related signage.

C. Verify that concrete curing compound and asphalt seal coat compound has become completely inert prior to painting. Remove paint by approved means for those areas where compound is still active.

3.03 INSTALLATION

A. Using proper masking, stencils, and application equipment recommended for the purpose by the manufacturer of the approved paint, apply the approved paint in strict accordance with its manufacturer's recommendations and Section 84, Caltrans Standard Specifications.

B. Provide minimum of two coats of paint at all striping, curbing, and related markings, in dry mil thickness as defined in Section 84, Caltrans Standard Specifications. Vary color of first coat slightly.

C. Coatings installed on asphalt paving shall be applied in thin, light coats to avoid peeling.

D. A minimum of ten (10) days shall elapse between seal coat application and pavement marking on asphaltic concrete.

E. Repaint markings damaged by construction traffic.

F. Install fire lane curb markings at locations required by Fire Marshal or at 20 feet on center, whichever is more restrictive.

G. Install markings within 1/2 inch tolerance. Maintain width to a tolerance of plus/minus 1/4 inch.

H. Apply court markings in accordance with lay-out as shown on drawings, in colors as selected by Architect. Provide minimum of two coats.

END OF SECTION 32 17 23

SECTION 32 17 23 - PAVEMENT MARKINGS

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes painted markings applied to asphalt and concrete pavement.

1.02 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Nevada County Operations Center, 12350 La Barr Meadows Road, Grass Valley, CA

B. ACTION SUBMITTALS

C. Materials List/Shop Drawings:

1. Provide Complete List of proposed materials for Architect’s review.

2. Provide Shop Drawing diagrams of graphics proposed for use in pavement marking, including proposed size and location.

PART 2 - PRODUCTS

2.01 DESIGN CRITERIA

A. All improvements shall be constructed per the referenced standards, the improvement drawings, and as specified in this section.

B. Where criteria shown on drawings or specified in this specification exceed that of the referenced standards, the more stringent criteria shall apply.

2.02 PAVEMENT MARKING PAINT

A. Product Characteristics:

1. Provide paint specifically formulated for use as pavement marking in automobile, pedestrian traffic and play court areas, and as required by jurisdictional authority.

B. Provide striping in size and multiple colors as selected by Architect, and as follows:

1. At all pavement markings associated with accessibility for the disabled, provide Federal Blue 15090 per FS 595B color as defined in Title 24, Part 2, CCR, 4 inch width. Provide accessible aisle markings at 36 inches on center.

2. Provide red color at fire lane curbs as shown on the plans. Repaint all red color lane curbs damaged during construction.

3. Provide white striping at parking space markings, 4 inch width.

4. Provide directional arrows, white color, and size as shown on drawings.

5. Provide a minimum of four colors in deep saturated hues at play court paving graphics. Provide striping with 2 inch width, unless noted otherwise.

C. Paint products shall comply with Section 91, Caltrans Standard Specifications, for "rapid-dry" type paints. Paint manufacturer shall provide written certification of conformance to standard.

D. Reflectorized beading not required, except where required at public improvements.

PART 3 - EXECUTION

3.01 SURFACE CONDITIONS

A. Inspection:

1. Prior to all work of this section, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where this installation may properly commence.

2. Verify pavement may be installed in strict accordance with the original design, all pertinent codes and regulations, and all pertinent portions of the referenced standards.

3. In the event of discrepancy, immediately notify the Architect.

4. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.

3.02 PREPARATION

A. Secure the Architect's approval of graphics design and layout prior to start of application, including compliance with accessibility standards of Title 24.

B. Secure Fire Marshal approval of all striping and marking of curbs, pavement, and related signage.

C. Verify that concrete curing compound and asphalt seal coat compound has become completely inert prior to painting. Remove paint by approved means for those areas where compound is still active.

3.03 INSTALLATION

A. Using proper masking, stencils, and application equipment recommended for the purpose by the manufacturer of the approved paint, apply the approved paint in strict accordance with its manufacturer's recommendations and Section 84, Caltrans Standard Specifications.

B. Provide minimum of two coats of paint at all striping, curbing, and related markings, in dry mil thickness as defined in Section 84, Caltrans Standard Specifications. Vary color of first coat slightly.

C. Coatings installed on asphalt paving shall be applied in thin, light coats to avoid peeling.

D. A minimum of ten (10) days shall elapse between seal coat application and pavement marking on asphaltic concrete.

E. Repaint markings damaged by construction traffic.

F. Install fire lane curb markings at locations required by Fire Marshal or at 20 feet on center, whichever is more restrictive.

G. Install markings within 1/2 inch tolerance. Maintain width to a tolerance of plus/minus 1/4 inch.

H. Apply court markings in accordance with lay-out as shown on drawings, in colors as selected by Architect. Provide minimum of two coats.

END OF SECTION 32 17 23

SECTION 32 17 26 - TACTILE WARNING SURFACING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section Includes:

1. Cast-in-place detectable warning tiles.
2. Detectable warning mats.
3. Detectable warning unit pavers.

B. Related Requirements:

1. Section 321313 "Concrete Paving" for concrete walkways serving as substrates for tactile warning surfacing.
2. Section 321400 "Unit Paving" for unit paving installations incorporating detectable warning unit pavers specified in this Section.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples for Initial Selection: For each type of exposed finish requiring color selection.

C. Samples for Verification: For each type of tactile warning surface, in manufacturer's standard sizes unless otherwise indicated, showing edge condition, truncated-dome pattern, texture, color, and cross section; with fasteners and anchors.

1.04 CLOSEOUT SUBMITTALS

A. Maintenance Data: For tactile warning surfacing, to include in maintenance manuals.

1.05 QUALITY ASSURANCE

A. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.

1. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.06 PROJECT CONDITIONS

A. Cold-Weather Protection: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen subgrade or setting beds. Remove and replace unit paver work damaged by frost or freezing.

B. Weather Limitations for Mortar and Grout:

1. Cold-Weather Requirements: Comply with cold-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.
2. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602. Provide artificial shade and windbreaks, and use cooled materials as required. Do not apply mortar to substrates with temperatures of 100 deg F (38 deg C) and higher.
   a. When ambient temperature exceeds 100 deg F (38 deg C), or when wind velocity exceeds 8 mph (13 km/h) and ambient temperature exceeds 90 deg F (32 deg C), set unit pavers within 1 minute of spreading setting-bed mortar.

1.07 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of tactile warning surfaces that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

   a. Deterioration of finishes beyond normal weathering and wear.
   b. Separation or delamination of materials and components.

2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 TACTILE WARNING SURFACING, GENERAL

A. Accessibility Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines for Buildings and Facilities, California Division of State Architect, and ICC A117.1 for tactile warning surfaces.

1. For tactile warning surfaces composed of multiple units, provide units that when installed provide consistent side-to-side and end-to-end dome spacing that complies with requirements.

B. Source Limitations: Obtain each type of tactile warning surfacing**,** joint material, setting material, anchor, and fastener from single source with resources to provide materials and products of consistent quality in appearance and physical properties.

2.02 DETECTABLE WARNING TILES

A. Cast-in-Place Detectable Warning Tiles: Accessible truncated-dome detectable warning tiles configured for setting flush in new concrete walkway surfaces, with slip-resistant surface treatment on domes and field of tile.

1. Shapes and Sizes:

    a. Rectangular panel, 36 by 60 inches minimum.
    b. Radius panel, nominal 36 inches (610 mm) deep by 3-foot outside radius.

2. Dome Spacing and Configuration: 1.67-inch (42.4-mm) spacing, 2.35-inch (59.7-mm) spacing, in square pattern.

3. Mounting:

    a. Permanently embedded detectable warning tile wet-set into freshly poured concrete.

2.03 ACCESSORIES

A. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of tactile warning surfaces, noncorrosive and compatible with each material joined, and complying with the following:

1. Furnish Type 304 stainless-steel fasteners for exterior use.
2. Fastener Heads: For nonstructural connections, use flathead or oval countersunk screws and bolts with tamper-resistant heads, colored to match tile.

B. Sealant: As recommended by manufacturer for sealing perimeter of tactile warning surfacing unit.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that pavement is in suitable condition to begin installation according to manufacturer's written instructions. Verify that installation of tactile warning surfacing will comply with accessibility requirements upon completion.

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

3.02 INSTALLATION OF TACTILE WARNING SURFACING

A. General: Prepare substrate and install tactile warning surfacing according to manufacturer's written instructions unless otherwise indicated.

B. Place tactile warning surfacing units in dimensions and orientation indicated. Comply with location requirements of AASHTO MP 12.

3.03 INSTALLATION OF DETECTABLE WARNING TILES

A. Cast-in-Place Detectable Warning Tiles:

1. Concrete Paving Installation: Comply with installation requirements in Section 321313 "Concrete Paving." Mix, place, and finish concrete to conditions complying with detectable warning tile manufacturer's written requirements for satisfactory embedment of tile.
2. Set each detectable warning tile accurately and firmly in place and completely seat tile back and embedments in wet concrete by tamping or vibrating. If necessary, temporarily apply weight to tiles to ensure full contact with concrete.
3. Set surface of tile flush with surrounding concrete and adjacent tiles, with variations between tiles and between concrete and tiles not exceeding plus or minus 1/8 inch (3 mm) from flush.
4. Protect exposed surfaces of installed tiles from contact with wet concrete. Complete finishing of concrete paving surrounding tiles. Remove concrete from tile surfaces.
5. Clean tiles using methods recommended in writing by manufacturer.

3.04 INSTALLATION OF DETECTABLE WARNING MATS

A. Lay out detectable warning mats as indicated and mark concrete pavement at edges of mats.

B. Prepare existing paving surface by grinding and cleaning as recommended by manufacturer.

C. Apply adhesive to back of mat in amounts and pattern recommended by manufacturer, and set mat in place. Firmly seat mat in adhesive bed, eliminating air pockets and establishing full adhesion to pavement. If necessary, temporarily apply weight to mat to ensure full contact with adhesive.

D. Install anchor devices through face of mat and into pavement using anchors located as recommended by manufacturer. Set heads of anchors flush with mat surface.

E. Mask mat perimeter and adjacent concrete, and apply sealant in continuous bead around perimeter of mat.

F. Remove masking, adhesive, excess sealant, and soil from exposed surfaces of detectable warning mat and surrounding concrete pavement using cleaning agents recommended in writing by manufacturer.

G. Protect installed mat from traffic until adhesive has set.

3.05 CLEANING AND PROTECTION

A. Remove and replace tactile warning surfacing that is broken or damaged or does not comply with requirements in this Section. Remove in complete sections from joint to joint unless otherwise approved by Architect. Replace using tactile warning surfacing installation methods acceptable to Architect.

B. Protect tactile warning surfacing from damage and maintain free of stains, discoloration, dirt, and other foreign material.

END OF SECTION 32 17 26

SECTION 32 31 00 - FENCES AND GATES

PART ONE - GENERAL

1.01 SECTION INCLUDES

A. Chain Link Fence and Gate

B. Tubular Steel Fence and Gate

1.02 RELATED SECTIONS

A. Section 03 30 00 -Cast-in-Place Concrete: Concrete anchorage for posts and connections to concrete.

B. Section 32 13 00.13 – Fence and Gate Operators: gate operators.

C. Section 32 90 00 – Planting: Plant installation.

1.03 MEASUREMENT AND PAYMENT

A. Payment of the various Construction Items described in the Schedule of Values shall be considered full compensation for work of this Section.

1.04 REFERENCES

A. ASTM A 36/A 36M -Standard Specification for Carbon Structural Steel; current version.

B. ASTM A53 / A53M – 12 - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless

C. ASTM A 123/A 123M -Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; current version.

D. ASTM A 153/A 153M -Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; current version.

E. ASTM A 392 -Standard Specification for Zinc-Coated Steel Chain-Link Fence Fabric; current version.

F. ASTM A 653/A 653M -Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; current version.

G. ASTM F668 Specification for Polymer Coated Chain Link Fence Fabric

H. ASTM F 1083 -Standard Specification for Pipe, Steel, Hot-Dipped Zinc-Coated (Galvanized) Welded, for Fence Structures; current version.

I. AWS D 1.1 -Structural Welding Code -Steel; current version.

J. ASTM F900 – Standard Specification for industrial and commercial swing gates.

K. ASTM F934 Specification for Standard Colors for Polymer-Coated Chain Link

L. ASTM F1184 – Standard Specification for industrial and commercial horizontal slide gates.

M. ASTMF1910 Specification for Long Barbed Tape Obstacles

N. ASTM F1911 Standard Practice for Installation of Barbed Tape

O. ASTM F2200 Specification for Automated Vehicular Gate Construction

P. ASTM F2408 – Ornamental Fences Employing Galvanized Steel Tubular Pickets.

Q. UL325 Automatic operators: Door, Drapery, Gate, Louver and Window

1.05 SUBMITTALS

A. Product Data: Provide data on fabric, posts, components, accessories, fittings and hardware.

B. Shop Drawings: Indicate plan layout, spacing of components, post foundation dimensions, hardware anchorage, and schedule of components.

1. For projects with automatic gate openers, show locations and details for installing operator components, switches, and controls. Indicate motor size, electrical characteristics, drive arrangement, mounting, and grounding provisions. Submit drawings showing connections to adjacent construction, range of travel, and all electrical and mechanical connections to the operator.

C. Samples:

1. Submit one sample of each component and one 6" sq sample of fabric or panel.

2. Color samples: Manufacturer supplied color samples showing full range of available colors and textures.

D. Manufacturer's Instructions: Indicate preparation instructions and recommendations, storage and handling requirements and recommendations, and installation requirements and methods.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than ten (10) years of experience.

B. Installer Qualifications: All products listed in this section are to be installed by a single installer with a minimum of five (5) years demonstrated experience in installing products of the same type and scope as specified.

C. Gate operators shall comply with UL 325.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Store and dispose of hazardous materials, and materials contaminated by hazardous materials, in accordance with requirements of local authorities having jurisdiction.

1.08 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits. sequence and scheduling

1.09 WARRANTY

A. At project closeout, provide to City an executed copy of the manufacturer's standard limited warranty against manufacturing defect, outlining its terms, conditions, and exclusions from coverage.

PART TWO - PRODUCTS

2.01 CHAIN LINK FENCE

A. Fabric

1. Material: Comply with ASTM A392.

2. Mesh fabric: Gage and size as indicated on drawings.

3. Selvage: Knuckled at both selvages.

4. Finish: Per plans.

   a. When galvanized: Class III (1.0 – 1.2 oz. zinc/sf)

B. Posts and Rails

1. Tube or Pipe Diameter or Thickness: Per ASTM F761.

2. Coating: Metallic coating.

3. Size: as indicated on drawings.

C. Tension Wire

1. General: Provide horizontal tension wire at top and bottom of fence fabric.

2. Metallic-Coated Steel Wire: 0.177-inch diameter, marcelled tension wire complying with ASTM A 817 and ASTM A 824.

   a. Metallic Coating: Type III, Zn-5-Al-MM alloy.

3. Aluminum Wire: 0.192-inch diameter tension wire, mill finished, complying with ASTM B 211, Alloy 6061-T94 with 50,000-psi minimum tensile strength.

D. Fittings

1. General: Comply with ASTM F 626.

2. Tension bands: 12 ga. x ¾", spaced 14"

3. Brace bands: 12 ga. x ¾"

4. Rail end, loop cap, caps: pressed steel.

5. Tension bars: 3/16" x ¾"

6. Carriage bolts: 5/16" x 1-1/2"

   a. Tie wire:

   b. Line posts: Aluminum 8 ¼" x 9 ga. 14" o.c.

   c. Rails: Aluminum 6 ½" x 9 ga. 18" o.c.

7. Finish:

   a. Metallic Coating for Pressed Steel or Cast Iron: Not less than 1.2 oz. /sq. ft. zinc.

   b. Aluminum: Mill finish.

E. Footings: Concrete, 3,000 psi unless otherwise noted.

2.02 TUBULAR STEEL FENCE AND GATES

A. Steel material for forming fence pickets and frame shall be galvanized prior to forming in accordance with ASTM A653/A653M.

B. Minimum yield strength: 45,000 psi (310 MPa).

C. Pickets: Square solid pickets, size as specified in plans. Minimum material size for pickets shall be ¾" x 14ga tubing.

D. Rails: Solid rectangular cross-sectional members, size as specified in plans.

E. Posts: Square tubing members, high-strength steel, size and shape per plans. Min 14 ga tubing.

F. Caps: Shape per plans, sized for post.

G. The manufactured fence system shall be capable of meeting the vertical load, horizontal load, and infill performance requirements for Industrial weight fences under ASTM F2408.

H. Swing gates shall be fabricated using 1.75" x 14ga Forerunner double channel rail, 2" sq. x 12ga. gate ends, and 1" sq. x 14ga. pickets. Gates that exceed 6' in width will have a 1.75" sq. x 14ga. intermediate upright. All rail and upright intersections shall be joined by welding. All picket and rail intersections shall also be joined by welding. Gusset plates will be welded at each upright to rail intersection. Cable kits will be provided for additional trussing for all gates leaves over 6'.

I. Pedestrian swing gates shall be self-closing, having a gate leaf no larger than 48" width. Integrated hinge-closer set (2 qty) shall be ADA compliant that shall include a variable speed and final snap adjustment with compact design (no greater than 5" x 6" footprint). Hinge-closer set (2 qty) shall be tested to a minimum of 500,000 cycles and capable of self-closing gates up to a maximum gate weight of 260 lbs. and maximum weight load capacity of 1,500 lbs. Hinge-closer device shall be externally mounted with tamper-resistant security fasteners, with full range of adjustability,

horizontal (.5” - 1.375”) and vertical (0 - .5”). Maintenance free hinge-closer set shall be tested to operate in temperatures of negative 20 F to 200 F degrees, and swings to negative 2 degrees to ensure reliable final lock engagement.

J. Finish: as specified on drawings.

2.03 CHAIN LINK FENCE FINISHES

A. Galvanized in accordance with ASTM A 123/A 123M, at 1.7 oz/sq ft.

2.04 FINISH

A. Metal components (except fasteners) shall receive commercial grade finish system after fabrication.

B. Finish and Color: Color and texture selected by Landscape Architect from manufacturer’s standards.

C. Touch-Up Paint: Provide high quality, exterior-grade spray paint suitable for conditions of use.

PART THREE - EXECUTION

3.01 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for site clearing, earthwork, pavement work, construction layout, and other conditions affecting performance of the Work.

B. Do not begin installation before final grading is completed unless otherwise permitted by Architect.

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

3.02 INSTALLATION: CHAIN LINK FENCING

A. General

1. Install chain-link fencing to comply with ASTM F 567 and more stringent requirements specified.

2. Conform to manufacturer’s specifications.

B. Post Excavation: Drill or hand-excavate holes for posts to diameters and spacings indicated, in firm, undisturbed soil.

C. Post Setting: Set posts as indicated on drawings, at indicated spacing into firm, undisturbed soil.

1. Concrete Fill: Place concrete around posts to dimensions indicated and vibrate or tamp for consolidation. Protect aboveground portion of posts from concrete splatter.

2. For installations that must be raked to follow sloping grades, the post spacing dimension must be measured along the grade

D. Terminal Posts: Locate terminal end, corner, and gate posts per ASTM F 567 and terminal pull posts at changes in horizontal or vertical alignment.

E. Line Posts: Space as indicated on drawings.

F. Post Bracing and Intermediate Rails: Install according to ASTM F 567. Install braces at end and gate posts and at both sides of corner and pull posts.

G. Tension Wire: Install according to ASTM F 567, maintaining plumb position and alignment of fencing.

H. Top Rail: Install according to ASTM F 567.

I. Bottom Rails: Install, spanning between posts.

J. Chain-Link Fabric: Apply fabric to project side of enclosing framework. Leave 1 inch between finish grade or surface and bottom selvage, unless otherwise indicated.

K. Tie Wires: Attach wire per ASTM F 626. Bend ends of wire to minimize hazard to individuals and clothing.

L. Fasteners: Install nuts for tension bands and carriage bolts on the side of the fence opposite the fabric side.

M. Gate posts shall be spaced according to the manufacturers' gate drawings, dependent on standard out-to-out gate leaf dimensions and gate hardware selected. Type and quantity of gate hinges shall be based on the application; weight, height, and number of gate cycles. The manufacturers' gate drawings shall identify the necessary gate hardware required for the application. Gate hardware shall be provided by the manufacture of the gate and shall be installed per manufacturer's recommendations.

3.03 INSTALLATION: TUBE STEEL FENCE AND GATES

A. Fence post shall be spaced according to Table 3, plus or minus ½". For installations that must be raked to follow sloping grades, the post spacing dimension must be measured along the grade. Fence panels shall be attached to posts with brackets supplied by the manufacturer. Posts shall be set in concrete footers having a minimum depth of 36" (Note: In some cases, local restrictions of freezing weather conditions may require a greater depth). The "Earthwork" and "Concrete" sections of this specification shall govern material requirements for the concrete footer. Posts setting by other methods such as plated posts or grouted core-drilled footers are permissible only if shown by engineering analysis to be sufficient in strength for the intended application.

B. Gate posts shall be spaced according to the manufacturers' gate drawings, dependent on standard out-to-out gate leaf dimensions and gate hardware selected. Type and quantity of gate hinges shall be based on the application; weight, height, and number of gate cycles. The manufacturers' gate drawings shall identify the necessary gate hardware required for the application. Gate hardware shall be provided by the manufacturer of the gate and shall be installed per manufacturer's recommendations.

3.04 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

SECTION 32 31 00.13 - FENCE AND GATE OPERATORS

PART ONE - GENERAL

1.01 SECTION INCLUDES

A. Pre-wired, self-contained, slide gate operator for horizontal sliding gates, including all selected attachments and accessory equipment.

B. Pre-wired gate operator for swing gates, including all selected attachments, accessory equipment, and mounting brackets.

1.02 RELATED SECTIONS

A. Section 03 30 00 -Cast-in-Place Concrete: Concrete anchorage for posts and connections to concrete.

B. Section 32 31 00 – Fences and Gates.

1.03 MEASUREMENT AND PAYMENT

A. Payment of the various Construction Items described in the Schedule of Values shall be considered full compensation for work of this Section.

1.04 REFERENCES

A. UL325 Automatic operators: Door, Drapery, Gate, Louver and Window

1.05 SUBMITTALS

A. Product Data: Provide data on fabric, posts, components, accessories, fittings and hardware.

B. Shop Drawings: Submit drawings showing connections to adjacent construction, range of travel, and all electrical and mechanical connections to the operator. All underground runs of electrical lines and inductive vehicle obstruction loop locations shall be indicated on drawings. Drawings shall also show the size and location of the concrete mounting pad.

C. Manufacturer's Instructions: Indicate preparation instructions and recommendations, storage and handling requirements and recommendations, and installation requirements and methods.

1.06 QUALITY ASSURANCE

A. Manufacturer: A company specializing in the manufacture of security gate operators of the type specified, with a minimum of seven years’

experience and minimum of five years' experience with gate operators of this type and design.

B. Installer: A minimum of three years' experience installing similar equipment.

C. Gate operators shall comply with UL 325.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

1.08 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits. sequence and scheduling

1.09 WARRANTY

A. Provide a five-year warranty against all defects in materials or workmanship. Defective materials shall be replaced with new materials furnished by the manufacturer, at no cost to the owner. Freight, labor and other incidental costs are not covered under the factory warranty, but may be covered by a separate service agreement between installing company and the owner.

1. To ensure validation of warranty, return completed warranty registration form to manufacturer.

PART TWO - PRODUCTS

2.01 MANUFACTURER AND MODEL

A. As specified in the drawings.

B. Substitutions allowed per conditions of this project as established elsewhere in the Contract Documents.

2.02 OPERATION

A. Operators shall be capable of handling gates for each specific location, gate swing, and condition operators are called for, per the plans.

B. Electrical requirements shall conform with available electrical supply provided or available with this project, refer to electrical engineer's plans.

C. Provide concrete mounting pedestals per manufacturer’s recommendations.

D. Fail-Safe Operation

1. System shall be compatible with back-up power source for the project.

2. Upon loss of primary power, system shall revert to a fail-safe mode allowing the gate to be pushed open without the use of special knowledge, keys or other releasing mechanisms.

E. Convenience Outlets: Two (2) 115 VAC for accessory transformers.

PART THREE - EXECUTION

3.01 SITE EXAMINATION

A. Locate concrete mounting pad in accordance with approved shop drawings.

B. Make sure that gate is operating smoothly under manual conditions before installation of gate operators. Do not proceed until gate panel is aligned and operates without binding.

3.02 INSTALLATION

A. Install gate operator in accordance with the manufacturer's printed instructions, current at the time of installation. Coordinate locations of operators with contract drawings, other trades and shop drawings.

B. Model 6300 shall be mounted, firmly secured, plumb and level, as required.

C. Wiring shall be uniform and in accordance with national electric codes and manufacturer’s instructions.

D. All splices shall be in easily accessible junction boxes or on terminal boards.

E. All cable runs in all junction boxes shall be tagged and identified.

F. Coordinate all work with other effected trades and contractors.

3.03 FIELD QUALITY CONTROL

A. Test gate operator through ten full cycles and adjust for operation without binding, scraping or uneven motion. Test limit switches for proper "at rest" gate position.

1. System shall be tested in presence of owner's representative.

B. All anchor bolts shall be fully concealed in the finished installation.

C. Owner, or owner’s representative, shall complete “punch list” with installing contractor prior to final acceptance of the installation and submit completed warranty documentation to manufacturer.

3.04 CONTINUED SERVICE AND DOCUMENTATION

A. Train owner's personnel on how to safely shut off electrical power, release and manually operate the gate.

B. Contractor shall provide owner with (2) copies of standard factory prepared operation, installation and maintenance manuals. Manuals shall include typical wiring diagrams.

C. Contractor shall provide owner with (2) copies of any risers, layouts, and special wiring diagrams showing any changes to standard drawings, if required on project.

END OF SECTION

SECTION 32 80 00 – IRRIGATION

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Pipe and fittings, valves, sprinkler heads, and accessories.

B. Control system.

C. Backflow Prevention System.

1.02 RELATED SECTIONS

A. Section 31 22 19 – Finish Grading

B. Section 32 90 00 - Planting: Coordination with fine grading and soil preparation.

1.03 MEASUREMENT AND PAYMENT

A. Measurement and Payment for Work of this Section shall be as indicated in the General Conditions.

1.04 REFERENCES

A. ASTM A53: Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless

B. ASTM D1784 - Specification for Rigid PVC Compounds and CPVC Compounds.

C. ASTM D1785 - Standard Specification for PVC Plastic Pipe, Schedules 40, 80, and 120.

D. ASTM D 2241 - Standard Specification for Poly (Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series); 2004b.

E. ASTM D2464 - Standard Specification for Threaded Poly Vinyl Chloride (PVC) Plastic Pipe Fittings, Schedule 80

F. ASTM D2466 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.

G. ASTM D2467 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.

H. ASTM D 2564 - Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems; 2004.

I. ASTM D3139 - Joints for Plastic Pressure Pipe Using Flexible Elastomeric Seals.

J. ASTM D3350 - Standard Specification for Polyethylene Plastics Pipe and Fittings Materials

K. ASTM F477 - Elastomeric Seals (Gaskets) for Joining Plastic Pipe

L. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); National Electrical Manufacturers Association; 2003.

1.05 DEFINITIONS

A. Extra Wire: Control wire that is intended for future valve.

B. Lateral Line: Pipe downstream of zone valve.

C. Mainline: Pipe from backflow device to zone valves.

D. Spare Control Wire: Control wire that is intended as a backup in case of faults or unknown conditions.

1.06 SYSTEM DESCRIPTION

A. Contractor shall provide and install a complete irrigation system with the intent of the Drawings and Specifications. System shall provide 100% coverage to all planted areas in a uniform manner.

1.07 SUBMITTALS

A. Shop Drawings: Prepare an submit the following fully dimensioned and labeled:
1. POC Connection enclosure including all appurtenances and equipment, to scale of detail not less than 1”=10’.
2. Backflow prevention assembly.
3. Controller assemblies including electrical.
4. Layout plan for controller area.

B. Product Data: Provide for all components incorporated into the Work and as requested to illustrate compliance with the Project Documents.

C. Samples: Provide as requested.

D. Test Reports as described in Part 3.

E. Record Documents: Record actual locations of all concealed components, piping system, conduit, and other items listed below. Dimension from two permanent points

of reference, building corners, sidewalk, or road intersections, etc., the location of the following items:

1. Connection to existing water lines.
2. Connection to existing electrical power.
3. Modifications to existing system.
4. Gate valves.
5. Routing of main line indicating all changes in direction and points along straight runs at intervals no more than 100'.
6. Sprinkler control valves.
7. Routing of control wiring.
8. Quick coupling valves.
9. Other related equipment as directed by the Landscape Architect.

F. Controller Charts: Provide color coded diagram of irrigation system as follows:
   1. Prepare at a scale that will fit inside of controller door or in standard size 3-ring binder or spiral bound as directed by Owner.
   2. Scale shall be legible and no less than 1" = 50'. Use multiple pages as required.
   3. Laminate all sheets with minimum 10 mil. plastic.
   4. Submit and obtain approval of Landscape Architect prior to requesting final observation of irrigation system.

G. Operation and Maintenance Data:
   1. Provide instructions for operation and maintenance of system and controls, seasonal activation and shutdown, and manufacturer's parts catalog.
   2. Provide schedule indicating length of time each valve is required to be open to provide a determined amount of water.

1.08 QUALITY ASSURANCE

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

B. Installer Qualifications: Company specializing in performing the work of this section with minimum five years of experience.

1.09 DELIVERY, STORAGE, AND HANDLING

A. Comply with manufacturer's instructions and requirements.

B. Coordinate on-site storage with Owner.

C. Handling of PVC Pipe and Fittings: Exercise care in handling, loading, unloading, storing and installation of PVC pipe and fittings. All PVC pipe shall be transported in a vehicle that allows the length of 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 or damaged will be discarded and, if installed, shall be replaced with new piping.

1.10 PROJECT CONDITIONS

A. The Contractor shall not willfully install the irrigation system as shown on the drawings when it is obvious in the field that obstructions, grade differences or discrepancies in area dimensions exist that might not have been considered in engineering. Such obstructions or differences should be brought to the attention of the Landscape Architect. In the event this notification is not performed, the irrigation Contractor shall assume full responsibility for any revision necessary.

1.11 REGULATORY REQUIREMENTS

A. Requirements of Regulatory Agencies: All work and materials shall be in full conformance with the latest rules and regulations of the California Plumbing and Electric codes.

B. Manufacturer's Directions: Manufacturer's directions and detailed drawings shall be followed in all cases where the manufacturers of articles used in this contract furnish directions covering points not shown in the drawings and specifications.

C. Underwriters Laboratories: Electrical wiring, controls, motors, and devices shall be UL listed, and so labeled.

1.12 PRE-INSTALLATION MEETING

A. Convene one week prior to commencing work of this Section.

B. Schedule after major components have been initially staked.

1.13 COORDINATION

A. Coordinate the work with site backfilling, landscape grading and delivery of plant life.

1.14 SEQUENCE AND SCHEDULING

A. Install all piping and provisions for equipment assemblies such as risers, swing joints, and nipples when subgrade has been established but prior to spreading any on-site or imported material over subgrade.

B. Stage installation of work in area of stock piled material as necessary.

1.15 MAINTENANCE SERVICES

A. Installer's Field Services: Prepare and start systems in accordance with process established elsewhere in these specifications or General Conditions.

B. Maintain system during plant establishment period specified in Section 32 90 00.

C. Instruct Owner personnel on detailed operation of system.

1.16 EXTRA MATERIALS

A. Furnish extra components:
1. Two valve keys for manual valves.
2. Two valve box keys.
3. Two keys for valve markers.
4. Two wrenches for each type head core and for removing and installing each type head.

1.17 WARRANTY

A. The warranty for the sprinkler irrigation system shall be made in accordance with the following form.

B. A copy of the warranty form shall be included in the operations and maintenance manual.

C. The warranty form shall be retyped onto the Contractor's letterhead and contain the following information

D. WARRANTY FOR SPRINKLER IRRIGATION SYSTEM
1. We hereby warrant that the sprinkler irrigation system we have furnished and installed is free from defects in materials and work quality, and the work has been completed in accordance with the drawings and specification. We agree to repair or replace any defects in material or work quality that may develop during the period of one year from the date of acceptance, except those that may be caused by ordinary wear and tear, unusual abuse or neglect. We also agree to repair or replace any damage resulting from the repairing or replacing of such defects at no additional cost to the Owner. We shall make such repairs or replacements within a reasonable time, as determined by the Owner, after receipt of written notice. In the event of our failure to make such repairs or replacements within a reasonable time after receipt of written notice from Owner, we authorize the Owner to proceed to have said repairs or replacements made at our expense, and we will pay the costs and charges therefore upon demand.
2. PROJECT:_____
3. CONTRACTOR:_____ PHONE NO.:_____
4. ADDRESS:_____ BY:_____
5. _____
6. DATE OF ACCEPTANCE:_____ BY:_____

PART 2 - PRODUCTS

2.01 PVC PIPE AND FITTINGS

A. PVC Materials: ASTM D1784, Type I Polyvinyl chloride plastic (PVC), cell classification 12454-B.

B. Class 200 PVC Pipe: ASTM D2241 listed with NSF-PW Standard 61 and Standard 14.

C. Class 315 PVC Pipe: ASTM D2241 listed with NSF-PW Standard 61 and Standard 14.

D. Schedule 40 PVC Pipe: ASTM D1785 listed with NSF-PW Standard 61 and Standard 14.

E. Flexible PVC Pipe: Agricultural Products Inc. 1174AG, Heavy Wall IPS Flex Vinyl (PVC) Pipe (C).
1. 1/2” IPS: 0.840” O.D., 0.147” wall thickness
2. 3/4” IPS: 1.05” O.D., 0.154” wall thickness
3. 1” IPS: 1.315” O.D., 0.179” wall thickness

F. PVC, Schedule 40 Socket Fittings: ASTM D2466 listed with NSF-PW Standard 61 and Standard 14.

G. PVC, Schedule 80 Socket Fittings: ASTM D2467 and listed with NSF-PW Standard 61 and Standard 14.

H. PVC, Schedule 80 Threaded Fittings: ASTM D2464 and listed with NSF-PW Standard 61 and Standard 14.

I. Gasket Joints: Comply with ASTM F477 and ASTM D3139

2.02 STEEL PIPE AND FITTINGS

A. Galvanized Pipe: Standard weight Schedule 40. Comply with ASTM A53.

B. Steel Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M or ASTM A 106, Schedule 40, galvanized, seamless steel pipe with threaded ends.

C. Malleable-Iron Unions: ASME B16.39, Class 150, hexagonal-stock body with ball-and-socket, metal-to-metal, bronze seating surface, and female threaded ends.

D. Gray-Iron Threaded Fittings: ASME B16.4, Class 125, galvanized, standard pattern.

E. Cast-Iron Flanges: ASME B16.1, Class 125.

F. Cast-Iron Flanged Fittings: ASME B16.1, Class 125, galvanized.

G. Galvanized Fittings: 150lbs. malleable iron, threaded. Comply with ASTM A53

H. Ductile Iron Pipe and Fittings: Comply with Section 33 11 00.

I. Cast Iron Pipe and Fittings: Comply with Section 33 11 00.

2.03 DRIPLINE PIPE AND FITTING

A. Dripline: 5/8" polyethylene tubing with integral self-cleaning pressure compensating emitters.

B. Dripline: As specified on the drawings. Fittings are to be by the same manufacturer and of type, style, and size to match dripline in accordance with manufacturer's recommendations.

2.04 PIPE SCHEDULE

A. Water Service: Conform to County standards.

B. Equipment Assemblies: Per referenced details.

C. Irrigation Mainline:
1. NPS ½" to 2": Schedule 40 PVC, solvent weld joints and fittings.
2. NPS 2½" and 3": Class 200 PVC, solvent weld joints and fittings.
3. NPS 4" and larger: Class 200 PVC bell-end gasketed joints, ductile iron fittings.

D. Lateral Lines:
1. NPS ½" to 2": Schedule 40 PVC, solvent weld joints and fittings.
2. NPS 2½" and 3": As specified on the Drawings, solvent weld fittings.

E. Sleeves: Schedule 40 PVC, solvent weld joints. Inside diameter shall be twice the outside diameter of pipe for which it is used.

F. PVC Fittings: Schedule 40 PVC unless otherwise indicated.

G. Swing Joint Assembly: Rainbird SA series, size and length as required.

2.05 EQUIPMENT

A. Remote Control Valves: As specified on the Drawings.

B. Ball Valves: Spears PVC Industrial Grade Compact Ball Valve

C. Gate Valves:
1. As specified on the Drawings.
2. 3" to 12": Comply with County Standards for water.

D. Quick Coupling Valves: As specified on the Drawings.

E. Master Valve: As specified on the Drawings.

F. Flow Sensor: As specified on the Drawings.

G. Controllers:
1. As specified on Drawings.
2. Powder coat enclosure color as selected by Landscape Architect. Submit available standard colors for selection.

2.06 ACCESSORIES

A. Control Wire: Copper, UL rated for direct burial, Type UF. Conform to NEC. Common shall be white and pilot wire shall be red. Spare control wires shall be of a different color approved by the Engineer.
1. Pilot Wire: 14 Gauge
2. Common Wire: 12 Gauge

B. Control Wire Connectors: Water tight. Rain Bird Pen-Tite Connectors, 3M DBY ore DBR direct burial splice kits, or fusible heat shrinking tubing, as specified on the Drawings or as approved. Sized as required for wire size and quantities at each splice.

C. Valve boxes: As indicated below. Provide one (1) 12" extension per box, unless different size otherwise indicated, by same manufacturer as box and stamp cover with identification of equipment or valve and controller number as applicable.
1. Master Valve: Christy B36
2. Flow Sensor: Christy B3 Utility Box
3. Quick Coupler Valves: Christy B3 Utility Box.
4. Gate Valves: Carson 1220 with T-cover and Bolt Down Loc-Kit, green.
5. Remote Control Valves: Rainbird VB-JMB-H.
   a. Extension: Rainbird VB-JMB-EXT-B.
6. Stub-Outs: Christy N30 box with bolt down lid.

D. Primer: Weldon P-70 PVC, IAMPO-UPC and NSF listed.

E. Solvent Weld Cement:
1. Comply with ASTM D2564, IAMPO-UPC and NSF listed. Compatible with pipe being joined and job site conditions.

F. Galvanized Pipe Paint: Carbon elastic Paint No. 2221 by American Tar Company or equal.

G. Thrust Blocks: As specified in the Drawings.

H. Pull line/cord: Polypropylene braided line or Let-line #232 or equal of 1/8” diameter with a minimum break strength of 200 pounds.

I. Remote Control Valve ID Tag: All vinyl, with embossed lettering and tie for valve connection. Christie, Ewing or equal.

2.07 IRRIGATION ASSEMBLIES

A. Drip Assemblies: As specified on the Drawings

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify location of existing utilities.

B. Verify that required utilities are available, in proper location, and ready for use.

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

D. Verify location of underground utilities and facilities. Drawings may show utilities in some locations but do not necessarily represent all underground utilities and facilities. Obtain locations prior to start of Work.

E. Verify that required utilities are available, in proper location, and ready for use.

F. Verify locations of existing sleeves. Notify Landscape Architect of discrepancies in existing sleeve locations and system requirements.

G. Beginning of installation shall signify acceptance of existing conditions.

H. Verification of Existing Pressure:
1. Verify existing static pressure prior to ordering irrigation components. Submit test results to Landscape Architect for further direction.

3.02 PREPARATION

A. Call Underground Service Alert 48 hrs prior to start of work. Field mark underground utilities prior to excavation. Make provisions to protect underground utilities and facilities.

B. Piping layout indicated is diagrammatic only. Route piping to avoid plants, ground cover, utilities, and structures and as directed. Locate in landscape areas wherever possible

C. Layout and stake locations of system components.
1. Layout by Survey: At a minimum, the following shall be laid out by survey using a qualified surveyor.
a. Mainline

D. Review layout requirements with other affected work. Coordinate locations of sleeves under paving to accommodate system.

E. Layout shall be reviewed by the Landscape Architect or Owner at pre-installation meeting prior to installation.

3.03 GENERAL

A. Install all equipment in compliance with applicable codes and regulations and manufacturer's printed instructions and specifications.

B. Provide all incidental materials, equipment, and components required for a complete and functional system even if such material, equipment, and components are not specifically included in the Drawings or Specifications.

3.04 TRENCHING

A. Trench and backfill in accordance with Section 31 22 19.

B. Trench bottom shall be flat to ensure piping is supported continuously on an even grade.

C. Where lines occur under paved areas, consider dimension to be below the subgrade.

D. Trench Size:
   1. Width: As indicated on the Drawings.
   2. Depth as required to provide for bedding and minimum cover as specified. Coordinate depths of various pipe runs as required to minimize conflict. Maintain consistent depths of each of line except as pre-approved by Landscape Architect.

E. Schedule of Minimum Pipe Cover:
   1. Water Service Line: Per County or other local Standards
   2. Mainline:
      a. Pipe Sizes Less Than 4 inches: 24 inches.
      b. Pipe 4 inches and Larger: 30 inches
   3. Lateral Lines: 18 inches.
   4. Control Wire: 24 inches.
   5. All Pipe and Control Wire under Paving: 36 inches minimum. Provide additional depth as required to provide a minimum of 12 inches cover to bottom of subgrade in new paving areas.

F. Trenching adjacent to existing trees shall be excavated by hand or machine boring as directed by the Landscape Architect. Comply with the County Standards.

G. Trench to accommodate grade changes.

H. Maintain trenches free of debris, material, or obstructions that may damage pipe.

3.05 PIPE INSTALLATION

A. General
1. Comply with manufacturer's printed instructions and recognized industry standards.
2. Pipe and equipment installed in trenches shall be fully supported by approved trench foundation material.
3. Pipe and equipment installed above grade shall be properly and securely anchored and supported by approved devices and means.
4. Pipe under paved areas shall be installed in PVC pipe sleeves.
5. Line Clearance: All lines shall have a minimum clearance of 6 inches from each other and from lines of other trades. Comply with applicable regulations for clearance between irrigation lines and other trades.
6. Parallel lines shall not be installed directly over one another.
7. Install pipe to allow for expansion and contraction without stressing pipe or joints.
8. Install trace wire as indicated in drawings.
9. Install 3" warning tape 12" above mainline.

B. PVC, Solvent-Cement Welded Joints
1. Comply with manufacturers' written specifications.
2. Comply with ASTM D2855 and ASTM F402

C. PVC, Threaded Joints:
1. Use teflon tape for plastic to plastic and plastic to galvanized joints. Hand tighten and use only light wrench pressure as required to produce sound, water tight joint.
2. Use pipe joint compound for galvanized to galvanized joints.

D. PVC, Gasket Joints:
1. Comply with manufacturers' written instructions.
2. Comply with ASTM D3139.

E. Galvanized Pipe:
1. Comply with industry standards.
2. Paint all below grade galvanized pipe with specified galvanized pipe paint.

F. Thrust Blocks:
1. Thrust blocks shall be cast-in-place concrete of the size and configuration appropriate for installation condition.
2. Comply with Standard Specifications and as indicated on the Drawings.
3. Leave thrust blocks exposed until pressure testing is complete.

3.06 EQUIPMENT INSTALLATION

A. Remote Control Valves:
1. Locate all valves a directed.
2. Install per applicable details.
3. Install after mainline has passed pressure test.
4. Flush mainline of all debris before installing valves.

5. Install each valve in a separate valve box.
6. After installation, re-pressurize mainline, check for leak, and eliminate all leaks.
7. Securely attach one ID tag per valve with number or lettering corresponding to vavles station on controller schedule.

B. Manual Drain Valves: Install at all low points in system.

C. Controller:
1. Locate as directed.
2. Install and wire in conformance with manufacturer's published instructions and specifications
3. Construct concrete footings as indicated and as required to support the controller cabinet.
4. Wire only one valve per station.
5. Make connection to electrical supply. Conform to applicable regulations and codes. Provide dedicated breaker of proper size for each controller. Provide one (1) additional duplex outlet at each controller. All electrical work shall be performed by properly licensed electrician.

D. Remote Control Valve Control Wiring:
1. Above grade wire shall be installed in approved conduit. Extend conduit to the full required depth of cover. Transition from vertical to horizontal alignment shall be made with a sweep elbow.
2. Lay control wire in mainline trench immediately adjacent to mainline wherever possible. Bundle wires with electrical tape at 10 feet intervals. Do not tape to mainline.
3. Run a separate pilot wire to each control valve.
4. Run a common ground for all control valves on a common controller. Provide a separate ground wire for each controller.
5. Make splices in valve boxes only. Use specified connectors. Provide a 36 inch loop at each valve.
6. Extra Control Wire: Install for future valves, if any, where indicated on the Drawings. Extra control wire shall not be used as spares without approval from Landscape Architect.
7. Spare Control Wires:
    a. Install one spare common wire the full length of the mainline.
    b. Install spare control wires at a ratio of 1 per each 6 valves the full length of the mainline. Provide a 36 inch loop at each valve.
8. Label ends of control wire indicating controller, valve number, and station. Use waterproof marker.

E. Valve Boxes
1. Excavate to required subgrade.
2. Place drain rock to specified depth and width prior to setting support blocks and valve box. At a minimum, drain rock shall be 12 inches deep and shall be the full width and length of the box extending 3 inches past the edges of the valve box.
3. Set valve boxes plumb and square with adjacent structures and adjacent boxes.
    a. Paved condition: Set box so that top of box is flush with adjacent paving.
    b. Landscape Condition: Set boxes so that top of box is 1" above adjacent finish grade.

4. Mark top of each box with approved designation of type of equipment housed within it. Use approved permanent means of marking. Identify zone number of remote control valves.

F. Quick Coupler
1. Locate 12" from paved surface unless approved otherwise.

3.07 FIELD QUALITY CONTROL

A. Identify the following scheduled observations in the Progress Schedule and provide notifications to Landscape Architect and Owner prior to each as follows:
1. Backflow assembly location: 48 hours.
2. Pressure supply line installation and testing: 48 hours.
3. Automatic controller location: 48 hours.
4. Control wire installation: 48 hours.
5. Lateral line and sprinkler installation: 48 hours.
6. Coverage test: 48 hours.
7. Final site review: 7 days.

B. When observations have been conducted by other than the Landscape Architect or Designated Representative, show evidence in writing of when and by whom these observations were made.

C. No site observations will commence without Record Drawing redline prints.

D. Pressure Testing:
1. General:
a. All hydrostatic pressure tests in the presence of the Landscape Architect or Owner representative. No pipe shall be completely backfilled until it has been inspected, tested and approved in writing.
b. Center load all pipe runs and secure as required to prevent damage to system during testing. Do not cover any joints or fittings.
c. Fill pipe with water a minimum of 24 hours prior to testing.
d. Furnish all force pumps and equipment required to conduct tests. Do not use system's booster pump to pressurize lines.
e. Conduct all pressure tests prior to spreading any soil amendment material.
f. Correct all deficiencies revealed by testing.
2. Mainline: Prior to installation of electrical control valves, quick couplers or any other equipment that might prevent a proper test from being performed pressurize mainline to 150 pounds per square inch and maintain pressure for a period of 6 hours.
3. Lateral Lines: Prior to installation of heads, cap risers and swing joints and pressurize to 100 pounds per square inch and maintain pressure for a period of 2 hours.
4. All Piping Under Paved Areas: pressurize to 150 pounds per square inch for a period of 2 hours and proved watertight prior to paving.

E. Coverage Test: When the sprinkler irrigation system is completed, perform a coverage test in the presence of the Landscape Architect or Designated Representative to

determine if the water coverage for planting areas is complete and adequate. Furnish all materials and perform all work required to correct any inadequacies of coverage due to deviations from plans.

1. Perform in presence of Landscape Architect and Owner representative.
2. Run each zone for sufficient length of time to demonstrate coverage and uniform application.
3. Adjust system components as required to correct inadequate or non-uniform coverage.

F. All tests that fail will require additional testing at Contractor's expense, including Landscape Architect's time and expenses, until accepted by Landscape Architect.

G. Final Observation:

1. The Contractor shall operate each system in its entirety for the Landscape Architect or Designated Representative at time of final observation. Any items deemed not acceptable by the Landscape Architect or Owner, or not in compliance with these specifications and drawings, shall be reworked to the complete satisfaction of the Landscape Architect and Owner.
2. The Contractor shall show evidence to the Landscape Architect that the Owner has received all accessories, charts, record drawings, and equipment as required before final observation can occur.

3.08 BACKFILLING

A. Clean trenches of debris and deleterious material.

B. Backfill trench and compact to specified subgrade elevation. Protect piping from displacement.

C. Backfill only after specified tests have been performed and Engineer's acceptance has been obtained.

D. Clean trenches of debris and rocks.

E. Bed pipe as indicated on the Drawings.

F. Place initial fill of select material as indicated on Drawings.

G. Backfill with approved native soil free of rocks, sticks, debris and other deleterious material.

H. Compaction

1. In landscape areas match compaction of landscape area soil and as required to prevent settling.
2. Under areas to be paved compact to a minimum of 95% per ASTM D1557. Meet minimum compaction requirements for pavement section

3.09 TEMPORARY REPAIRS

A. The Owner reserves the right to make temporary repairs as necessary to keep the sprinkler system equipment in operating condition. The exercise of this right by the Owner shall not relieve the Contractor of his responsibilities under the terms of the warranty as herein specified.

3.10 SYSTEMS STARTUP

A. Adjust control system to achieve time cycles required.

B. Adjust control system to achieve time cycles required to deliver proper precipitation rates for the various planting types. Adjust sequencing of stations such that the required watering can be accomplished during the Owner-specified watering time window.

C. Change head and nozzle types as directed and as required to achieve proper coverage and precipitation rates.

D. Adjust heads and valve pressures as required to provide proper irrigation coverage and precipitation rates.

E. Adjust all sprinkler heads to prevent as much as possible any overspray onto walks and roadways. No spray is permitted on buildings.

F. Radii shall not be reduced by more than 25% of the nozzle's radius as determined by manufacturer.

3.11 MAINTENANCE

A. The entire sprinkler irrigation system shall be under full automatic operation for a period of seven days prior to any planting.

B. The Landscape Architect or Owner Representative reserves the right to waive or shorten the operation period.

C. Maintain system during the plant establishment period specified in Section 32 90 00.

3.12 CLEANUP

A. Cleanup shall be performed as each portion of the work progresses. Refuse and excess dirt shall be removed from the site, all walks and paving shall be broomed or washed down, and any damage sustained to the work of others shall be repaired and work returned to its original condition.

3.13 OPERATING INSTRUCTIONS

A. The Contractor shall train Owner’s maintenance personnel in proper operation of all major equipment. Provide written evidence of the person or persons so trained.

3.14 DEMONSTRATION

A. Instruct Owner's personnel in operation and maintenance of system. Use operation and maintenance material as basis for demonstration.

END OF SECTION

SECTION 32 90 00 - PLANTING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SECTION INCLUDES

A. Trees.

B. Shrubs.

C. Ground covers.

D. Plants.

E. Topsoil and soil amendments.

F. Fertilizers and mulches.

G. Stakes and guys.

H. Landscape edgings.

1.03 MEASUREMENT AND PAYMENT

A. Payment of the various Construction Items described in the Schedule of Values shall be considered full compensation for work of this Section.

B. Unit prices for soil preparation and for items that include backfill mixes shall be adjusted to reflect changes due to the requirements of soil lab recommendation.

1.04 RELATED SECTIONS

A. Section 32 80 00 – Irrigation: Coordination with head, pipe, and equipment locations.

B. Section 31 22 19 – Finish Grading: Topsoil

1.05 SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.

B. Materials List:
1. Within 15 days of Award, submit documentation that specified plants have been ordered. Include names and addresses of suppliers, and make arrangements for Landscape Architect to inspect plants at supplier's nursery.
2. Submit requests for substitutions with materials list.

C. Delivery Tickets:
1. Submit for all plants installed as part of the Project.
2. Include full botanical and common names of all plants.

D. Product Data - Submit data on the following:
1. Soil amendments.
2. Herbicides.
3. Fertilizers.
4. Substitutions for specified accessories.
5. Root Barrier.

E. Product certificates signed by manufacturers certifying that their products comply with specified requirements.
1. Manufacturer's certified analysis for standard products.
2. Analysis for other materials by a recognized laboratory made according to methods established by the Association of Official Analytical Chemists, where applicable.
3. Label data substantiating that plants, trees, shrubs, and planting materials comply with specified requirements.

F. Certification of grass seed from seed vendor for each grass-seed mixture stating the botanical and common name and percentage by weight of each species and variety, and percentage of purity, germination, and weed seed. Include the year of production and date of packaging.
1. Certification of each seed mixture for sod, identifying sod source, including name and telephone number of supplier.

G. Material test reports from qualified independent testing agency indicating and interpreting test results relative to compliance of the following materials with requirements indicated.
1. Analysis of existing surface soil.
2. Analysis of imported topsoil.

H. Samples of each of the following:
1. 5 lb of mineral mulch for each color and texture of stone required for Project, in labeled plastic bags.
2. Submit a 1 cubic foot sample of the following. Indicate supplier.
3. Organic matter.
4. Mulch.

5. Edging materials and accessories to verify color selection.

I. Planting schedule indicating anticipated dates and locations for each type of planting.

J. Test Reports: Submit soil test results and recommendations.

K. Maintenance instructions recommending procedures to be established by Owner for maintenance of landscaping during an entire year. Submit before expiration of required maintenance periods.

1.06 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced Installer who has completed landscaping work similar in material, design, and extent to that indicated for this Project and with a record of successful landscape establishment.
   1. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on the Project site during times that landscaping is in progress.

B. Provide quality, size, genus, species, and variety of trees and shrubs indicated, complying with applicable requirements of ANSI Z60.1 "American Standard for Nursery Stock."

C. Plant nomenclature shall conform to that used in New Sunset Western Garden Book, 2012 edition or later, published by Sunset Publishing Corporation. Names and varieties not listed in this reference shall be those most commonly used in the nursery trade.

D. Topsoil Analysis: Furnish a soil analysis made by a qualified independent soil-testing agency stating percentages of organic matter, inorganic matter (silt, clay, and sand), deleterious material, pH, and mineral and plant-nutrient content of topsoil.
   1. Report suitability of topsoil for growth of applicable planting material. State recommended quantities of nitrogen, phosphorus, and potash nutrients and any limestone, aluminum sulfate, or other soil amendments to be added to produce satisfactory topsoil.

E. Measurements: Measure trees and shrubs according to ANSI Z60.1 with branches and trunks or canes in their normal position. Do not prune to obtain required sizes. Take caliper measurements 6 inches above ground for trees up to 4-inch caliper size, and 12 inches above ground for larger sizes. Measure main body of tree or shrub for height and spread; do not measure branches or roots tip-to-tip.

F. Herbicides shall be applied by licensed applicator. Submit name, address, and license number of application firm.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Packaged Materials: Deliver packaged materials in containers showing weight, analysis, and name of manufacturer. Protect materials from deterioration during delivery and while stored at site.

B. Seed: Deliver seed in original sealed, labeled, and undamaged containers.

C. Trees and Shrubs: Deliver trees and shrubs in sizes as indicated in the drawings. Do not prune before delivery, except as approved by Landscape Architect. Protect bark, branches, and root systems from sun scald, drying, sweating, whipping, and other handling and tying damage. Do not bend or bind-tie trees or shrubs in such a manner as to destroy natural shape. Provide protective covering during delivery. Do not drop trees and shrubs during delivery.

D. Deliver trees, shrubs, ground covers, and plants after preparations for planting have been completed and install immediately. If planting is delayed more than 6 hours after delivery, set planting materials in shade, protect from weather and mechanical damage, and keep roots moist.
   1. Do not remove container-grown stock from containers before time of planting.
   2. Water root systems of trees and shrubs stored on site with a fine-mist spray. Water as often as necessary to maintain root systems in a moist condition.

1.08 PROJECT CONDITIONS

A. Utilities: Determine location of above grade and underground utilities and perform work in a manner which will avoid damage. Hand excavate, as required. Maintain grade stakes until removal is mutually agreed upon by parties concerned.

B. Excavation: When conditions detrimental to plant growth are encountered, such as rubble fill, adverse drainage conditions, or obstructions, notify Landscape Architect before planting.

C. Planting operations shall not be conducted under the following conditions:
   1. Freezing weather.
   2. Excessive heat.
   3. High winds.
   4. Excessively wet conditions.

1.09 SEQUENCING AND SCHEDULING

A. Coordinate planting operations with other construction to avoid damage to plants by other trades.

1.10 WARRANTY

A. General Warranty: The special warranty specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.

B. Special Warranty: Warrant the following living planting materials for the following specified time period after date of Substantial Completion, against defects including death and unsatisfactory growth, except for defects resulting from lack of adequate maintenance, neglect, or abuse by Owner, abnormal weather conditions unusual for warranty period, or incidents that are beyond Contractor's control.
   1. Trees – 1 year.
   2. Shrubs – 6 months.
   3. Ground covers – Length of maintenance period.

C. Remove and replace dead planting materials immediately unless required to plant in the succeeding planting season.

D. Replace planting materials that are in a substantially unhealthy condition (more than 25 percent of the plant dead or removed due to death of branches, etc.) at end of warranty period.

E. A limit of one replacement of each plant material will be required, except for losses or replacements due to failure to comply with requirements.

1.11 MAINTENANCE

A. Maintain trees, shrubs, groundcovers, and lawns by pruning, cultivating, watering, weeding, fertilizing, restoring planting saucers, tightening and repairing stakes and guy supports, and resetting to proper grades or vertical position, as required to establish healthy, viable plantings. Spray as required to keep trees and shrubs free of insects and disease. Time period of the maintenance periods as specified on the drawings, or if not specified then a minimum of 3 months.

B. Maintain and establish lawns by watering, fertilizing, weeding, mowing, trimming, replanting, and other operations. Roll, re-grade, and replant bare or eroded areas and re-mulch to produce a uniformly smooth lawn.

PART 2 - PRODUCTS

2.01 TREE AND SHRUB MATERIAL

A. General: Furnish nursery-grown trees and shrubs conforming to ANSI Z60.1, with healthy root systems developed by transplanting or root pruning. Provide well-shaped, fully-branched, healthy, vigorous stock free of disease, insects, eggs, larvae, and defects such as knots, sun scald, injuries, abrasions, and disfigurement.

B. Grade: Provide trees and shrubs of sizes and grades conforming to ANSI Z60.1 for type of trees and shrubs required. Trees and shrubs of a larger size may be used if acceptable to Landscape Architect.

C. Label at least 1 tree and 1 shrub of each variety and caliper with a securely attached, waterproof tag bearing legible designation of botanical and common name.

2.02 CONIFEROUS EVERGREENS

A. Form and Size: Normal-quality, well-balanced, coniferous evergreens, of type, height, spread, and shape required, conforming to ANSI Z60.1.

2.03 GROUND COVERS AND PLANTS

A. Provide ground covers and plants established and well rooted in removable containers or integral peat pots and with not less than the minimum number and length of runners required by ANSI Z60.1 for the pot size indicated.

2.04 GRASS MATERIALS

A. Grass Seed: Fresh, clean, dry, new-crop seed complying with the Association of Official Seed Analysts' "Rules for Testing Seeds" for purity and germination tolerances. Seed shall be of the latest crop, labeled in accordance with the California Food and Agricultural Code.
   1. Seed mix as indicated on the plans.

2.05 TOPSOIL

A. Topsoil: ASTM D 5268, pH range of 5.5 to 7, 4 percent organic material minimum, free of stones 1 inch or larger in any dimension, and other extraneous materials harmful to plant growth. Any topsoil added shall be thoroughly mixed with the existing site soil to a depth of 12” minimum (unless otherwise noted on drawings).
   1. Topsoil Source: Amend existing surface soil to produce topsoil. Supplement with imported topsoil when required.

2.06 SOIL AMENDMENTS

A. Lime: ASTM C 602, Class T, agricultural limestone containing a minimum 80 percent calcium carbonate equivalent, with a minimum 99 percent passing a No. 8 sieve and a minimum 75 percent passing a No. 60 sieve.
   1. Provide lime in the form of dolomitic limestone.

B. Aluminum Sulfate: Commercial grade, unadulterated.

C. Sand: Clean, washed, natural or manufactured sand, free of toxic materials.

D. Perlite: Horticultural perlite, soil amendment grade.

E. Peat Humus: Finely divided or granular texture, with a pH range of 6 to 7.5, composed of partially decomposed moss peat (other than sphagnum), peat humus, or reed-sedge peat.

F. Sawdust or Ground-Bark Humus: Decomposed, nitrogen-treated, of uniform texture, free of chips, stones, sticks, soil, or toxic materials.

G. Manure: Well-rotted, un-leached stable or cattle manure containing not more than 25 percent by volume of straw, sawdust, or other bedding materials; free of toxic substances, stones, sticks, soil, weed seed, and material harmful to plant growth.

H. Water: Potable.

2.07 HERBICIDES

A. EPA registered and approved, of type recommended by manufacturer.

B. Surflan, Round-Up or approved equal.

2.08 FERTILIZER

A. Bonemeal: Commercial, raw, finely ground; minimum of 4 percent nitrogen and 20 percent phosphoric acid.

B. Commercial Fertilizer: Commercial-grade complete fertilizer of neutral character, consisting of fast- and slow-release nitrogen, 50 percent derived from natural organic sources of urea-form, phosphorous, and potassium in the compositions as indicated on the drawings or as recommended by the soil test (soil test recommendation to take precedence over drawings).

2.09 MULCHES

A. Organic Mulch: Organic mulch, free from deleterious materials and suitable as a top dressing of trees and shrubs, consisting of one of the following:
   1. Type: Wood and bark chips – refer to drawings.

B. Mineral Mulch: Hard, durable stone, washed free from loam, sand, clay, and other foreign substances, of following type, size range, and color:
   1. Rounded riverbed gravel or smooth faced stone.
   2. Crushed stone or gravel. – per plans.

C. Peat Mulch: Provide peat moss in natural, shredded, or granulated form, of fine texture, with a pH range of 4 to 6 and a water-absorbing capacity of 1100 to 2000 percent.

2.10 STAKES AND GUYS

A. Upright: Rough-sawn, sound, new hardwood, redwood, or pressure-preservative-treated softwood, free of knots, holes, cross grain, and other defects, 2 by 2 inches by length indicated, pointed at one end.

B. Guy and Tie Wire: ASTM A 641, Class 1, galvanized-steel wire, 2-strand, twisted, 0.106 inch in diameter.

C. Guy Cable: 5-strand, 3/16-inch diameter, galvanized-steel cable, with zinc-coated turn buckles, 3-inch- long minimum, with two 3/8-inch- galvanized eyebolts.

D. Hose Chafing Guard: Reinforced rubber or plastic hose at least 1/2 inch in diameter, black, cut to lengths required to protect tree trunks from damage.

E. Flags: Standard surveyor's plastic flagging tape, white, 6 inches long.

2.11 LANDSCAPE EDGINGS

A. Edging: Refer to drawings.

2.12 ROOT BARRIER

A. As specified in the plans.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine areas to receive landscaping for compliance with requirements and for conditions affecting performance of work of this Section. Do not proceed with installation until unsatisfactory conditions have been corrected.

B. Start of work shall indicate Contractor's acceptance of existing conditions.

3.02 PREPARATION

A. Conduct weed control measures as specified in the drawings.

B. Lay out individual tree and shrub locations and areas for multiple plantings. Stake locations, outline areas, and secure Landscape Architect's acceptance before the start of planting work. Make minor adjustments as may be required.

3.03 PLANTING SOIL PREPARATION

A. Soil Testing: confirm that required soil testing has been completed and that soil mixes and soil preparation specifications have been revised to reflect the recommendations of the soils laboratory as approved by Landscape Architect.

B. Before mixing, clean topsoil of roots, plants, sods, stones, clay lumps, and other extraneous materials harmful to plant growth.

C. Mix soil amendments and fertilizers with topsoil at rates indicated. Delay mixing fertilizer if planting does not follow placing of planting soil within a few days.

D. For tree pit or trench backfill, mix planting soil before backfilling and stockpile at site.

E. For planting beds, mix planting soil either prior to planting or apply on surface of topsoil and mix thoroughly before planting.

3.04 GROUND COVER AND PLANT BED PREPARATION

A. Till soil in beds to a minimum depth of 12 inches and mix with specified soil amendments and fertilizers.

3.05 EXCAVATION FOR TREES AND SHRUBS

A. Pits and Trenches: Excavate with vertical sides and with bottom of excavation slightly raised at center to assist drainage. Loosen hard subsoil in bottom of excavation.
   1. Container-Grown Trees and Shrubs: Excavate pits twice the width and 1½ the depth of the container.

B. Mix subsoil removed from landscape excavations with soil amendment to use as backfill.

C. Obstructions: Notify Landscape Architect if unexpected rock or obstructions detrimental to trees or shrubs are encountered in excavations.

D. Drainage: Notify Landscape Architect if subsoil conditions evidence unexpected water seepage or retention in tree or shrub pits.

E. Fill excavations with water and allow to percolate out before placing setting layer and positioning trees and shrubs.

3.06 PRE-EMERGENT HERBICIDE

A. Apply herbicides in accordance with manufacturer’s recommended rates and procedures.

B. Apply to soil of all planting bed areas prior to placement of mulch.

3.07 PLANTING TREES AND SHRUBS

A. Set container-grown stock plumb and in center of pit or trench with top of ball raised above adjacent finish grades as indicated.
   1. Carefully remove containers so as not to damage root balls.
   2. Place stock on setting layer of compacted planting soil.
   3. Place backfill around ball in layers, tamping to settle backfill and eliminate voids and air pockets. When pit is approximately 1/2 backfilled, water thoroughly before placing remainder of backfill. Repeat watering until no more is absorbed. Water again after placing and tamping final layer of backfill.

B. Dish and tamp top of backfill to form a 3-inch-high mound around the rim of the pit (not in turf). Do not cover top of root ball with backfill.

3.08 TREE AND SHRUB PRUNING

A. Prune, thin, and shape trees and shrubs as directed by Landscape Architect.

3.09 TREE AND SHRUB GUYING AND STAKING

A. Upright Staking and Tying: Use a minimum of 2 stakes of length required to penetrate at least 18 inches below bottom of backfilled excavation and to extend at least 72 inches above grade. Set vertical stakes and space to avoid penetrating balls or root masses. Support trees with 2 strands of tie wire encased in hose sections at contact points with tree trunk. Allow enough slack to avoid rigid restraint of tree. Refer to staking detail in the drawings.

B. Guying and Staking: Guy and stake trees exceeding 14 feet and more than 3-inch caliper unless otherwise indicated. Securely attach no fewer than 3 guys to stakes 30 inches long, driven to grade. Attach flags to each guy wire, 30 inches above finish grade.

3.10 PLANTING GROUND COVER AND PLANTS

A. Space ground cover and plants as indicated on the drawings.

B. Dig holes large enough to allow spreading of roots, and backfill with planting soil. Work soil around roots to eliminate air pockets and leave a slight saucer indentation around plants to hold water. Water thoroughly after planting, taking care not to cover plant crowns with wet soil.

3.11 MULCHING

A. Mulch backfilled surfaces of pits, trenches, planted areas, and other areas indicated.

B. Mulch: Apply the following average thickness of mulch per plans and finish level with adjacent finish grades. Do not place mulch against trunks or stems.
   1. Thickness: As indicated on drawings.

3.12 INSTALLATION OF EDGINGS

A. Wood Headers: Install wood headers or edgings where indicated. Anchor with wood stakes spaced up to 36 inches apart, driven at least 1 inch below top elevation of header or edging. Use 2 galvanized nails per stake to fasten headers and edging; length as needed to penetrate both members and provide 1/2-inch clinch at point. Pre-drill stakes when needed to avoid splitting.

3.13 CLEANUP AND PROTECTION

A. During landscaping, keep pavements clean and work area in an orderly condition.

B. Protect landscaping from damage due to landscape operations, operations by other contractors and trades, and trespassers. Maintain protection during installation and maintenance periods. Treat, repair, or replace damaged landscape work as directed.

3.14 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Disposal: Remove surplus soil and waste material, including excess subsoil, unsuitable soil, trash, and debris, and legally dispose of it off the Owner's property.

END OF SECTION

SECTION 33 41 00 – STORM DRAINAGE SYSTEM

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Storm drainage piping, fittings, and accessories.

B. Catch basins and related structures.

C. Cast in place concrete culvert structure.

1.02 RELATED SECTIONS

A. Section 02315 - Filling and Backfilling.

B. Section 02320 - Trenching.

1.03 REFERENCES

A. ASTM C 76 - Reinforced Concrete Culvert, Storm Drain and Sewer Pipe.

B. ASTM D3034 - Type PSM Poly (vinyl Chloride) (PVC) Sewer Pipe and Fittings.

C. ASTM D2751 - ABS Sewer Pipe and Fittings.

D. *State of California, Department of Transportation (CalTrans), Standard Specifications*, as adopted by serving jurisdictional authority.

E. Regional Standard Drawings, latest edition, with amendments as adopted by serving jurisdictional authority.

F. Nevada County Road Standards, latest edition, with amendments as adopted by serving jurisdictional authority.

1.04 PUBLIC AGENCY DESIGN CRITERIA

A. Construct all systems indicated as public agency standards in accordance with the standard plans and specifications of that agency.

B. Where connections are made to existing public drainage systems, connect in accordance with the instructions or specifications of the authority having jurisdiction and in the presence of a representative of that agency.

C. Where drain lines, drainage structures, and appurtenances are constructed in public streets or rights of way, construct in accordance with the standard plans and specifications of the authority having jurisdictions and in the presence of a representative of that agency.

D. The Owner will pay for associated inspection fees.

E. Upon completion of the work, provide the Architect with written certification of acceptance of work by the governing agency having jurisdiction.

1.05 REGULATORY REQUIREMENTS

A. Conform to *State of California, Department of Transportation (CalTrans), Standard Specifications,* as adopted by serving jurisdictional authority.

B. Conform to Regional Standard Drawings, latest edition, with amendments as adopted by serving jurisdictional authority.

1.06 PUBLIC AGENCY STANDARDS

A. Construct all systems indicated as public agency standards in accordance with the standard plans and specifications of that agency.

B. Where connections are made to existing public drainage systems, connect in accordance with the instructions or specifications of the authority having jurisdiction and in the presence of a representative of that agency.

C. Where drain lines, drainage structures, and appurtenances are constructed in public streets or rights of way, construct in accordance with the standard plans and specifications of the authority having jurisdictions and in the presence of a representative of that agency.

D. Secure and pay for all necessary permits for work performed. The Owner will pay for associated inspection fees.

E. Upon completion of the work, provide the Architect with written certification of acceptance of work by the governing agency having jurisdiction.

1.07 QUALITY ASSURANCE:

A. Contractor Qualifications:

1. Installing Company: Company specializing in installation of storm drainage systems, with minimum 5 years documented experience in installation of projects of similar scale and scope.

2. Installing Foreman: Individual specializing in installation of storm drainage systems, with minimum 5 years documented experience in installation of projects of similar scale and scope.

3. Use only staff who are completely familiar with the manufacturers' recommended methods of installation as well as the requirements of this work.

1.08 SUBMITTALS

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

B. Shop Drawings:

1. Manholes: Include plans, elevations, sections, details, frames, and covers.

2. Drainage Inlets: Include plans, elevations, sections, details, frames, and covers.

1.09 PROJECT RECORD DOCUMENTS

A. Accurately record location of pipe runs, connections, catch basins, manholes, cleanouts, and invert elevations.

PART 2 - PRODUCTS

2.01 PIPE MATERIALS

A. PVC Pipe:

1. Pipe 4 inch diameter and smaller: ASTM D 2751, SDR 35, with solvent welded joints per ASTM D 2235.

2. Pipe 4 to 15 inch diameter: ASTM D 3034, Type PSM SDR 35, bell and spigot end configuration for elastomeric gaskets.

B. Reinforced Concrete Pipe and Transitions: Pipe conforming to ASTM C 76, Class 1350-D minimum//D loading shall be per manufacturers recommendations.

C. HDPE Pipe:

1. Provide ADS N-12 HDPE pipe, with integral bell and spigot joints, corrugated exterior with smooth interior, at locations shown on drawings, complying with Section 64, CalTrans Standard Specifications and AASHTO Designation M-252 or M-294 Type S. Unless shown otherwise, provide cell classification 324420C, or as required by jurisdictional authority

D. Non-Reinforced Concrete Pipe and Transitions: Pipe shall conform to ASTM C 14, Class 3.

2.02 PIPE ACCESSORIES

A. Fittings: Same material as pipe, molded, or formed to suit pipe size and end design, in required 'T', bends, elbows, reducers, taps, and other connections.

B. Joint Gaskets: ASTM F 477.

1. PVC Joint Gaskets: Comply with ASTM F 477.

2. Concrete Pipe Joint Gaskets Assemblies and Pipe Ends: Unless noted otherwise, provide rubber joints complying with ASTM C 443, suitable for use with sewage.

(a) Provide bell and spigot joints, with neutral lubricant agent.

(b) Provide tongue and groove joints, with neutral lubricant agent.

(c) Provide tongue and groove joint, with AASHTO M198, Type B preformed plastic gasket. Provide primer and lubricant as recommended by manufacturer.

C. Cleanouts - Paving areas: J. R. Smith or equal, 4240/37 Series, scoriated cast-iron lid, tractor type, set flush with surface, with vandal proof screw. Stamped in accordance with agency requirements.

D. Cleanouts - Landscaped/planting areas: J. R. Smith or equal, 4220/4231 Series, scoriated cast-iron lid, set flush with surface, with vandal proof screw. Stamped in accordance with agency requirements.

2.03 CATCH BASINS

A. Provide cast-in-place concrete base with precast concrete catch basin where shown on drawings.

B. Provide grate and frame, dimension as shown on Drawings, hot dipped galvanized finish after fabrication, with 1/2 inch maximum grate opening dimension in direction of travel, and H-20 traffic loading capacity in traffic-rated areas. Provide lockable device for anchoring grate to frame.

2.04 AREA DRAINS

A. Asphalt paving areas: Nyloplast, or equal, cast-iron lid, tractor type, set flush with surface, with vandal proof screw.

B. Concrete paving areas: Nyloplast, or equal, cast-iron lid, ½-inch maximum grate opening, set flush with surface, with vandal proof screw.

C. Landscaped/planter areas: Nyloplast, or equal, cast iron square grates, 12 inch square, with all required fittings, caps, catch basin box, and risers. Grate color as selected by Architect.

2.05 HEADWALLS/INLET/RECEPTOR/OUTLET BOX STRUCTURES

A. Cast in place concrete, complying with Section 03310 and referenced standards.

2.06 BEDDING/BACKFILL MATERIAL

A. As specified in Section 02320.

2.07 CAST IN PLACE CONCRETE CULVERT STRUCTURE

A. Cast in place concrete, complying with Section 03310.

2.08 DESIGN CRITERIA

A. General

1. All improvements shall be constructed per the referenced standards, the contract documents, and as specified in this section.

2. Where criteria shown on drawings or specified in this specification exceed that of the referenced standards, the more stringent criteria shall apply.

PART 3 - EXECUTION

3.01 SURFACE CONDITIONS

A. Inspection

1. Prior to work of this section, carefully inspect previously installed work. Verify all such work is complete to the point where this installation may properly commence.

2. Verify that work of this section may be installed in strict accordance with the original design, all pertinent codes and regulations, and all pertinent portions of the referenced standards.

3. In the event of discrepancy, immediately notify the Architect.

4. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.

3.02 PREPARATION

A. Hand trim excavations to required elevations. Correct over excavation with fill material as specified in Section 02320.

B. Remove large stones or other hard matter which could damage drainage pipe or impede consistent backfilling or compaction.

C. Preparation

1. Provide all staking and field engineering required to implement the work as shown on the drawings.

2. Protect all stakes and benchmarks. Replace all stakes and benchmarks damaged during the course of construction at no cost to Owner.

3. Provide all equipment of such type, function and design as required to achieve specified values.

3.03 INSTALLATION - PIPE

A. Install pipe, fittings, and accessories in accordance with manufacturer's instructions. Seal joints tight

B. Lay pipe on bedding and to slope gradients noted on drawings. Begin construction at lowest point of connection or discharge, lay continuously upstream.

C. Lay bell and spigot or tongue and groove pipe with bell end or groove end upstream.

D. Install additional bedding at sides and over top of pipe as shown on drawings. Provide top cover to minimum compacted thickness of 12 inches minimum, or as specified in manufacturer's specifications, whichever is greater.

E. Backfill trench in accordance with the provisions of Section 02320.

3.04 INSTALLATION - CATCH BASINS AND CLEANOUTS

A. Establish elevations and pipe inverts for inlets and outlets as indicated.

B. Form bottom of excavation clean and smooth to correct elevation.

C. Form and place cast in place concrete catch basins with pipe ends in place.

D. Mount lid and frame level at elevation indicated.

3.05 PROTECTION

A. Protect finished installation so that the finished work complies accurately with the Project documents.

3.06 *INSTALLATION - CULVERT SYSTEM*

A. Establish elevations and pipe inverts for inlets and outlets as indicated.

B. Form culvert as shown on drawings and per Section 03100.

C. Install reinforcing in compliance with Section 03200.

D. Install concrete in compliance with Section 03310, including mix design, quality control and placement criteria.

3.07 FIELD QUALITY CONTROL

A. Field inspection will be performed under provisions of Section 00700, Article 58 and 59.

1. Inspection of private system work will be performed by Owner’s engineer of record.

2. Inspection of public system work will be performed by jurisdictional authority inspector.

3. Obtain approval of all piping installations prior to covering piping.

B. Alignment Inspection

1. Private lines will be checked by the engineer when backfill has reached the top of the pipe. Both external and internal inspections for alignment may be made at this time.

2. Correct, to the engineer's satisfaction, any section of the line found to be unsatisfactory in material, alignment, grade, or joints.

3. Comply with inspection sequence and scope requirements as established by jurisdictional authority for public system.

END OF SECTION 33 41 00

APPENDIX A

Nevada County Operations Center
Mitigation Measures

AESTHETICS

Mitigation Measures

None required.

AGRICULTURAL & FOREST RESOURCES

Mitigation Measures

None required.

AIR QUALITY

Mitigation Measures

MM-3a. The Project will incorporate the following mitigation measures during the construction phase, as recommended by NSAQMD for emissions within the Level B Threshold range (shown in *italics*):

a) *Alternatives to open burning of vegetative material will be used unless otherwise deemed infeasible by the District. Among suitable alternatives are chippings, mulching, or conversion to biomass fuel.*

b) *Grid power shall be used (as opposed to diesel generators) for job site power needs where feasible during construction.*

c) *Construction activities shall be scheduled to direct traffic flow to off-peak hours as much as practical.*

d) *Prepare a Dust Control Plan in compliance with District / State Rules & Regulations as follows:*

Recommended Dust Control Plan Conditions

1. *The applicant shall be responsible for ensuring that all adequate dust control measures are implemented in a timely manner during all phases of project development and construction.*
2. *All material excavated, stockpiled, or graded shall be sufficiently watered, treated, or covered to prevent fugitive dust from leaving the property boundaries and causing a public nuisance or a violation of an ambient air standard. Watering should occur at least twice daily, with complete site coverage.*
3. *All areas with vehicle traffic shall be watered or have dust palliative applied as necessary for regular stabilization of dust emissions.*
4. *All on-site vehicle traffic shall be limited to a speed of 15 mph on*

unpaved roads.

5. *All land clearing, grading, earth moving, or excavation activities on a project shall be suspended as necessary to prevent excessive windblown dust when winds are expected to exceed 20 mph.*
6. *All inactive portions of the development site shall be covered, seeded, or watered until a suitable cover is established. Alternatively, the applicant may apply County-approved nontoxic soil stabilizers (according to manufacturer's specifications) to all inactive construction areas (previously graded areas which remain inactive for 96 hours) in accordance with the local grading ordinance.*
7. *All material transported off-site shall be either sufficiently watered or securely covered to prevent public nuisance, and there must be a minimum of six (6) inches of freeboard in the bed of the transport vehicle.*

   Paved streets adjacent to the project shall be swept or washed at the end of each day, or more frequently if necessary, to remove excessive or visibly raised accumulations of dirt and/or mud which may have resulted from activities at the project site.
8. *Prior to final occupancy, the applicant shall re-establish ground cover on the site through seeding and watering in accordance with the local grading ordinance.*

MM-3b. All architectural coating activities associated with construction of the proposed project shall be required to use interior and exterior coatings that contain less than 250 grams of volatile organic compounds (VOC/ROG) per liter of coating.

MM-3c. To offset project contributions to cumulative air quality degradation, wood burning stoves or fireplaces are prohibited.

MM-3d. All material that may cause dust such as sand, rock, dirt, etc. shall be watered down during placement or removal of the material from the site.

BIOLOGICAL RESOURCES

MM-4a. No more than 30 days prior to ground disturbance or commencement of construction (March 1 – September 15), a qualified biologist shall conduct a pre-construction survey for long-eared owl, raptors, and migratory bird species. The survey shall be conducted to identify any active nests located within or near the construction area. If active nests are found during the survey, the applicant shall delay construction activities in the area until a qualified biologist determines that juveniles have fledged the nest(s), relocating the nest if avoidance of

the nesting period is not feasible, or establishing a "no construction" buffer zone (to be determined by the biologist) around the nest, as approved by the California Department of Fish and Wildlife. These measures will ensure compliance with the Migratory Bird Treaty Act and the California Department of Fish and Game Code 3503.5.

CULTURAL RESOURCES

MM-5a. In the event that previously undiscovered cultural resources are encountered during project construction, all activity within 200 feet of the find shall cease until it can be evaluated by a qualified archaeologist. If the archaeologist determines that the resources may be significant, the archaeologist will notify the Facilities Program Manager and will develop an appropriate treatment plan for the resources. Mitigation measures, as recommended by the archaeologist and approved by the Community Development Director in accordance with Appendix K of the CEQA Guidelines, shall be implemented prior to recommencement of construction activity.

The archaeologist shall consult with Native American representatives in determining appropriate treatment for unearthed cultural resources if the resources are prehistoric or Native American in nature. If avoidance is infeasible, other appropriate measures (e.g., data recovery) will be instituted. Work may proceed on other parts of the project area while mitigation for cultural resources is being carried out.

MM-5b. If human skeletal remains are uncovered during project construction, the contractor shall immediately halt work, contact the Nevada County Coroner to evaluate the remains, and follow the procedures and protocols set forth in Section 15064.5 (e)(1) of the CEQA Guidelines.

If the County Coroner determines that the remains are Native American, the project proponent will contact the NAHC, in accordance with Health and Safety Code Section 7050.5, subdivision (c), and Public Resources Code 5097.98 (as amended by AB 2641). Per Public Resources Code 5097.98, the landowner shall ensure that the immediate vicinity where the Native American human remains are located, is not damaged or disturbed by further development activity until the landowner has discussed and conferred, as prescribed in this section (PRC 5097.98), with the most likely descendants regarding their recommendations, if applicable, taking into account the possibility of multiple human remains.

GEOLOGY & SOILS

Nevada County Operations Center
Mitigation Measures

To ensure that the construction techniques are done in accordance with the recommendations of the geotechnical engineering report, the following mitigation measures are proposed:

MM-6a. Erosion control measures and incorporation of Best Management Practices (BMPs) shall be implemented to stabilize areas disturbed. Temporary measures should be installed to provide short-term protection until the permanent measures are installed and effective. Temporary BMP's shall include measures to slow runoff velocity and intercept suspended sediment to prevent sediment discharge from the construction area while allowing runoff to continue down gradient. Typical temporary BMP's may include: silt fences, straw bales, sediment logs, water bars, detention basins, covering of exposed soil and/or channel linings. Temporary erosion control measures may be left in place for a complete growing season following completion of construction and planting/seeding. The type and location of the BMP's shall be included on the Improvement Plans and shall meet the Regional Water Quality Control Board, Central Valley Region's standards for erosion and sediment control. Prior to any site disturbance, approved erosion control measures and BMPs shall be installed onsite.

MM- 6b. Permanent BMP's including rock slope protection (if steep slopes are encountered), rock lined ditches, inlet/outlet protection, rock energy dissipaters, infiltration/detention basins and re-vegetation shall be in place prior to removal of temporary erosion and sediment control measures. All areas disturbed by construction that are not surfaced or landscaped shall be re-vegetated with native seed mix.

MM-6c. Grading disturbance shall be minimized and existing vegetation should be protected and undisturbed where possible. Organic surface topsoil shall be stockpiled for reuse in landscape areas.

GEOLOGY & SOILS

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MM-6c. Grading disturbance shall be minimized and existing vegetation should be protected and undisturbed where possible. Organic surface topsoil shall be stockpiled for reuse in landscape areas.

GREENHOUSE GAS EMISSIONS

Mitigation Measures

None Required.

HAZARDS/HAZARDOUS MATERIAL

MM-8a. Prior to building permit issuance, a No Further Action letter shall be obtained from DTSC.

MM-8b. If evidence of contamination associated with past operations is encountered during construction, an environmental professional shall be retained to assess the environmental conditions and assist in evaluating proper removal and disposal options.

MM-8c. Pursuant to Public Resources Code Section 4291(b), Nevada County Corporation Yard shall maintain the 100 foot fuel clearance setback for all new structures located at the project site.

HYDROLOGY& WATER QUALITY

Nevada County Operations Center
Mitigation Measures

Mitigation Measures

None required.

LAND USE & PLANNING

Mitigation Measures

None required.

MINERAL RESOURCES

Mitigation Measures

None required.

NOISE

MM-12a. Hours of operation for exterior construction activities shall be limited from 7 am to 7 pm, Monday through Saturday. Interior construction activities may occur after these hours if such activities will not result in exterior noise audible at the property boundary. Hours of operation shall be noted on the Improvement Plans. These hours of operation are for the construction phase only and do not apply to the day- to-day operations.

POPULATION & HOUSING

Mitigation Measures

None required.

PUBLIC SERVICE

Mitigation Measures

None required.

RECREATION

Mitigation Measures

None required.

TRANSPORTATION/TRAFFIC

Mitigation Measures

None required.

UTILITIES/SERVICE SYSTEMS

Mitigation Measures

No Mitigation Required.

APPENDIX B

GEOTECHNICAL ENGINEERING REPORT
NEVADA COUNTY OPERATIONS CENTER
12350 LaBarr Meadows Road
Nevada County, California

Prepared for:
LDA Partners
222 Central Court
Stockton, CA 95204

Prepared by:
Holdrege & Kull
792 Searls Avenue
Nevada City, CA 95959

Project No. 4266A-01
June 28, 2017

HOLDREGE & KULL
CONSULTING ENGINEERS • GEOLOGISTS

Project No. 4266A-01
June 28, 2017

LDA Partners
222 Central Court
Stockton, CA 95204

Attention: Peter Rosado, Architect

Reference: ***Nevada County Operations Center***
12350 LaBarr Meadows Road
Grass Valley, California

Subject: ***Geotechnical Engineering Report***

Dear Mr. Rosado:

Holdrege & Kull (H&K) prepared this report to present the findings of our geotechnical engineering investigation for the proposed Nevada County Operations Center (NCOC) at 12350 LaBarr Meadows Road, near the southern boundary of Grass Valley in Nevada County, California. We understand that the proposed development consists of a single commercial structure with associated equipment storage and parking areas. The subject property comprises approximately 39.3 acres and includes Nevada County Assessor's Parcel Numbers (APNs) 22-331-05, 22-331-06, 22-331-07, 22-331-09, and 22-331-12.

The findings presented in this report are based on our May 2017 investigation including literature review, exploratory trenching, laboratory analysis and geophysical survey, as well as our understanding of the currently proposed development.

Our opinion is that the project is feasible from a geotechnical standpoint, provided that the recommendations presented in this report are incorporated into the project plans. Our investigation identified subsurface conditions (uncompacted fill containing organic debris) that may cause settlement related issues for overlying structures and pavement. The debris fill should be mitigated pursuant to the recommendations of this report prior to site development.

Please contact us if you have questions regarding the findings and recommendations presented in this report.

Sincerely,

HOLDREGE & KULL

Prepared by:

Bryan Botsford
Staff Geologist

Reviewed by:

Jason W. Muir, G.E. 2697
Associate Engineer

copies: 5 to LDA Partners
PDF to LDA Partners: Peter Rosado, prosado@ldapartners.com

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Appendix D Laboratory Reports
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1 INTRODUCTION

At the request of LDA Partners, Holdrege & Kull (H&K) prepared this geotechnical report to support the design and construction of the proposed Nevada County Operations Center (NCOC) to be located at 12350 LaBarr Meadows Road near the southern boundary of Grass Valley in Nevada County, California.

H&K's services were performed in general accordance with our March 2, 2016 proposal, a copy of which is included as Appendix A of this report. For your review, Appendix B contains a document prepared by ASFE entitled *Important Information About Your Geotechnical Engineering Report,* which summarizes the general limitations, responsibilities, and use of geotechnical reports.

1.1 SITE DESCRIPTION

The proposed Nevada County Operations Center is located east of State Route 49 and west of La Barr Meadows Road, approximately one tenth of a mile south of the southern city limits of Grass Valley in Nevada County, California. The property comprises five parcels, which are designated as Nevada County Assessor's Parcel Numbers (APNs) 22-331-05, 22-331-06, 22-331-07, 22-331-09, 22-331-12.

Elevations at the property range from approximately 2,430 feet to 2,550 feet above mean sea level. The property generally slopes to the north, northeast and northwest from a high point at the southern property boundary. Site topography is generally characterized by a gentle north-northeast trending natural ridge line. The proposed development is to be located centrally within this upland portion of the site, and no development is planned in the low-lying, northeastern portion of the property where previous investigation has identified poor drainage and soil conditions. The northeastern portion of the site retains features from past industrial operations such as the Bear River lumber mill and Bullion gold mine.

Figure 1 is a topographic map of the site vicinity prepared by the United States Geological Survey (USGS; photo-revised 1973) depicting the site location with respect to Grass Valley. Figure 2 is a site map depicting our exploratory locations and proposed site improvements.

1.2 PROPOSED IMPROVEMENTS

H&K's understanding of the proposed development project is based on our review of the *Schematic Site Plan, Nevada County Operations Center* (LDA Partners; March 1, 2017) and the *Preliminary Grading Exhibit* (SCO Planning and

Engineering; May 2017). We understand that the proposed development will include a commercial structure with associated equipment storage and parking areas. The proposed commercial structure will consist of a pre-engineered, single-story metal structure including separate office and shop spaces. Based on information provided by LDA Partners, this structure could potentially include a second story. We anticipate that the structure foundations will include continuous and isolated, reinforced concrete footings with concrete slab-on-grade floors. Appurtenant construction will include paved roads, parking lots, various covered storage areas, and underground utilities.

1.3 PURPOSE

The geotechnical engineering recommendations presented in this report are intended to support the design and construction of the proposed Nevada County Operations Center. The findings presented in this report are based on our geotechnical engineering investigation including literature review, exploratory trenching, laboratory analysis and geophysical survey, as well as our understanding of the currently proposed development.

The validity of the recommendations presented in this report is contingent upon our review of construction plans and our observation and testing during construction. When construction plans are finalized, H&K should be retained to review the plans in order to verify that our recommendations have been incorporated. H&K should be retained to observe and test during construction to verify that our recommendations are implemented, and to verify that subsurface conditions are as observed in our exploratory trenches.

1.4 SCOPE OF INVESTIGATION

H&K's geotechnical investigation included:

- Review of readily available geologic maps and soil survey information;
- Review of readily available reports and data pertaining to past site investigation;
- Subsurface investigation consisting of exploratory trenches;
- Collection and laboratory testing of soil samples to determine their engineering material properties;
- Seismic refraction and refraction microtremor (ReMi) survey; and
- Engineering analysis to determine geotechnical design criteria.

H&K's scope of geotechnical investigation did not include a groundwater flow analysis or an evaluation of the site for the presence of hazardous materials, asbestos or mold. H&K previously performed hazardous materials site investigation (H&K, 2014a and 2014b), the findings of which facilitated a regulatory "No Further Action Required" determination by the California Department of Toxic Substances Control (DTSC, 2015a), including a land use covenant located in the northeastern portion of the property (DTSC, 2015b).

2 SITE CHARACTERIZATION

H&K performed a geotechnical engineering investigation to characterize surface conditions and shallow subsurface soil/rock conditions. Our investigation included a literature review and field investigation as described below.

2.1 SITE HISTORY

Hard rock gold mining was performed in the vicinity of the site from the middle of the 19th century to the early 20th century. Although no mine workings are known at the site, the workings of the former Bullion Mine are located to the north and northeast of the site, and waste rock associated with these mine workings is the subject of a land use covenant in the low-lying area at the eastern side of the northern edge of the site, as documented by H&K (2014a, 2014b) and DTSC (2015a and 2015b). In general, the nearby underground mine workings extend towards the northeast, away from the site.

Lumber milling and wood products production facilities were located north of the site from 1956 until 1978 (Jensen, 1999). The former Bear River Sawmill was located immediately north of the site, and the Valley Veneer facility was located approximately ¼ mile north of the site.

2.2 PREVIOUS ASSESSMENT

H&K reviewed the following previous assessment documents related to hazardous materials and geotechnical conditions. The information in these reports includes the subject property as well as portions of the property immediately north and adjacent to the subject property.

1. Phase 1 Site Characterization, Bear River Sawmill and Valley Veneer Plant, Nevada County, California. Emcon Associates, January 1990
2. Remedial Investigation/Alternative Analysis Summary Report, Bear River Sawmill and Valley Veneer Plant, Nevada County, California. Emcon Associates, June 1991
3. Preliminary Geotechnical and Geologic Hazards Report. H&K, August 20, 1999
4. Preliminary Abandoned Mine Site Characterization for Bear River Mill Site. H&K, October 3, 2001
5. Bear River Mill Site, La Barr Meadows Road, Nevada County, California. Carlton Engineering Inc., January 8, 2002

6. Preliminary Geotechnical Engineering Report for Crestview Drive / State Route 49 Intersection, Nevada County, California. H&K, July 13, 2005
7. Final Bear River Removal Action Workplan. Carlton Engineering Inc., September 23, 2005
8. Preliminary Geologic Hazards Report. H&K, October 10, 2008
9. Phase I Environmental Assessment, Former Bear River Sawmill Property, State Highway 49/La Barr Meadows Road, Nevada County, California. Rainey Geotechnical Inc., June 23, 2011
10. Discussion of Potential Contaminants, Bear River Mill Site, APNs 22-311-05, 06, 07, 09, and 12, Nevada County, California. H&K, July 20, 2011
11. Nevada County, Bear River Mill Properties - Request for No Further Action. Nevada County Facilities Management Division, June 6, 2012
12. Notice of Proposed Negative Declaration APNs 22-311-05, 06, 07, 08, 09, 10, 11, 12; and 22-250-10, 16, 23. Nevada County Planning Department, May 2, 2013
13. Final Supplemental Site Investigation Work Plan, Nevada County Facilities Management Site. H&K, July 18, 2014
14. Final Report of Supplemental Site Investigation, Nevada County Facilities Management Site. H&K, December 17, 2014

Other previous assessment documents were not available for review but were referenced by the reports listed above.

2.2.1 Previous Geotechnical Engineering Investigation

The subject Nevada County Operations Center (NCOC) site previously comprised the southern end of the 65-acre former Bear River Saw Mill (BRM) site. H&K (1999) performed a preliminary geotechnical and geologic hazards investigation for the BRM site, which included the excavation of 33 exploratory trenches to depths ranging from 3 to 13 feet below the ground surface (bgs). Findings and preliminary geotechnical engineering recommendations are presented in H&K's *Preliminary Geotechnical and Geologic Hazards Report for Bear River Mill Site* (August 20, 1999).

H&K (2000) issued an amendment to the report (January 31, 2000) which addressed shallow mine workings identified in the northeast portion of the BRM site (north of the subject NCOC site). H&K (2001) performed additional subsurface investigation and soil sampling to characterize abandoned mine features on the

BRM site. Findings and recommendations are presented in H&K's *Preliminary Abandoned Mine Site Characterization for Bear River Mill Site, Nevada County, California* (October 3, 2001).

H&K (2005a) performed a preliminary geotechnical engineering investigation for proposed improvement of the intersection of State Route 49 and Crestview Drive. Findings are presented in H&K's *Preliminary Geotechnical Engineering Report for Crestview Drive / State Route 49 Intersection, Nevada County, California* (July 13, 2005).

H&K (2008) performed a preliminary geologic hazards report investigation for the BRM site as part of the previously proposed Village at SouthHill development.

2.2.2 Previous Hazardous Materials Site Investigation and Cleanup

As stated above, the subject Nevada County Operations Center (NCOC) site previously comprised the southern end of the 65-acre former Bear River Saw Mill (BRM) site (Envirostor ID 29240006, DTSC Site Code 100331).

The County of Nevada acquired the NCOC site (also known as the Nevada County Facilities Management site, Envirostor ID 60001746, DTSC Site Code 102189) and executed a Voluntary Cleanup Agreement (VCA) with DTSC in 2013. H&K (2014b) characterized environmental conditions at the site. DTSC certified the site in a "No Further Action" letter (November 5, 2015) subject to a land use covenant (LUC) that was recorded on the eastern portion of the northern edge of the property to address elevated metals concentrations remaining in place in soil resulting from previous industrial activities.

The remainder of the former BRM site is now owned by Jim and Jamie Hopper, who are presently working with DTSC to address environmental conditions on that property. Environmental investigation and remediation activities have been performed at the BRM site since 1988, initially under a VCA between DTSC and Sierra Pacific Industries. The early site investigations at the BRM site focused on the prior release of wood treating chemicals and diesel fuel. Investigation findings and monitoring results were presented in approximately 26 reports prepared by Emcon Associates, Vector Engineering, Kennedy/Jenks/ Chilton Consultants, Inc., Anderson Consulting Group and Sierra Pacific Industries. Diesel contamination was not detected in site groundwater after 1999. The California Regional Water Quality Control Board (RWQCB) issued a "No Further Action Required" letter pertaining to the diesel fuel release on October 6, 2004.

Concrete and soil impacted by pentachlorophenol (PCP, a fungicide) were removed from the Green Chain Area of the former Bear River Sawmill and disposed at a landfill in 1989 and 1991. Subsequent verification soil sampling was performed by Carlton Engineering, Inc. (Carlton) under the oversight of the DTSC. No PCP or other semi-volatile organic compounds were detected in soil samples obtained from the excavation areas. Wood treating chemicals were not reported to have been used at the Valley Veneer Plant and were not detected in soil or groundwater samples collected from that area.

H&K (2001, 2005a, 2011, 2017a, 2017b) and Carlton (2002, 2005) characterized abandoned mine features at the BRM site (north of the subject NCOC site). A Removal Action Work Plan (RAW) was approved by DTSC in 2005, but it has not yet been implemented. A supplemental site investigation associated with the proposed removal action is scheduled to be performed by H&K in July 2017.

2.3 PHYSICAL SETTING

The site is located in the Sierra Nevada Foothills, on the western side of the Sierra Nevada geomorphic province. The Sierra Nevada province is an elongate, north-west trending structural block that is tilted upward to form a steep scarp above the adjacent Basin and Range province to the east. The western slope of the Sierra Nevada dips gently westward, and extends beneath sediment of the Great Valley province. Continual uplift and erosion of the Sierra Nevada contributes to sediment within the Great Valley.

2.3.1 Geologic Setting

The western foothills of the Sierra Nevada consist of a complex assemblage of igneous and metamorphic rocks. The regional structure of the foothills is characterized by the north-northwest trending Foothills Fault System, a feature formed during the Mesozoic era between 65 million and 230 million years before present (MYBP) in a compressional tectonic environment. A change to an extensional tectonic environment during the Late Cenozoic (last 9 million years) resulted in normal faulting which has occurred coincident with some segments of the older faults near the site.

The 1:250,000-scale Geologic Map of the Chico Quadrangle (G.J. Saucedo and D.L. Wagner, California Division of Mines and Geology, 1992) maps the property location as being underlain by plutonic rocks. According to Tuminas (1983), the site is underlain by early Cretaceous, La Barr Meadows quartz diorite. The early Cretaceous period encompasses a time frame of approximately 100 to 145 MYBP.

2.3.2 Soil Conditions

The *Soil Survey of Nevada County Area, California* (soil survey) published by the United States Department of Agriculture Soil Conservation Service and Forest Service (1993) depicts four general soil types at the location of the site: Musick Sandy Loam, Hoda Sandy Loam, Horseshoe Gravelly Loam, and Alluvial Land.

Musick and Hoda soil types dominate the higher, southern portion of the site. Both soil types are characterized by well drained surface soil underlain by weathered granodiorite rock.

The soil survey depicts the Horseshoe gravelly loam in the western portion of the site. The Horseshoe series is characterized by very deep well drained soils formed in materials from gravelly Tertiary terrace remnants and basic volcanic rocks, principally tuff breccia.

The soil survey depicts Alluvial Land in the northeastern corner of the site. Alluvial Land is characterized by clayey soil of slow to very slow permeability. Runoff is typically slow and flooding is common during the rainy season. Clayey alluvial deposits are likely to exhibit high shrink/swell characteristics when subjected to moisture variation. H&K (1999, 2000) typically observed firm clay and medium dense, clayey silt at depths of 3 to 6 feet bgs in the exploratory trenches excavated in the lower, northeastern portion of the site. Standing water, saturated surface soil, and evidence of seasonal flooding was common in this area, which is not part of the proposed development plans.

Soil conditions in the northern end of the site have been altered by previous grading and are not specifically classified by the soil survey. The cut/fill area in the northern end of the site is in an area of Musick Sandy Loam, and the cut/fill area in the central-western portion of the site would likely have been classified as alluvial land prior to grading.

2.3.3 Site Seismicity

H&K reviewed California Division of Mines and Geology Open File Report OFR96-08, *Probabilistic Seismic Hazard Assessment for the State of California*, and the California Geological Survey updates to the report, *2002 California Fault Parameters*. The documents categorize faults as Class A, B, or C. Class A faults are capable of producing large magnitude events, and have a high rate of slip. Class C faults are not capable of producing large magnitude earthquakes, and

have a relatively low slip rate. Class B faults are all other type faults. The report indicates only B and C type faults are within 100 kilometers of the subject site.

Special Publication 42 (Interim Revision 2007), *Fault Rupture Hazard Zones in California*, describes active faults and fault zones (activity within 11,000 years), pursuant to the Alquist-Priolo Earthquake Fault Zoning Act. According to Special Publication 42, the site area is not contained within or near an Alquist-Priolo special studies zone. The Alquist-Priolo Earthquake Fault Zoning Act was passed following the 1971 San Fernando Earthquake and only addresses the hazards associated with surface fault ruptures. Ground shaking, liquefaction, seismically induced slope instability, and other seismic hazards are not addressed by the Alquist-Priolo Act. The closest fault zoned under the Alquist-Priolo Act is the Cleveland Hill Fault, located approximately 30 miles northwest of the property.

2.3.4 Regional Seismic Sources

According to the *California Geological Survey Fault Parameters Map* (2002), the project site is located within the Foothills Fault System that extends approximately 150 miles along the western foothills of the Sierra Nevada.

Foothills Fault System

The Foothills Fault System is a group of northwest trending, steeply dipping to vertical faults whose major tectonic activity occurred in the late Jurassic period (135 to 150 MYBP). The Foothills Fault System is designated as a Class C fault zone, with low seismicity and a low rate of recurrence. The present day hazard is derived from the evaluation of the Foothills Fault System as an areal source, rather than as individual faults. The Foothills Fault system is believed to be capable of producing an earthquake with a maximum magnitude 6.5.

The Fault Activity Map of California (California Geological Survey, 2010) shows several known faults in the region that are part of the Foothills Fault System, including the Gillis Hill Fault, Foresthill Fault, Grass Valley Fault, and the Wolf Creek Fault Zone. One branch of the Gillis Hill Fault is within 4 miles of the site. The main branch of the Gillis Hill Fault is located approximately 6 miles east of the project site. The Wolf Creek Fault zone is approximately 1 mile west of the site. The Foresthill Fault is approximately 11 miles east of the site. These three faults are believed to have been most recently active during the Mesozoic era (65 to 230 MYBP). Segments of the Wolf Creek and Bear Mountain Fault Zones located approximately 6, 19 and 26 miles south of the site show evidence of displacement

during the late Quaternary period (0.7 MYBP). The Fault Activity Map shows that the Grass Valley Fault lies approximately 2 miles north of the site. The Grass Valley Fault is depicted as either a Pre-Quaternary fault (older than 1.7 million years) or as a fault without recognized Quaternary displacement.

Other Seismic Sources

The California Geological Survey earthquake catalog (2002) identifies other potential seismic sources including the fault zones noted below. Fault hazard sources are typically those within 100 kilometers, or approximately 62.5 miles. The seismic sources within 100 kilometers of the site are designated as areal sources with the hazard distributed over a zone rather than a specific fault or fault strand.

The Western Nevada Fault Zones 1 through 3 are located in the eastern portion of California and western portion of Nevada between 55 and 96 miles east of the site. The Western Nevada zone is designated as a Class C areal zone that accommodates dextral shear from the Walker Zone, with the hazard distributed over the area of the zone. The Western Nevada Zone is capable of producing earthquakes of magnitude 7.1.

Mohawk-Honey Lake Fault Zones 3, 4, and 5 are located between 48 and 98 miles northeast of the site, north of the Western Nevada Zone. The Mohawk-Honey Lake Fault Zone is designated as a Class C dextral shear zone capable of producing magnitude 7.3 earthquakes.

2.3.5 Historic Seismicity

Several earthquakes have occurred since 1850 which have produced noticeable ground shaking in the vicinity. Some of the earthquakes felt in the area include:

- In 1867, an earthquake with estimated 5.0 magnitude occurred approximately 18 miles east of the site. No details about the earthquake were available.
- The Dunnigan Hills Fault, located approximately 54 miles southwest of the project site, is believed to be the source of the 1892 Vacaville-Winters earthquake.
- In 1909, two earthquakes with estimated Richter magnitudes of 5.0 to 5.5 occurred approximately 35 miles west-northwest of Nevada City.

- An earthquake with magnitude 6.0 on the Dog Valley fault, located near Stampede Reservoir approximately 70 miles northeast of the site, produced noticeable shaking and ground rupture in 1966.
- In 1975, a magnitude 6.2 earthquake occurred on the Cleveland Hill fault, located within the Foothills Fault System approximately 30 miles northwest of the site. The event was strongly felt in the Grass Valley/Nevada City area; however, no major damage or injuries were reported.
- The October 17, 1989 Loma Prieta Earthquake, measuring 7.1 magnitude and centered near Santa Cruz, produced ground shaking as far east as Reno, Nevada.
- An unnamed fault located near Emigrant Gap, approximately 13 miles east of the site, has been the source of several small earthquakes since 1989 which produced ground shaking in the Nevada City area.

2.4 FIELD INVESTIGATION

H&K performed a geophysical survey on May 18, 2017, and a subsurface investigation on May 23, 2017. Surface and subsurface conditions encountered at the site are summarized in the following sections.

The subsurface investigation included the observation of 14 exploratory trenches to depths ranging between 4 to 13 feet below the ground surface (bgs). The trenches were excavated using a John Deere 310SE backhoe with an 18-inch bucket. An H&K staff geologist logged the soil conditions revealed in the exploratory trenches and collected relatively undisturbed and bulk soil samples for laboratory testing. Exploratory trench locations are depicted on Figure 2.

Undocumented fill (i.e., fill without quality control documentation) was encountered at two locations (Fill Areas 1 and 2). Locations are depicted approximately on Figure 2, and the fill is described in Section 2.4.2.

2.4.1 Surface Conditions

The site is undeveloped except for dirt and gravel roadways and a cut-fill area used for materials storage. The site is vegetated by pine, fir and underbrush including manzanita. According to the *Preliminary Grading Plan* (SCO, May 2017), site elevations range from approximately 2,430 feet above mean sea level (MSL) in the western portion of the site to approximately 2,550 feet MSL in the southern portion of the site.

2.4.2 Subsurface Soil Conditions

The soil conditions described in the following paragraphs are generalized based on H&K's observation of soil revealed during the subsurface investigation. Lithologic logs are presented in Appendix C. The approximate locations of exploratory trenches are depicted on Figure 2.

Native Soil Profile

Exploratory trenches T-1, 2, 4, 5, 8, 9, 10, 11 and 13 were generally excavated in native soil and weathered rock, except for minor fill in some areas in the upper foot. Upper soil horizons were not present in previously cut areas. In general, the native soil and weathered rock were described as approximately three to four feet of strong brown, medium dense, sandy silt underlain by yellowish-red, dense, silty sand with gravel. Completely weathered granodiorite rock texture was often apparent at depths of approximately six feet bgs. Locally less weathered rock may be present based on areas of isolated rock outcrop.

Fill Area 1

Exploratory trenches T-3, T-12 and T-14 were excavated in an area of undocumented fill that is generally not suitable for reuse as engineered fill due to high organics content, including sawdust and large wood debris. The fill was deeper than 15 feet near the hinge point (top) of the fill slope located southwest of the proposed NCOC building. The fill was approximately three feet deep in trench T-3, which was located in the vicinity of the proposed concrete apron on the southwestern side of the proposed building. The organic-rich fill encountered in exploratory trenches T-3, T-12 and T-14 was generally described as very dark brown, soft, clayey silt with wood debris.

Fill Area 2

Exploratory trenches T-6 and T-7 were excavated in an area of undocumented fill on the northern end of the proposed staff and public parking area. Based on the topography depicted on Sheet 2, the fill may be up to approximately 12 feet deep. The fill appears to have been generated from the cut slope located on the southern end of the proposed parking area. As the fill is undocumented we assume that it will be removed and reworked during site grading. Although we encountered relatively thin layers of the fill that contained organic materials, which are not suitable for reuse as engineered fill, we anticipate that the majority of the fill will be suitable for reuse.

Exploratory trenches T-6 and T-7 were excavated through fill material described as yellowish red, loose, silty sand with angular and subangular rock to 2 feet in diameter. Deeper in the fill, an organic-rich layer one to two feet thick was described as very dark brown organic-rich sandy silt.

2.4.3 Surface Water Conditions

Surface water from the site generally drains to the west, towards Wolf Creek, which is located approximately one-half mile west of the site. Site topography is generally characterized by a gentle north-northeast trending natural ridge line. Within the site, the property generally drains to the north, northeast and northwest from this ridge.

2.4.4 Groundwater Conditions

We did not observe seepage or saturated soil in the exploratory trenches. However, groundwater conditions will change seasonally, and near-surface seepage and standing water may be encountered above resistant soil or rock layers, particularly during and after the rainy season.

Carlton (2005) reports the results of groundwater investigation north of the site near the former Bear River Mill by others during the late 1980s. Groundwater was reported to be first encountered during drilling at depths of 15 to 25 feet bgs. Groundwater generally stabilized in well casings at depths 3 to 10 feet higher than the first encountered depths, suggesting partially confined conditions. The groundwater gradient was reported to be toward the north/northwest, generally following surface topography.

2.4.5 Seismic Refraction Microtremor Survey

H&K performed a seismic refraction microtremor (ReMi) survey to estimate the in-situ shear-wave (S-wave) velocity profile of the first 100 feet of soil and rock beneath the site and to facilitate the determination of the seismic site class pursuant to the 2016 California Building Code (CBC) Chapter 16A, Section 1613A.3.2.

The ReMi survey was performed using a multichannel SeisOpt® ReMi™ Vs30 seismograph using a seismic line with 12 geophones. The seismic source consisted of ambient microtremors which are continuously generated by vehicle traffic, railroads, construction and other activities. Microtremor data were collected during the course of 10 recording periods, each lasting approximately 30 seconds. The approximate location of the ReMi survey line (R-1) is depicted on Figure 2.

Survey data were analyzed by Dr. Satish Pullammanappallil with the Nevada Seismological Lab at the University of Nevada, Reno. The resulting subsurface shear wave model indicates that the average seismic shear wave velocity for the upper 100 feet of the subsurface was approximately 1,076 feet per second. Graphical representation of the shear wave velocity model is presented in Appendix E.

2.4.6 Seismic Refraction Survey

H&K performed three seismic refraction lines at the site. Two of the seismic refraction lines (SR-1 and SR-2) were located in the central portion of the site, in the vicinity of the proposed deepest cut. The third seismic refraction line (SR-3) was located in the southern portion of the site. The survey alignment locations are depicted on Figure 2. The purpose of the survey was to estimate the seismic velocity of shallow weathered rock beneath the site. The seismic refraction method measures the velocity of compression waves in the underlying soil and rock materials. Compression wave velocities are used as a general indication of the rippability of subsurface soil and rock and the depth and thicknesses of the underlying soil and rock stratum.

The seismic refraction technique is limited in nature, and assumes that less dense or softer, lower velocity materials overlie denser, higher velocity materials. Thin strata are not reliably detected by the method. Average velocities and depth measurements are obtained in areas containing boulders, irregular bedrock surfaces, and variably weathered rock. The results of the seismic refraction survey should be considered as an indication of average or typical values, rather than as a direct measurement or observation of subsurface conditions.

The seismic refraction survey lines consisted of 12 geophones spaced approximately 10 feet apart, for a total seismic line length of 120 feet. A 12-channel, microprocessor controlled, signal enhancement seismograph was used to record the arrival time of mechanically produced shock waves. Shock waves were initiated through the use of a sledgehammer striking a steel plate placed on the ground surface. The sledgehammer is equipped with a trigger mechanism that is connected to the seismograph data collector with an electric line.

As shown in Attachments 2 through 4 of Appendix E, the shallow soil seismic velocities, from ground surface down to approximately 50 feet bgs range from 1,000 to 3,000 ft/sec. From approximately 50 to 70 feet bgs, the seismic refraction velocities range from 3,000 to 6,000 ft/sec, and peak to approximately 8,000 ft/sec

at a depth of approximately 80 feet bgs. The seismic refraction technique does not provide the resolution or precision required to delineate isolated zones of slightly cemented soil or weathered and less weathered rock.

3 LABORATORY TESTING

H&K performed laboratory tests on selected soil samples collected from the exploratory trenches to determine their engineering material properties. These engineering material properties were used to develop geotechnical engineering design parameters. Laboratory reports are presented in Appendix D. The testing program included:

- Moisture and Density
- Particle Size Determination
- Atterberg Indices
- Direct Shear Strength
- Resistance Value (R-value)

Table 3.1 summarizes the moisture/density and direct shear test results. Appendix D presents graphical Atterberg limits, direct shear, and R-value test results.

Table 3.1 - Summary of Moisture / Density and Shear Strength Testing

Trench Number	Sample Number	Depth (feet)	Dry Density (pcf)	Moisture Content (%)	Shear Friction Angle (degrees)	Shear Cohesion (psf)
T-4	SS-2	3	91.4	19.9	38	246
T-2	SS-3	1.5	94.7	24.4	36	165

Notes:
pcf = pounds per cubic foot
psf = pounds per square foot

Table 3.2 - Summary of Atterberg Limits Testing

Trench Number	Sample Number	Depth (feet)	Liquid Limit (LL)	Plastic Limit (PL)	Plasticity Index (PI)	USCS Description
T-4	Bulk-3	0-2	38	22	16	Sandy Lean Clay
T-1	Bulk-6	0-3	33	24	9	Clayey Sand

Notes:
USCS = Unified Soil Classification System

Particle size determination (gradation) was performed using soil samples Bulk 3 and Bulk 6. Bulk 3 was obtained from 0-2 feet bgs in trench T-4, and Bulk 6 was obtained from 0-3 feet bgs in trench T-1. Oversize materials (cobbles and boulders)

were excluded from the particle size determination. Results are summarized in Table 3.3 below.

Table 3.3 - Summary of Soil Particle Size Determination

Trench Number	**Sample Number**	**Depth** (feet)	**Gravel** (%)	**Sand** (%)	**Silt and Clay** (%)
T-4	Bulk 3	0-2	0.6	48.3	51.1
T-1	Bulk 6	0-3	11.9	42.9	45.2

Resistance value (R-value) testing was performed using sample Bulk 6-4-5, a composite bulk sample obtained from trenches T-1, T-2 and T-5. Sample Bulk 6-4-5 was composed of reddish brown clayey silt. The R-value testing indicated that the soil sample had an R-value of 53 by exudation pressure.

4 CONCLUSIONS

The following conclusions are based on the findings of H&K's field investigation and review of laboratory test results, as well as our experience with similar projects in the vicinity.

1. Our opinion is that, from a geotechnical engineering standpoint, the subject property is suitable to support the proposed development, provided that the geotechnical engineering recommendations and design criteria presented in this report are incorporated into the development plans.
2. Exploratory trenches T-1, 2, 4, 5, 8, 9, 10, 11 and 13 were generally excavated in native soil and weathered rock, except for minor fill in some areas in the upper foot. Upper soil horizons were not present in previously cut areas. In general, the native soil and weathered rock were described as approximately three to four feet of strong brown, medium dense, sandy silt underlain by yellowish-red, dense, silty sand with gravel. Completely weathered granodiorite rock texture was often apparent at depths of approximately six feet bgs. Locally less weathered rock may be present based on areas of isolated rock outcrop.
3. Fill Area 1: Exploratory trenches T-3, T-12 and T-14 were excavated in an area of undocumented fill that is generally not suitable for reuse as engineered fill due to high organics content, including sawdust and large wood debris. The fill was deeper than 15 feet near the hinge point (top) of the fill slope located southwest of the proposed NCOC building. The fill was approximately three feet deep in trench T-3, which was located in the vicinity of the proposed concrete apron on the southwestern side of the proposed building. The organic-rich fill encountered in exploratory trenches T-3, T-12 and T-14 was generally described as very dark brown, soft, clayey silt with wood debris.
4. Fill Area 2: Exploratory trenches T-6 and T-7 were excavated in an area of undocumented fill on the northern end of the proposed staff and public parking area. Based on the topography depicted on Sheet 2, the fill may be up to approximately 12 feet deep. The fill appears to have been generated from the cut slope located on the southern end of the proposed parking area. As the fill is undocumented we assume that it will be removed and reworked during site grading. Oversize rock should be removed from the fill or windrowed in deep fill as determined in the field by H&K during grading. Although we encountered relatively thin layers of the fill that contained organic materials, which are not suitable for reuse as engineered fill, we anticipate that the majority of the fill will be suitable for reuse. In general the fill was described as yellowish red, loose, silty sand with angular and subangular rock to 2 feet in diameter. Deeper in the

fill, an organic-rich layer one to two feet thick was described as very dark brown organic-rich sandy silt.

5. The lower, northeastern portion of the site, which is not part of the proposed development plans, is characterized by low-permeability, clayey soil and poor drainage conditions. The clayey soil is likely to exhibit high shrink/swell characteristics when subjected to moisture variation. H&K (1999, 2000) typically observed firm clay and medium dense, clayey silt at depths of 3 to 6 feet bgs in the exploratory trenches excavated in this area, which is subject to seasonal standing water and saturated surface soil.

6. The validity of the recommendations presented in this report is contingent upon our review of construction plans and our observation and testing during construction. When final construction plans are prepared, H&K should be retained to review the plans in order to verify that our recommendations have been incorporated, and to provide additional recommendations if necessary. H&K should be retained to observe and test during construction to verify that our recommendations are implemented, and to verify that subsurface conditions are as observed in our exploratory trenches.

5 RECOMMENDATIONS

The following geotechnical engineering recommendations are based on our understanding of the project as currently proposed, our field observations, the results of our laboratory testing program and engineering analysis, and our experience in the area.

5.1 GRADING

The following grading recommendations address clearing and grubbing, soil preparation, cut slope grading, fill placement, fill slope grading, erosion control, subsurface drainage, surface water drainage, plan review, and construction monitoring.

5.1.1 Clearing and Grubbing

The areas to be graded should be cleared and grubbed to remove vegetation and other deleterious materials as described below.

1. After vegetation clearing, strip and remove debris and soil that contains vegetation, roots and other deleterious materials. Organic-rich topsoil can be stockpiled onsite for subsequent use in landscape areas, but organic-containing soil is not suitable for use as fill. The project geotechnical engineer should approve any proposed use of the spoil generated from stripping prior to placement.
2. Excavation of large trees, boulders and other site features may result in areas of disturbed soil and shallow depressions. Depressions should be over-excavated to competent native material and backfilled in accordance with the fill placement recommendations presented in this report.
3. Overexcavate any relatively loose debris and soil that is encountered to underlying, competent material.
4. Overexcavate loose, untested fill. Excavation of untested fill and loose material should extend at least ten feet laterally beyond the areas of proposed improvements, including structures, pavement, flatwork and appurtenant construction. In areas of deep fill (e.g., Fill Areas 1 and 2 as described in Section 4), the extent of fill removal and replacement must be verified by the project geotechnical engineer during grading:
    a. Fill Area 1: Exploratory trenches T-3, T-12 and T-14 were excavated in an area of undocumented fill that is generally not suitable for reuse as

engineered fill due to high organics content, including sawdust and large wood debris. The fill was deeper than 15 feet near the hinge point (top) of the fill slope located southwest of the proposed NCOC building. The fill was approximately three feet deep in trench T-3, which was located in the vicinity of the proposed concrete apron on the southwestern side of the proposed building. The organic-rich fill encountered in exploratory trenches T-3, T-12 and T-14 was generally described as very dark brown, soft, clayey silt with wood debris.

b. Fill Area 2: Exploratory trenches T-6 and T-7 were excavated in an area of undocumented fill on the northern end of the proposed staff and public parking area. Based on the topography depicted on Sheet 2, the fill may be up to approximately 12 feet deep. The fill appears to have been generated from the cut slope located on the southern end of the proposed parking area. As the fill is undocumented we assume that it will be removed and reworked during site grading. Oversize rock should be removed from the fill or windrowed in deep fill as determined in the field by H&K during grading. Although we encountered relatively thin layers of the fill that contained organic materials, which are not suitable for reuse as engineered fill, we anticipate that the majority of the fill will be suitable for reuse. In general the fill was described as yellowish red, loose, silty sand with angular and subangular rock to 2 feet in diameter. Deeper in the fill, an organic-rich layer one to two feet thick was described as very dark brown organic-rich sandy silt.

c. Organic-rich or otherwise unsuitable materials that are not suitable for reuse as engineered fill should be overexcavated and removed from the site, or placed in a suitable location outside of the proposed development area.

5. Overexcavate any loose soil in exploratory trenches and abandoned subsurface utility trenches within the proposed improvement area to underlying competent soil, as determined by a representative of H&K.

6. Remove rocks greater than 8 inches in greatest dimension (oversized rock) by scarifying to a depth of 12 inches below finish grade in areas to support pavement, slabs-on-grade or other flatwork. Oversized rock may be used in landscape areas, rock landscape walls, or removed from the site. Oversized rock can be stockpiled onsite and used to construct fills, but must be placed at or near the bottom of deep fills and must be placed in windrows to avoid nesting, as approved in the field by a representative of H&K. No oversized rock

should be placed in the upper three feet of any structural fill. The project geotechnical engineer should approve the use of oversized rock prior to constructing fill.

7. Fine grained, potentially expansive soil, if encountered, should be mixed with granular soil, or overexcavated and stockpiled for removal from the project site or for later use in landscape areas. A typical mixing ratio for granular to expansive soil is 4 to 1. The actual mixing ratio should be determined by H&K based on field observation and/or laboratory testing, as determined appropriate by H&K.
8. Vegetation, deleterious materials, structural debris, and oversized rock not used in landscape areas, drainage channels, or other non-structural uses should be removed from the site.

5.1.2 Cut Slope Grading

In general, permanent cut slopes should not be steeper than 2:1, horizontal to vertical (H:V). Steeper cut slopes may be feasible, depending on the soil/rock conditions encountered, and should be reviewed on a case-by-case basis by H&K. If steeper cut slope gradients are employed, the upper two feet of all cut slopes should be graded no steeper than 2:1, H:V to reduce the potential of sloughing and erosion.

Temporary cut slopes may be constructed to facilitate retaining wall construction. We anticipate that subsurface conditions in native soil will be favorable for construction of temporary cut slopes no steeper than 1:1, H:V, for a maximum height of approximately 8 feet. This slope gradient will not likely be stable for cut slopes in existing fill. To reduce the likelihood of sloughing or failure, temporary cut slopes should not remain over the winter. Temporary cut slopes should not be constructed adjacent to existing improvements without prior review by H&K.

A representative of H&K must observe steepened, temporary cut slopes during grading to confirm the soil and rock conditions encountered. Depending on the subsurface conditions revealed, temporary cut slopes may require regrading to gentler configurations. Because the recommended temporary cut slope gradient may be steeper than recommended by OSHA standards, we recommend that personnel not be allowed between the cut slope and the proposed retaining structure, form work, grading equipment, or parked vehicles during construction.

5.1.3 Soil Preparation for Fill Placement

Where fill placement is proposed, and after clearing and grubbing, the soil surface should be prepared as described below.

1. The surface soil should be scarified to a minimum depth of 8 inches below the existing ground surface. Oversized rock and roots generated during scarification must be removed. Following scarification, the soil should be uniformly moisture conditioned to within approximately 3 percentage points above the ASTM D1557 optimum moisture content.
2. The scarified and moisture-conditioned soil should then be compacted to achieve a minimum relative compaction of 90 percent based on ASTM D1557 maximum dry density. The moisture content, density and relative percent compaction should be verified by a representative of H&K. To facilitate testing, the earthwork contractor should excavate test pads with onsite earth moving equipment.

5.1.4 Fill Placement

Soil fill placement proposed for the project should incorporate the following recommendations:

1. Soil used for fill should consist of uncontaminated, predominantly granular, non-expansive native soil or approved import soil. If encountered, rock used in fill should be broken into pieces no larger than 8 inches in diameter. Rocks larger than 8 inches are considered oversized material and should be stockpiled for offhaul or later use in landscape areas or drainage channels.
2. Import soil should be uncontaminated, predominantly granular, non-expansive and free of deleterious material. Import material that is proposed for use onsite should be submitted to H&K for approval and possible laboratory testing at least 72 hours prior to transport to the site.
3. Cohesive, predominantly fine grained, or potentially expansive soil encountered during grading should be stockpiled for removal, mixed as directed by H&K, or used in landscape areas.
4. Soil used to construct fill should be uniformly moisture conditioned to within approximately 3 percentage points of the ASTM D1557 optimum moisture content. Wet soil may need to be air dried or mixed with drier material to facilitate placement and compaction, particularly during or following the spring snow melt.

5. Fill should be constructed by placing uniformly moisture conditioned soil in maximum 8-inch-thick loose, horizontal lifts (layers) prior to compacting.
6. Fill should be compacted to a minimum relative compaction of 90 percent of the ASTM D1557 maximum dry density. The upper 12 inches of fill in paved areas, beneath proposed slabs-on-grade, and within the proposed building footprint should be compacted to a minimum of 95 percent relative compaction based on ASTM D1557.
7. The moisture content, density and relative percent compaction of fill should be confirmed by a representative of H&K during construction.

5.1.5 Differential Fill Depth

The recommendations presented in this section are intended to reduce the magnitude of differential settlement-induced structural distress associated with variable fill depth beneath structures:

1. Site grading should be performed so that cut-fill transition lines do not occur directly beneath any structures. The cut portion of cut-fill building pads utilizing slabs-on-grade, if proposed, should be scarified to a minimum depth of 12 inches, and recompacted to 95 percent relative compaction based on ASTM D1557.
2. Fill depth differential beneath a structure should not exceed 5 feet. For example, if the maximum fill depth is 8 feet across a building pad, the minimum fill depth beneath that pad should not be less than 3 feet. If a cut-fill building pad is used in this example, the cut portion would need to be overexcavated 3 feet and rebuilt with compacted fill.

5.1.6 Fill Slope Grading

In general, permanent fill slopes should be no steeper than 2:1, H:V. H&K must be retained to review fill slope configurations greater than approximately 10 feet in height, if proposed, prior to fill placement. Compaction and fill slope grading must be confirmed by H&K in the field.

Steeper fill slopes may be feasible with the use of geotextile reinforcement and/or rock facing. We can provide reinforced or buttressed fill slope design, if requested.

Conventional equipment-width keyways should be provided at the base of fill slopes that will have gradients steeper than 5:1, H:V. The keyway should extend a minimum of 2 feet into competent native soil on the outside (down-slope) edge of

the keyway, and the base of the keyway should be sloped into the native slope at an approximate gradient of 15 percent.

A conventional equipment-width bench should be constructed at least every 3 vertical feet as fill progresses. Benching must extend through loose surface soil into suitable material, and must be performed at intervals such that no loose soil is left beneath the fill.

Fill should be placed in horizontal lifts. Slopes should be constructed by overbuilding the slope face and then cutting it back to the design slope gradient. Fill slopes should not be constructed or extended horizontally by placing soil on an existing slope face. Fill should not be compacted on a slope face by "track-walking."

5.1.7 Erosion Control

A site-specific Storm Water Pollution Prevention Plan (SWPPP) will be required pursuant to the State Water Resources Control Board (SWRQCB) General Permit for Storm Water Discharges Associated with Construction and Land Disturbance Activities (the Construction General Permit).

Best management practices (BMPs) for erosion and sediment control should be incorporated into the design and construction of this project. As a minimum, the following controls should be installed prior to and during grading to reduce erosion.

1. Erosion and sediment control measures can be categorized as temporary or permanent. Temporary measures should be installed to provide short-term protection until the permanent measures are installed and effective. Typical temporary measures include properly installed silt fences, straw bales, wattles, water bars, detention basins, covering of exposed soil, channel linings and inlet protection. Permanent erosion and sediment control measures may include rock slope protection (RSP), rock lined ditches and inlet/outlet protection, rock energy dissipaters, infiltration/detention basins and vegetation.
2. Prior to commencement of site work, fiber rolls and silt fences should be installed down slope of the proposed area of disturbance to reduce migration of sediment from the site. Fiber rolls on slopes are intended to reduce sediment discharge from disturbed areas. If a single layer of fiber rolls is not sufficient to reduce migration of sediment, a second layer should be placed no more than 10 feet above or below the first layer. The fiber rolls should remain in place until construction activity is complete and until revegetated slopes become established.

3. Existing vegetation should be protected and undisturbed where possible, and revegetation should consist of native brush and grass species. All areas disturbed by construction should be revegetated. Graded portions of the site should be seeded as soon as possible to allow vegetation to become established prior to the wet season.
4. Following seeding, jute netting or erosion control blankets should be placed and secured over the slopes steeper than 2:1, H:V, to keep seeds and straw from being washed or blown away. Tackifiers or binding agents may be used in lieu of jute netting.
5. Slope faces should be temporarily protected against erosion resulting from direct rain impact until permanent vegetation can be established. Soil exposed in permanent slope faces should be hydroseeded or hand seeded/strawed with an appropriate seed mixture compatible with the soil and climate conditions of the site as recommended by the local Resource Conservation District.
6. Under no circumstances should surface water be allowed to run over slope faces. Surface water drainage ditches should be established as necessary to intercept and redirect concentrated surface water away from cut and fill slope faces. Interceptor (brow) ditches should be considered at the tops of slopes in order to collect and divert runoff which otherwise would flow over the slope face. The intercepted water should be discharged into natural drainage courses or into other collection and disposal structures.

5.1.8 Underground Utility Trenches

Underground utility trenches should be excavated and backfilled as described below.

1. The California Occupational Safety and Health Administration (OSHA) requires all utility trenches deeper than 4 feet bgs be shored with bracing equipment prior to being entered by any individuals, whether or not they are associated with the project.
2. We anticipate that shallow subsurface seepage may be encountered, particularly if utility trenches are excavated during the winter, spring, or early summer. The earthwork contractor may need to employ dewatering methods, as discussed in Section 5.1.9 Construction Dewatering, to excavate, place and compact the trench backfill materials.
3. Soil used as trench backfill should be non-expansive and should not contain rocks greater than 3 inches in greatest dimension.

4. Soil used to backfill trenches should be uniformly moisture conditioned to approximately 3 percentage points over the ASTM D1557 optimum moisture content.
5. Trench backfill should be constructed by placing uniformly moisture conditioned soil in maximum 8-inch-thick loose lifts (layers) prior to compacting.
6. Trench backfill placed beneath the utilities (bedding) should be compacted to achieve a minimum relative compaction of 90 percent of the ASTM D1557 maximum dry density.
7. Trench backfill soil should be compacted to a minimum relative compaction of 90 percent of the ASTM D1557 maximum dry density.
8. Trench backfill soil placed within 1 foot of the finished subgrade in building, road, and parking lot areas should be compacted to a minimum relative compaction of 95 percent of the ASTM D1557 maximum dry density.
9. The loose lift thickness, moisture, density and relative compaction of the trench backfill soil should be verified by our construction quality assurance (CQA) monitor. The earthwork contractor should excavate test pads with onsite earth moving equipment.
10. Construction quality assurance tests should be performed at a frequency determined by the project geotechnical engineer.

5.1.9 Construction Dewatering

Seepage may be encountered during grading, particularly in deeper excavations. The earthwork contractor should be prepared to dewater excavations if seepage is encountered during grading. Seepage may be encountered if grading is performed during and immediately after the wet season. In addition, perched groundwater may be encountered on low permeability soil layers even during the summer months.

If subsurface seepage or groundwater conditions are encountered which reduces or restricts fill placement or construction of the proposed improvements, subdrains may be necessary. If seepage is encountered during trench excavation, it may be necessary to remove underlying saturated soil and replace it with free draining, open-graded crushed rock. Soil backfill may be placed after backfilling with drain rock to an elevation higher than encountered groundwater.

If groundwater or saturated soil conditions are encountered during grading, we should be retained to observe the conditions and provide site specific subsurface drainage recommendations.

5.1.10 Surface Water Drainage

Functional surface water drainage is important to the successful development of the project. Inadequate surface drainage can result in moisture intrusion through concrete floor slabs, degradation of asphalt concrete pavements, increased frost heave and other adverse conditions. We recommend the following measures to help mitigate surface water drainage problems:

1. Slope final grades in structural areas so that surface water drains away from interior finish subgrade at a minimum 2 percent slope for a minimum distance of 15 feet. For structures utilizing slab-on-grade interior floor systems we recommend increasing the slope to 4 percent. Drains should be considered on the upslope side of exterior foundations and should be placed along continuous interior wall foundations and in all crawl space areas. Direct downspouts to positive drainage or a closed collector pipe that discharges flow to positive drainage. Roof drip-lines should be protected from erosion with a gravel layer and riprap.
2. Drains should extend to a properly designed infiltration gallery. Recommended subsurface drain locations can be provided at the time of construction and when foundation elevations are known. Basements and enclosed subsurface living space should be constructed in accordance with the recommendations provided in the “Retaining Wall Design Criteria” section of this report.
3. To reduce surface water infiltration, compact and slope soil placed adjacent to building foundations such that water is not allowed to pond. Backfill should be free of deleterious materials.
4. Construct V-ditches at the top of cut and fill slopes as necessary to reduce surface water flow over slope faces, if created onsite. Typically, V-ditches should be 3 feet wide and at least 6 inches deep. Surface water collected in V-ditches should be directed away and downslope from proposed building pads and driveways into a drainage channel. Concentrated surface water should not be allowed to flow over cut and fill slopes.
5. If open-graded gravel or other permeable material is used for underground utilities, the trench should slope away from the structure or the potential flow

path should be plugged with a less permeable material at the exterior of the foundation. All utility pipes should have sealed joints.

5.1.11 Grading Plan Review and Construction Monitoring

Construction quality assurance includes review of plans and specifications and performing construction monitoring as described below.

1. H&K should be retained to review the final grading plans prior to construction to confirm our understanding of the project at the time of our investigation, to determine whether our recommendations have been implemented, and to provide additional and/or modified recommendations, if necessary.
2. H&K should be retained to perform CQA monitoring of all earthwork grading performed by the contractor to determine whether our recommendations have been implemented, and if necessary, provide additional and/or modified recommendations.

5.2 STRUCTURAL IMPROVEMENT DESIGN CRITERIA

The following sections present our structural improvement design criteria and recommendations.

5.2.1 Seismic Design Criteria

Table 5.2.1.1 below summarizes seismic design criteria based on the results of the ReMi survey, ASCE 7-10, the 2016 California Building Code and the United States Geological Survey (USGS) U.S. Seismic Design Maps tool (available online at http://earthquake.usgs.gov/hazards/designmaps/usdesign.php).

5.2.1.1 - Seismic Design Parameters

Description	Value	Reference	Description	Value	Reference
Latitude Longitude	39.183021° N 121.050327° W	1	Site Class	D	2
Site Coefficient, F_A	1.341	5	Site Coefficient, F_V	1.914	6
Short (0.2 sec) Spectral Response, S_S	0.574 g	3	Long (1.0 sec) Spectral Response, S_1	0.243 g	4
S_S modified for Site Class Effects, S_{MS}	0.770 g	7	S_1 modified for Site Class Effects, S_{M1}	0.465 g	8
Design Spectral Response Acceleration, Short Periods, S_{DS}	0.513 g	9	Design Spectral Response Acceleration, Long Periods, S_{D1}	0.310 g	10

References:

1. *USGS 7.5 min*
2. *ASCE 7-10 Table 20.3-1*
3. *ASCE 7-10 Figure 22-1*
4. *ASCE 7-10 Figure 22-2*
5. *ASCE 7-10 Table 11.4-1*
6. *ASCE 7-10 Table 11.4-2*
7. *ASCE 7-10 Equation 11.4-1*
8. *ASCE 7-10 Equation 11.4-2*
9. *ASCE 7-10 Equation 11.4-3*
10. *ASCE 7-10 Equation 11.4-4*

5.2.2 Foundations

Provided that the grading for the project is performed in accordance with the recommendations presented in this report, our opinion is that the site will be suitable for the use of conventional perimeter footings and isolated interior footings. Following are our recommendations for foundations constructed on compacted and tested fill or competent native soil:

1. Exterior foundations should be embedded a minimum of 24 inches below the lowest adjacent exterior finish grade for frost protection. The bottom of interior footings should be at least 12 inches below lowest adjacent finish grade. The project structural engineer should determine reinforcing steel requirements for foundations.
2. Footing excavations should be cleaned of all loose soil and construction debris prior to placing concrete. A representative from H&K should observe the footing excavations to confirm soil conditions and footing dimensions prior to concrete placement.

3. Reinforcing steel requirements for foundations should be determined by the project architect or structural engineer. However, at a minimum, the footings should be designed with two No. 4 rebar reinforcements, one near the top of the footing and one near the bottom. A minimum of 3 inches of concrete coverage should surround the bars.
4. In an effort to reduce the likelihood of differential settlement-induced distress to the proposed structures and in an attempt to maintain a total consolidation settlement of less than approximately ½ inch, we recommend that strip and isolated footings with a minimum embedment depth of 12 inches in competent soil be sized for an allowable bearing capacity of 4,000 psf for dead plus live loads. This value can be increased by 500 psf for each additional foot of embedment up to a limiting value of 6,000 psf. Allowable bearing may be increased by 33 percent for additional transient loading such as wind or seismic.
5. A triangularly-distributed lateral resistance (passive soil resistance) of 300d psf, where d is footing depth, may be used for footings. This value may be increased by 33 percent for wind and seismic. As an alternate to the passive soil resistance described above, a coefficient of friction for resistance to sliding of 0.35 may be used.
6. Footing excavations should be saturated a minimum of 24 hours prior to placing concrete to reduce the risk of problems caused by wicking of moisture from curing concrete. However, concrete should not be placed through standing water in the footing excavations.

5.2.3 Concrete Slabs-on-Grade

A concrete slab-on-grade floor may be used in conjunction with a perimeter concrete foundation. Slabs-on-grade should be designed by the project architect or structural engineer with consideration of the anticipated loading. We make the following geotechnical recommendations regarding slabs-on-grade:

1. The slab-on-grade should be a minimum of 4 inches thick. If floor loads higher than 250 psf or intermittent live loads are anticipated, a structural engineer should review the slab thickness and steel reinforcing schedule.
2. The subgrade soil around slabs-on-grade should be sloped away from the proposed slab subgrade a minimum of 4 percent for a distance of 15 feet as discussed in the Surface Water Drainage section of this report. A

representative from H&K should observe pad and subgrade elevations prior to forming the slab footings.

3. As a minimum, No. 3 rebar on 24-inch centers or flat sheets of 6x6, W2.9xW2.9 welded wire mesh (WWM) should be used as slab reinforcement. We do not recommend using rolls of WWM because vertically centered placement of rolled mesh within the slab is difficult to achieve. All rebar and sheets of WWM should be placed in the center of the slab and supported on concrete "dobies". We do not recommend "hooking and pulling" of steel during concrete placement.
4. Concrete slabs subjected to heavy traffic loads may require additional reinforcement steel as determined by the project architect or structural engineer.
5. Slabs should be underlain by at least 4 inches of crushed, washed rock with no fines. The rock should be uniformly graded so that 100% passes the 1-inch sieve, with 0% to 5% passing the No. 4 sieve. Prior to placing concrete, slab subgrade soil must be moisture conditioned to between 75 and 90 percent saturation to a depth of 36 inches. After rock placement, moisture conditioning should be performed for a minimum of 48 hours prior to concrete placement. If the soil is not moisture conditioned prior to placing concrete, moisture will be wicked out of the concrete, possibly contributing to shrinkage cracks. The rock should then be overlain by a continuous vapor barrier at least 15 mils thick. A minimum of 2 inches of clean sand should be spread over the vapor barrier. The sand will act as a leveling pad and aid in curing the concrete. Prior to pouring concrete, the sand leveling pad should be moistened to reduce moisture withdrawal of the concrete during curing.
6. The vapor barrier and sand may be omitted in areas that do not have moisture sensitive floor coverings and where significant moisture transmission is considered acceptable (i.e., exterior parking areas).
7. For finished floors and interior surfaces, a waterproofing specialist should be consulted regarding waterproofing and moisture transmission through slabs-on-grade. The general recommendations for slab underlayment presented in this section may not sufficiently reduce moisture transmission in all cases. Regardless of the type of vapor barrier used, moisture can wick up through a concrete slab. Excessive moisture transmission through a slab can cause adhesion loss, warping and peeling of resilient floor coverings, deterioration of adhesive, seam separation, formation of air pockets, mineral deposition beneath flooring, odor and fungi growth. Slabs can be tested for water

transmissivity in areas that are moisture sensitive. Commercial sealants, entrained air, fly ash and a reduced water to cement ratio can be incorporated into the concrete to reduce slab permeability.

8. Expansion joints should be provided between the slab and perimeter footings and bisect the length and width of the slab at intervals specified by the American Concrete Institute (ACI) or Portland Concrete Association (PCA).
9. Exterior slabs-on-grade such as sidewalks may be placed directly on compacted fill without the use of a baserock section. For exterior slabs, the native soil should be ripped, moisture conditioned and recompacted to an 8-inch depth per the grading recommendations presented in this report.
10. Prior to placing concrete, the upper 18 inches of slab subgrade soil must be moisture conditioned to 4 to 6 percentage points over optimum. Moisture conditioning should be performed for a minimum of 24 hours prior to concrete placement. If the soil is not moisture conditioned prior to placing concrete, moisture will be wicked out of the concrete, possibly contributing to shrinkage cracks. Additionally, our opinion is that moisture conditioning the soil prior to placing concrete will reduce the likelihood of soil swell or heave following construction at locations where fine grained, potentially expansive soil is encountered. To facilitate slab-on-grade construction, we recommend that the slab subgrade soil be moisture conditioned following rock placement. Following moisture conditioning, the vapor barrier and leveling sand should be placed.
11. All deleterious material must be removed from slab subgrade and the underslab surface prior to placing concrete.
12. Exposed concrete slabs should be moisture cured for at least seven days after placement.
13. Concrete slabs impart a relatively small load on the subgrade (approximately 50 psf). Therefore, some vertical movement should be anticipated from freeze/thaw, expansion and/or differential loading.

5.2.4 Retaining Wall Design Criteria

The following active and passive pressures are for retaining walls in cut native soil or backfilled with granular onsite soil. If import soil is used, a representative from our firm should be retained to observe and test the soil to determine its strength properties. The pressures exerted against retaining walls may be assumed to be equal to a fluid of equivalent unit weight.

Table 5.2.4.1 presents equivalent fluid unit weights for cut native soil and onsite fill compacted per the grading recommendations presented in this report. We assume that the retained fill surface will be no steeper than 10% for a minimum distance of the wall height from the back of the retaining wall. Recommendations have also been provided for retaining a fill surface with a slope up to 50%. For retention of slopes, and if surcharge loads (such as adjacent building foundations) or live loads will be applied within a distance of the wall height from the back of the wall, we should be retained to review the loading conditions and revise our recommendations, as necessary.

Table 5.2.4.1 - Equivalent Fluid Unit Weight

Loading Condition	**Retained Cut or Compacted Fill** (approximately horizontal backfill)	**Retained Cut or Compacted Fill** (retained slope up to 2:1, H:V)
Active Pressure	30 pcf	45 pcf
Passive Pressure	300 pcf	300 pcf
At-Rest Pressure	45 pcf	60 pcf
Coefficient of Friction	0.35	0.35

Note: (1) The equivalent fluid unit weights presented are ultimate values and do not include a factor of safety. The passive pressures provided assume footings are founded in competent native soil or engineered fill. pcf = pounds per cubic foot

If the “Active Pressure” unit weight is used for design, then the designer must assume that the wall will accommodate sufficient deflection for mobilization of the retained soil to occur. Typically, a wall yield of less than 1 percent of the wall height is sufficient to mobilize active conditions in granular soil. However, if the walls are rigid or restrained to reduce rotation, at-rest conditions should be used for design.

Recommendations for design and construction of retaining walls are presented below:

1. Compaction equipment should not be used directly adjacent to retaining walls unless the wall is designed or braced to resist the additional lateral pressures.
2. Surcharge loading should be considered in retaining wall design due to accumulation of snow or stockpiling during snow removal. If any surface loads are closer to the top of the retaining wall than its height, H&K should review the loads and retaining wall configuration. We can provide additional

design criteria for specific load configurations if requested. We should be retained to review wall details and plans for any wall over 10 feet in height.

3. All retaining walls must be well drained to reduce hydrostatic pressures. Walls should be provided with a drainage blanket to reduce additional lateral forces and minimize saturation of the backfill soil. Drainage blankets may consist of graded rock drains or geosynthetic blankets.

4. Additional lateral loading on retaining structures due to seismic accelerations may be considered at the designer's option. For an earthquake producing a design horizontal acceleration of 0.3g, we recommend estimating the resulting additional lateral force applied to retaining structures onsite as $P_{ae} = 9H^2$ pounds, where H is the height of the wall in feet. The additional seismic force may be assumed to be applied at a height of 0.33H above the base of the wall. Because the additional lateral seismic force is a short duration loading, it is common to increase the allowable bearing pressure and passive resistance by one third (33 percent) when reviewing wall stability. In addition, a lower acceptable factor of safety (e.g., 1.1 or 1.2) is often employed when using the combined lateral earth pressure and seismic loading.

5. Rock drains should consist of a minimum 12-inch wide, Caltrans Class II, permeable drainage blanket, placed directly behind the wall; or crushed washed rock enveloped in a non-woven geotextile filter fabric such as Amoco 4546 or equivalent. Drains should have a minimum 4-inch diameter, perforated, schedule 40, PVC pipe placed at the base of the wall, inside the drain rock, with the perforations placed down. The PVC pipe should be sloped so that water is directed away from the wall by gravity. A geosynthetic drainage blanket such as Enkadrain or equivalent may be substituted for the rock drain, provided the collected water is channeled away from the wall. If a geosynthetic blanket is used, backfill must be compacted carefully so that equipment or soil does not tear or crush the drainage blanket.

6. Drainage and waterproofing of retaining walls associated with finished interior spaces is essential to reduce the likelihood of seepage and vapor transmission into the living space. We recommend that an appropriate waterproofing sealant be applied to the exterior surface of such retaining walls. A waterproofing consultant may be contacted to further review seepage and vapor transmission.

5.2.5 Pavement Sections

The pavement sections provided below in Table 5.2.5.1 are based on the results of laboratory testing and a design R-value of 35 considering variability of site soil conditions. The recommended pavement sections are based on example traffic indices (TIs) of 5, 6, and 7. Additional pavement sections can be provided for other TIs that may be required for the project.

Table 5.2.5.1 - Recommended Pavement Sections

Traffic Index: 5 Design R-Value 35 Traffic Description: Residential streets; light auto and light truck traffic;	Alternate A Pavement Section (inches)	Alternate B Pavement Section (inches)
Caltrans Section 39, Standard Specifications, Asphalt Concrete	3.0	
Caltrans Section 26, Class 2 Baserock 95% compaction	5.5	
Subgrade Soil 95% compaction	12.0	
Traffic Index: 6 Design R-Value: 35 Traffic Description: Residential collectors; moderate auto and light truck traffic, light construction traffic	Alternate A Pavement Section (inches)	Alternate B Pavement Section (inches)
Caltrans Section 39, Standard Specifications, Asphalt Concrete	3.5	3
Caltrans Section 26, Class 2 Baserock 95% compaction	7.0	8.0
Subgrade Soil 95% compaction	12.0	12.0
Traffic Index: 7 Design R-Value 35 Traffic Description: Commercial roads (arterials serving areas which are primarily commercial in nature)	Alternate A Pavement Section (inches)	Alternate B Pavement Section (inches)
Caltrans Section 39, Standard Specifications, Asphalt Concrete	4.0	4.5
Caltrans Section 26, Class 2 Baserock 95% compaction	8.5	7.5
Subgrade Soil 95% compaction	12.0	12.0

We make the following recommendations regarding paving at the site.

1. Fill must be compacted to a minimum of 90 percent of the maximum dry density per ASTM D 1557, Modified Proctor. The upper 12 inches of subgrade in areas to be paved must be compacted to a minimum of 95 percent per ASTM D 1557. Baserock should be compacted to a minimum of 95 percent per ASTM D 1557. Moisture content, density and relative percent compaction should be verified by H&K. In addition to density testing, the subgrade must be proof-rolled under the observation of a representative of H&K, prior to baserock placement.
2. To reduce the likelihood of saturation of the aggregate base and subsequent frost heave, subgrade should be sloped to drain away from the proposed road alignment at a minimum 2 percent gradient.
3. Import soil, if used, should be predominantly granular, non-expansive and free of deleterious material. Proposed import should be submitted to H&K for testing prior to transport to the site.
4. Steel reinforced concrete slabs should be considered for use in loading bays, service docks, garbage facilities, and other areas where frequent, heavy vehicle loads are anticipated. The project structural engineer should determine slab thickness and steel reinforcement.

6 LIMITATIONS

The following limitations apply to the findings, conclusions and recommendations presented in this report:

1. Our professional services were performed consistent with the generally accepted geotechnical engineering principles and practices employed in the region. No warranty is expressed or implied.
2. These services were performed consistent with our agreement with our client. We are not responsible for the impacts of any changes in environmental standards, practices, or regulations subsequent to performance of our services. We do not warrant the accuracy of information supplied by others, or the use of segregated portions of this report. This report is solely for the use of our client unless noted otherwise. Any reliance on this report by a third party is at the party's sole risk.
3. If changes are made to the nature or design of the project as described in this report, then the conclusions and recommendations presented in this report should be considered invalid. Therefore, we should be retained to review project changes and prepare written responses with regards to their impacts on our conclusions and recommendations. However, we may require additional fieldwork and laboratory testing to develop any modifications to our recommendations. Any additional work will be performed only after receipt of an approved scope of services, budget, and written authorization to proceed.
4. The analyses, conclusions and recommendations presented in this report are based on site conditions as they existed at the time we performed our surface and subsurface field investigations. We have assumed that the subsurface soil and groundwater conditions encountered at the exploratory locations are generally representative of the subsurface conditions throughout the entire project site. However, the actual subsurface conditions at locations between and beyond our exploratory trenches may differ. Therefore, if the subsurface conditions encountered during construction are different than those described in this report, then we should be notified immediately so that we can review these differences and, if necessary, modify our recommendations.
5. The elevation or depth to groundwater underlying the project site may differ with time and location.
6. The project site map shows approximate exploratory locations as determined by pacing distances from identifiable site features. Therefore, the trench

locations should not be relied upon as being exact nor located with surveying methods.

7. The findings of this report are valid as of the present date. However, changes in the conditions of the property can occur with the passage of time. The changes may be due to natural processes or to the works of man, on the project site or adjacent properties. In addition, changes in applicable or appropriate standards can occur, whether they result from legislation or the broadening of knowledge. Therefore, the recommendations presented in this report should not be relied upon after a period of two years from the issue date without our review.

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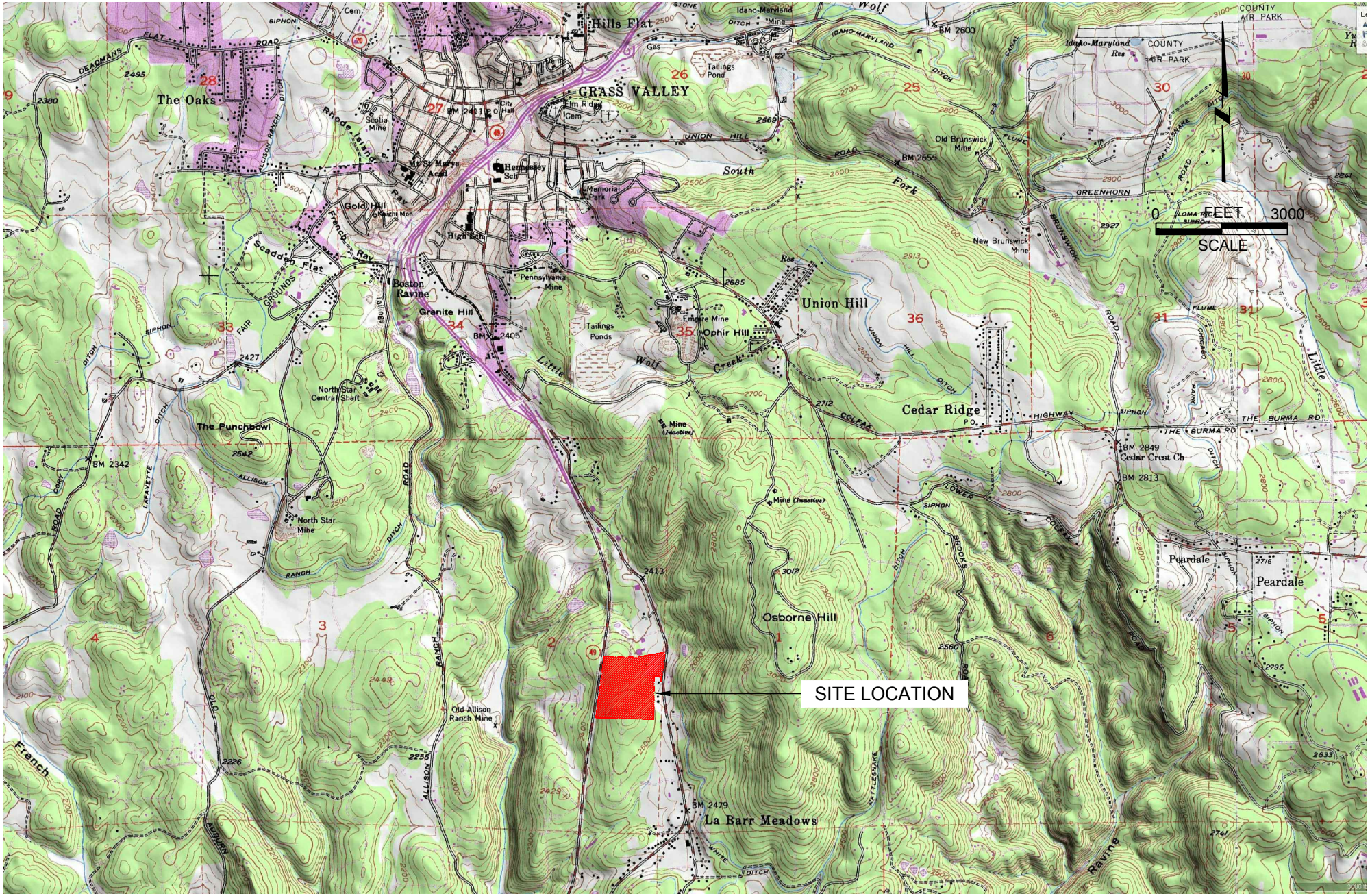
FIGURES

Figure 1 Location Map

Figure 2 Site Map



BASE MAP FROM USGS 7.5 MINUTE TOPOGRAPHIC MAP, GRASS VALLEY, CALIFORNIA QUADRANGLE, PHOTOREVISED 1973

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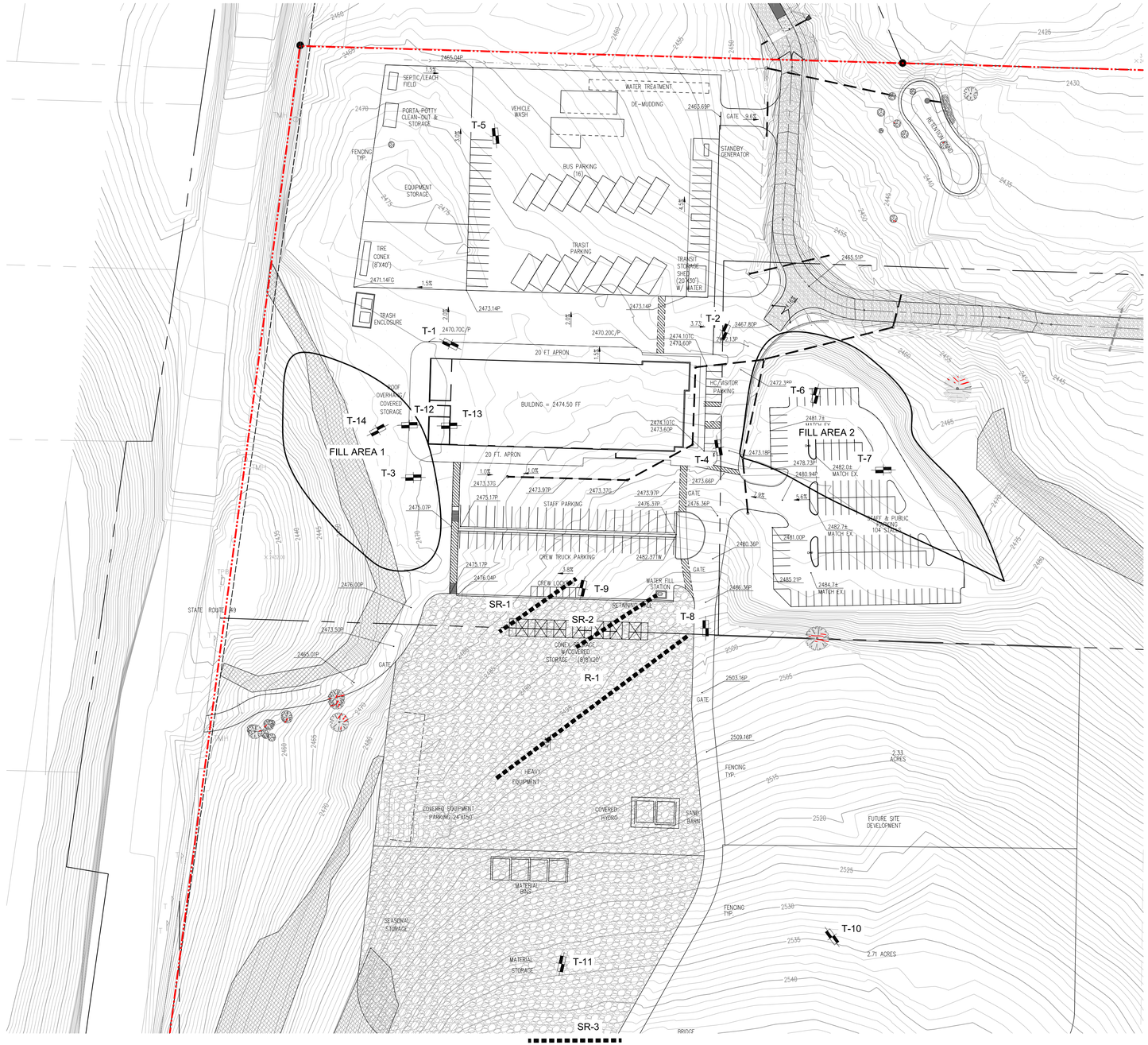
LOCATION MAP

NEVADA COUNTY OPERATIONS CENTER

GRASS VALLEY, CALIFORNIA

DRAWN BY:	BOTSFORD
CHECKED BY:	MUIR
H&K PROJECT:	4266A-01
DATE:	JUNE 2017

FIGURE
1



LEGEND

- APPROXIMATE PROPERTY BOUNDARY
- APPROXIMATE BOUNDARY OF FILL MATERIAL
- SR-3 / R-1 — APPROXIMATE SEISMIC REFRACTION / REMI LINE
- T-7 — EXPLORATORY TRENCH LOCATION

N

0 FEET 60
SCALE

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SITE MAP
FIGURE 2
NEVADA COUNTY OPERATIONS CENTER
GRASS VALLEY, CALIFORNIA

NO.	REVISIONS	DATE

DRAWN BY:	BJB
CHECKED BY:	JWM
H&K PROJECT:	4266A-01
DATE:	JUNE 2017

APPENDIX A

Proposal for Geotechnical Engineering Services

HOLDREGE & KULL
CONSULTING ENGINEERS • GEOLOGISTS

March 2, 2016

Reference: ***Nevada County Corporation Yard***
Bear River Mill Site
Nevada County, California

Subject: ***Proposal to Provide Geotechnical Engineering Services***

This letter presents our proposal to perform a design-level geotechnical report for the Nevada County Corporation Yard, to be located on 39 acres at the old Bear River Mill site, 12350 La Barr Meadows Road in Grass Valley. To prepare this proposal, we reviewed a Site Plan for the project prepared by SCO Planning, dated January 2016.

The purpose of our services will be to provide a design-level geotechnical investigation for the project that will provide information regarding the subsurface conditions at the project site and also provide engineering design criteria for the design of foundations, retaining walls, site grading recommendations, and pavement design.

SCOPE OF SERVICES

Based on our understanding of the project, we propose the following scope of services.

Literature Review

H&K will perform a map and literature review of published documents pertinent to the project site, including geologic maps and soil survey maps.

Site Investigation

H&K will perform a limited investigation of the project site to characterize shallow soil, rock, and groundwater conditions.

Surface Reconnaissance

H&K will perform a site reconnaissance to identify surface conditions that may impact the proposed development plans. An engineer or geologist from our firm will observe and describe surface exposures of the following existing site conditions:

1. Site and surrounding land uses
2. Surface soil conditions
3. Site topography and drainage
4. Vegetation
5. Geologic units exposed at the surface

While performing our surface reconnaissance, we will mark the area of proposed subsurface investigation for underground service alert.

Subsurface Investigation

Our field investigation will include the excavation of 10 to 12 exploratory trenches to depths of up to 10 feet below the ground surface or refusal. Excavated soil will be placed back into the exploratory trenches, but will not be compacted. Recompaction of the trenches should be accomplished during grading for the project.

During our field investigation, an engineer or geologist from our firm will log the soil conditions and collect relatively undisturbed and bulk soil samples. Relatively undisturbed soil samples will be collected with a 2.0-inch-diameter (inside diameter) hand-activated sampler equipped with brass liner tubes. Additional soil samples may be taken and/or the sample intervals may be changed depending upon the soil conditions encountered. The soil samples will be labeled, sealed, and transported to our office for storage.

Laboratory Testing

H&K will perform laboratory tests on selected soil samples to determine their engineering material properties. Laboratory tests will be performed using American Society for Testing and Materials (ASTM) and Caltrans methods as guidelines. Depending on the nature of the soil samples collected, the testing may include:

C117 No. 200 Mesh Wash Particle Size Analysis
D1557, Compaction Curve (4" mold)
D2216, Moisture Content
D2487, Unified Soil Classification System
D2937, Density-Moisture
D3080, Direct Shear Strength
D2166, Unconfined Compression Testing
D4829, Expansion Index
D2844, Resistance Value
Soil Corrosion Suite

The actual tests performed may vary, depending on the subsurface conditions encountered.

Data Analysis and Engineering

Following the completion of laboratory testing, data will be analyzed, and engineering calculations will be performed to determine the following:

1. Soil bearing capacity for shallow foundations
2. Lateral earth pressures for foundation and retaining wall design
3. Soil-concrete friction coefficients
4. Soil shear strength
5. Soil expansion and swell potential (if appropriate)

H&K will develop geotechnical engineering recommendations for earthwork and structural improvements and provide applicable recommendations. The geotechnical engineering recommendations will include the following:

Earthwork Improvement Recommendations

1. Subgrade preparation
2. Fill moisture conditioning, placement, and compaction requirements
3. Utility trench backfill placement and compaction requirements
4. Retaining wall backfill specifications
5. Retaining wall drainage
6. Surface water drainage
7. Expansive soil mitigation (if appropriate)
8. Temporary construction dewatering methods
9. Subdrain recommendations (if appropriate)

Structural Improvement Recommendations

1. Foundation types and embedment depths
2. Allowable soil bearing capacity
3. Foundation soil friction coefficients
4. Concrete slab-on-grade floors
5. Corrosion, soil/concrete – steel interaction.
6. Cantilever retaining wall lateral earth pressure coefficients, including effects of surcharge and seismic loading
7. Seismic design parameters
8. Pavement sections/recommendations

Report Preparation

We will prepare a geotechnical engineering report for the site that will present our findings, conclusions, and recommendations. The report will include descriptions of site conditions, a summary of the field investigation, laboratory test results, and geotechnical engineering design recommendations for the proposed improvements, including foundation design criteria and pavement recommendations. The report will also include a site plan showing the approximate locations of the exploratory trenches. The report appendices will present the exploratory trench logs and laboratory test data.

Plan Review

We will provide a review of design documents to determine conformance with our geotechnical engineering report recommendations.

Environmental Engineering Consultation

We will provide limited consultation services regarding the historical contaminated soils investigation. Our scope is limited to eight hours of consultation and does not include providing site investigation and environmental testing services. If the need should arise for additional environmental consultation, we are able to provide the additional services on a time and materials basis upon written authorization.

ASSUMPTIONS AND CLIENT RESPONSIBILITIES

The proposed scope of services is based on the following assumptions:

- The client will provide H&K with the authorization to access the site. Although reasonable care will be used during our investigation, the client understands that unmarked underground utilities may be damaged. H&K will not be responsible for repair of utilities that were not marked or were improperly marked prior to the investigation.
- Four copies of the report will be sent to the client and/or the client's engineers and architects. In addition, we will prepare a pdf format version of the report to facilitate distribution to the project team.

FEE

Our fee to perform the geotechnical investigation described above will be . This fee includes the costs associated with backhoe services to excavate exploratory trenches. Billing will be monthly on a percent-complete basis. If this proposal is acceptable, please return a signed copy of the attached agreement as our authorization to proceed.

SCHEDULE

Based on our current work load, we would be able to schedule our field investigation within two weeks of receiving authorization to proceed, weather permitting. We can provide our geotechnical engineering report within four weeks of performing the field investigation.
We appreciate the opportunity to provide you with this proposal. If you have any questions, please feel free to contact our office.

Sincerely,
HOLDREGE & KULL

Chuck Kull, G.E. 2359
Principal Engineer

Attached: Agreement for Geotechnical Engineering Services

F:\2 Proposals\PN16041-01 Bear River Mill Site\PN16041 Draft Proposal Bear River Mill Site (CRK).doc

APPENDIX B

Important Information About Your Geotechnical Engineering Report
(Included with permission of GBA, Copyright 2016)

Important Information about This

Geotechnical-Engineering Report

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes.

While you cannot eliminate all such risks, you can manage them. The following information is provided to help.

The Geoprofessional Business Association (GBA) has prepared this advisory to help you – assumedly a client representative – interpret and apply this geotechnical-engineering report as effectively as possible. In that way, clients can benefit from a lowered exposure to the subsurface problems that, for decades, have been a principal cause of construction delays, cost overruns, claims, and disputes. If you have questions or want more information about any of the issues discussed below, contact your GBA-member geotechnical engineer. Active involvement in the Geoprofessional Business Association exposes geotechnical engineers to a wide array of risk-confrontation techniques that can be of genuine benefit for everyone involved with a construction project.

Geotechnical-Engineering Services Are Performed for Specific Purposes, Persons, and Projects

Geotechnical engineers structure their services to meet the specific needs of their clients. A geotechnical-engineering study conducted for a given civil engineer will not likely meet the needs of a civil-works constructor or even a different civil engineer. Because each geotechnical-engineering study is unique, each geotechnical-engineering report is unique, prepared *solely* for the client. *Those who rely on a geotechnical-engineering report prepared for a different client can be seriously misled*. No one except authorized client representatives should rely on this geotechnical-engineering report without first conferring with the geotechnical engineer who prepared it. *And no one – not even you – should apply this report for any purpose or project except the one originally contemplated.*

Read this Report in Full

Costly problems have occurred because those relying on a geotechnical-engineering report did not read it *in its entirety*. Do not rely on an executive summary. Do not read selected elements only. *Read this report in full.*

You Need to Inform Your Geotechnical Engineer about Change

Your geotechnical engineer considered unique, project-specific factors when designing the study behind this report and developing the confirmation-dependent recommendations the report conveys. A few typical factors include:

- the client's goals, objectives, budget, schedule, and risk-management preferences;
- the general nature of the structure involved, its size, configuration, and performance criteria;
- the structure's location and orientation on the site; and
- other planned or existing site improvements, such as retaining walls, access roads, parking lots, and underground utilities.

Typical changes that could erode the reliability of this report include those that affect:

- the site's size or shape;
- the function of the proposed structure, as when it's changed from a parking garage to an office building, or from a light-industrial plant to a refrigerated warehouse;
- the elevation, configuration, location, orientation, or weight of the proposed structure;
- the composition of the design team; or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project changes – even minor ones – and request an assessment of their impact. *The geotechnical engineer who prepared this report cannot accept responsibility or liability for problems that arise because the geotechnical engineer was not informed about developments the engineer otherwise would have considered.*

This Report May Not Be Reliable

Do not rely on this report if your geotechnical engineer prepared it:

- for a different client;
- for a different project;
- for a different site (that may or may not include all or a portion of the original site); or
- before important events occurred at the site or adjacent to it; e.g., man-made events like construction or environmental remediation, or natural events like floods, droughts, earthquakes, or groundwater fluctuations.

Note, too, that it could be unwise to rely on a geotechnical-engineering report whose reliability may have been affected by the passage of time, because of factors like changed subsurface conditions; new or modified codes, standards, or regulations; or new techniques or tools. *If your geotechnical engineer has not indicated an "apply-by" date on the report, ask what it should be*, and, in general, *if you are the least bit uncertain* about the continued reliability of this report, contact your geotechnical engineer before applying it. A minor amount of additional testing or analysis – if any is required at all – could prevent major problems.

Most of the "Findings" Related in This Report Are Professional Opinions

Before construction begins, geotechnical engineers explore a site's subsurface through various sampling and testing procedures. *Geotechnical engineers can observe actual subsurface conditions only at those specific locations where sampling and testing were performed*. The data derived from that sampling and testing were reviewed by your geotechnical engineer, who then applied professional judgment to form opinions about subsurface conditions throughout the site. Actual sitewide-subsurface conditions may differ – maybe significantly – from those indicated in this report. Confront that risk by retaining your geotechnical engineer to serve on the design team from project start to project finish, so the individual can provide informed guidance quickly, whenever needed.

This Report's Recommendations Are Confirmation-Dependent

The recommendations included in this report – including any options or alternatives – are confirmation-dependent. In other words, *they are not final*, because the geotechnical engineer who developed them relied heavily on judgment and opinion to do so. Your geotechnical engineer can finalize the recommendations *only after observing actual subsurface conditions* revealed during construction. If through observation your geotechnical engineer confirms that the conditions assumed to exist actually do exist, the recommendations can be relied upon, assuming no other changes have occurred. *The geotechnical engineer who prepared this report cannot assume responsibility or liability for confirmation-dependent recommendations if you fail to retain that engineer to perform construction observation.*

This Report Could Be Misinterpreted

Other design professionals' misinterpretation of geotechnical-engineering reports has resulted in costly problems. Confront that risk by having your geotechnical engineer serve as a full-time member of the design team, to:

- confer with other design-team members,
- help develop specifications,
- review pertinent elements of other design professionals' plans and specifications, and
- be on hand quickly whenever geotechnical-engineering guidance is needed.

You should also confront the risk of constructors misinterpreting this report. Do so by retaining your geotechnical engineer to participate in prebid and preconstruction conferences and to perform construction observation.

Give Constructors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can shift unanticipated-subsurface-conditions liability to constructors by limiting the information they provide for bid preparation. To help prevent the costly, contentious problems this practice has caused, include the complete geotechnical-engineering report, along with any attachments or appendices, with your contract documents, *but be certain to note conspicuously that you've included the material for informational purposes only*. To avoid misunderstanding, you may also want to note that "informational purposes" means constructors have no right to rely on the interpretations, opinions, conclusions, or recommendations in the report, but they may rely on the factual data relative to the specific times, locations, and depths/elevations referenced. Be certain that constructors know they may learn about specific project requirements, including options selected from the report, *only* from the design drawings and specifications. Remind constructors that they may perform their own studies if they want to, and *be sure to allow enough time* to permit them to do so. Only then might you be in a position to give constructors the information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions. Conducting prebid and preconstruction conferences can also be valuable in this respect.

Read Responsibility Provisions Closely

Some client representatives, design professionals, and constructors do not realize that geotechnical engineering is far less exact than other engineering disciplines. That lack of understanding has nurtured unrealistic expectations that have resulted in disappointments, delays, cost overruns, claims, and disputes. To confront that risk, geotechnical engineers commonly include explanatory provisions in their reports. Sometimes labeled "limitations," many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely*. Ask questions. Your geotechnical engineer should respond fully and frankly.

Geoenvironmental Concerns Are Not Covered

The personnel, equipment, and techniques used to perform an environmental study – e.g., a "phase-one" or "phase-two" environmental site assessment – differ significantly from those used to perform a geotechnical-engineering study. For that reason, a geotechnical-engineering report does not usually relate any environmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated subsurface environmental problems have led to project failures*. If you have not yet obtained your own environmental information, ask your geotechnical consultant for risk-management guidance. As a general rule, *do not rely on an environmental report prepared for a different client, site, or project, or that is more than six months old.*

Obtain Professional Assistance to Deal with Moisture Infiltration and Mold

While your geotechnical engineer may have addressed groundwater, water infiltration, or similar issues in this report, none of the engineer's services were designed, conducted, or intended to prevent uncontrolled migration of moisture – including water vapor – from the soil through building slabs and walls and into the building interior, where it can cause mold growth and material-performance deficiencies. Accordingly, ***proper implementation of the geotechnical engineer's recommendations will not of itself be sufficient to prevent moisture infiltration.*** Confront the risk of moisture infiltration by including building-envelope or mold specialists on the design team. ***Geotechnical engineers are not building-envelope or mold specialists.***

GEOPROFESSIONAL BUSINESS ASSOCIATION

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APPENDIX C

Lithologic Logs

TRENCH T–1

PROJECT NO.	PROJECT NAME	ELEVATION	DATE	PAGE	TRENCH NO.
4266A–01	NEVADA COUNTY OPS. CENTER	NA	5–23–17	1 OF 1	T–1

EXCAVATION METHOD	SAMPLING METHOD	GROUNDWATER ENCOUNTERED	CAVED
JOHN DEERE 310SE WITH 18–INCH BUCKET	GRAB–HAND–BULK	NONE	NONE

SAMPLE NO.	POCKET PEN (tsf)	DRY DENSITY (PCF)	PERCENT MOISTURE	DEPTH (FT)	USCS	DESCRIPTIONS/REMARKS
BULK–6						1 – 2 INCHES FOREST DUFF
				1	ML	STRONG BROWN (7.5YR 4/6) SANDY SILT, MOIST, MEDIUM DENSE, ANGULAR ROCKS TO 4" IN DIAMETER THROUGHOUT. FIELD ESTIMATE: 40% FINE SAND, 60% LOW PLASTICITY CLAY–SILT.
				2		
				3		
				4	SM	YELLOWISH RED (5YR 5/8) SILTY SAND WITH GRAVEL, DAMP, DENSE, NON PLASTIC. FIELD ESTIMATE: 70% FINE SAND, 30% LOW PLASTICITY CLAY–SILT.
				5		
				6		
				7		COMPLETELY WEATHERED ROCK STRUCTURE VISIBLE (QUARTZ DIORITE).
				8		
				9		
				10		TRENCH TERMINATED AT 10 FEET BGS
				11		
				12		
				13		
				14		
				15		
				16		
				17		
				18		
				19		
				20		

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TRENCH T-2

PROJECT NO.	PROJECT NAME	ELEVATION	DATE	PAGE	TRENCH NO.
4266A-01	NEVADA COUNTY OPS. CENTER	NA	5-23-17	1 OF 1	T-2

EXCAVATION METHOD	SAMPLING METHOD	GROUNDWATER ENCOUNTERED	CAVED
JOHN DEERE 310SE WITH 18-INCH BUCKET	GRAB-HAND-BULK	NONE	NONE

SAMPLE NO.	POCKET PEN (tsf)	DRY DENSITY (PCF)	PERCENT MOISTURE	DEPTH (FT)	USCS	DESCRIPTIONS/REMARKS
BULK-3						3 - 4 INCHES FOREST DUFF
				1	ML	STRONG BROWN (7.5YR 5/8) SANDY SILT WITH CLAY, DAMP, LOOSE.
				2		
				3		
SS-3						
				4	SM	STRONG BROWN (7.5YR 5/8) SILTY SAND WITH GRAVEL, DAMP, MEDIUM DENSE.
				5		COMPLETELY WEATHERED ROCK STRUCTURE VISIBLE (QUARTZ DIORITE).
				6		
				7		
				8		TRENCH TERMINATED AT 8 FEET BGS
				9		
				10		
				11		
				12		
				13		
				14		
				15		
				16		
				17		
				18		
				19		
				20		

HOLDREGE & KULL

TRENCH T–3

PROJECT NO.	PROJECT NAME	ELEVATION	DATE	PAGE	TRENCH NO.
4266A–01	NEVADA COUNTY OPS. CENTER	NA	5–23–17	1 OF 1	T–3

EXCAVATION METHOD	SAMPLING METHOD	GROUNDWATER ENCOUNTERED	CAVED
JOHN DEERE 310SE WITH 18–INCH BUCKET	GRAB–HAND–BULK	NONE	NONE

SAMPLE NO.	POCKET PEN (tsf)	DRY DENSITY (PCF)	PERCENT MOISTURE	DEPTH (FT)	USCS	DESCRIPTIONS/REMARKS
						1 – 2 INCHES FOREST DUFF
				1	SM	(FILL) DARK BROWN (7.5YR 3/4) SILTY SAND, DAMP, LOOSE. FIELD ESTIMATE: 70% FINE SAND, 30% LOW PLASTICITY CLAY AND SILT.
				2		
				3	OL	(FILL) VERY DARK BROWN (7.5YR 2.5/2) ORGANIC RICH CLAYEY SILT, MOIST, SOFT, DECOMPOSED ROOTS AND WOOD DEBRIS THROUGHOUT. FIELD ESTIMATE: 30% FINE SAND, 70% LOW PLASTICITY CLAY AND SILT.
				4		
				5		
				6		
				7		
BULK–8				8	ML	(FILL) DARK BROWN (7.5YR 3/4) CLAYEY SILT, MOIST, SOFT, LESS ORGANIC MATERIAL. FIELD ESTIMATE: 40% FINE SAND, 60% LOW PLASTICITY CLAY AND SILT.
				9		
				10		
				11		TRENCH TERMINATED AT 11 FEET BGS.
				12		
				13		
				14		
				15		
				16		
				17		
				18		
				19		
				20		

TRENCH T–4

PROJECT NO.	PROJECT NAME	ELEVATION	DATE	PAGE	TRENCH NO.
4266A–01	NEVADA COUNTY OPS. CENTER	NA	11–01–05	1 OF 1	T–4

EXCAVATION METHOD	SAMPLING METHOD	GROUNDWATER ENCOUNTERED	CAVED
JOHN DEERE 310SE WITH 18–INCH BUCKET	GRAB–HAND–BULK	NONE	NONE

SAMPLE NO.	POCKET PEN (tsf)	DRY DENSITY (PCF)	PERCENT MOISTURE	DEPTH (FT)	USCS	DESCRIPTIONS/REMARKS
						3 – 4 INCHES FOREST DUFF
BULK–3				1	ML	STRONG BROWN (7.5YR 5/8) SANDY SILT WITH CLAY, DAMP, LOOSE, SOIL STRUCTURE VISIBLE THROUGHOUT.
				2		
SS–2				3		
				4	SM	BROWN (7.5YR 5/3) SILTY SAND WITH GRAVEL, DAMP TO DRY, LOOSE, NON PLASTIC. FIELD ESTIMATE: 70% FINE SAND, 30% LOW PLASTICITY CLAY AND SILT.
				5		
				6		
				7		
				8		
				9		
				10		
				11		TRENCH TERMINATED AT 11 FEET BGS
				12		
				13		
				14		
				15		
				16		
				17		
				18		
				19		
				20		

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TRENCH T-5

PROJECT NO.	PROJECT NAME	ELEVATION	DATE	PAGE	TRENCH NO.
4266A-01	NEVADA COUNTY OPS. CENTER	NA	5-23-17	1 OF 1	T-5

EXCAVATION METHOD	SAMPLING METHOD	GROUNDWATER ENCOUNTERED	CAVED
JOHN DEERE 310SE WITH 18-INCH BUCKET	GRAB-HAND-BULK	NONE	NONE

SAMPLE NO.	POCKET PEN (tsf)	DRY DENSITY (PCF)	PERCENT MOISTURE	DEPTH (FT)	USCS	DESCRIPTIONS/REMARKS
						3 INCHES FOREST DUFF
BULK-5				1	SM	YELLOWISH RED (5YR 5/8) SILTY FINE SAND WITH GRAVEL, DAMP, DENSE, NON PLASTIC. FIELD ESTIMATE: 50% FINE SAND, 50% LOW PLASTICITY CLAY AND SILT
				2		
				3		
				4		
SS-4				5		
				6		COMPLETELY WEATHERED ROCK STRUCTURE VISIBLE (QUARTZ DIORITE).
				7		
				8		
				9		
				10		
				11		
				12		TRENCH TERMINATED AT 11.5 FEET BGS
				13		
				14		
				15		
				16		
				17		
				18		
				19		
				20		

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TRENCH T-6

PROJECT NO.	PROJECT NAME	ELEVATION	DATE	PAGE	TRENCH NO.
4266A-01	NEVADA COUNTY OPS. CENTER	NA	5-23-17	1 OF 1	T-6

EXCAVATION METHOD	SAMPLING METHOD	GROUNDWATER ENCOUNTERED	CAVED
JOHN DEERE 310SE WITH 18-INCH BUCKET	GRAB-HAND-BULK	NONE	NONE

SAMPLE NO.	POCKET PEN (tsf)	DRY DENSITY (PCF)	PERCENT MOISTURE	DEPTH (FT)	USCS	DESCRIPTIONS/REMARKS
				1	SM	(FILL) YELLOWISH RED (5YR 5/8) SILTY SAND WITH ANGULAR GRAVEL TO 4" IN DIAMETER, DRY, LOOSE, NON-PLASTIC. FIELD ESTIMATE: 60% FINE SAND, 40% LOW PLASTICITY CLAY AND SILT.
				2		
				3		
BULK-1				4		
				5		
				6		
				7		
				8		
				9	OL	(FILL) VERY DARK BROWN (5YR 5/8) SANDY SILT WITH DECOMPOSED ORGANIC DEBIS THROUGHOUT, MOIST, MEDIUM DENSE, NON-PLASTIC (FILL). FIELD ESTIMATE: 70% FINE SAND, 30% LOW PLASTICITY CLAY AND SILT.
				10		TRENCH TERMINATED AT 10 FEET BGS
				11		
				12		
				13		
				14		
				15		
				16		
				17		
				18		
				19		
				20		

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TRENCH T-7

PROJECT NO.	PROJECT NAME	ELEVATION	DATE	PAGE	TRENCH NO.
4266A-01	NEVADA COUNTY OPS. CENTER	NA	5-23-17	1 OF 1	T-7

EXCAVATION METHOD	SAMPLING METHOD	GROUNDWATER ENCOUNTERED	CAVED
JOHN DEERE 310SE WITH 18-INCH BUCKET	GRAB-HAND-BULK	NONE	NONE

SAMPLE NO.	POCKET PEN (tsf)	DRY DENSITY (PCF)	PERCENT MOISTURE	DEPTH (FT)	USCS	DESCRIPTIONS/REMARKS
				1	SM	(FILL) YELLOWISH RED (5YR 5/8) SILTY SAND WITH SUBANGULAR GRAVEL AND BOULDERS TO 2' IN DIAMETER, DAMP, LOOSE, NON PLASTIC. FIELD ESTIMATE: 60% FINE SAND, 40% LOW PLASTICITY CLAY AND SILT.
SS-1				2		
				3		
				4		
				5		
BULK-2				6	OL	(FILL) VERY DARK BROWN (5YR 5/8) SILTY SAND WITH DECOMPOSED ORGANIC DEBIS THROUGHOUT, MOIST, MEDIUM DENSE, NON-PLASTIC (FILL). FIELD ESTIMATE: 60% FINE SAND, 40% LOW PLASTICITY CLAY AND SILT.
				7		
				8	ML	YELLOWISH RED (5YR 5/8) SANDY SILT WITH CLAY, DAMP, LOOSE, LOW PLASTICITY. FIELD ESTIMATE: 40% FINE SAND, 60% LOW PLASTICITY CLAY AND SILT.
				9		
				10		
				11		
				12		TRENCH TERMINATED AT 11.5 FEET BGS
				13		
				14		
				15		
				16		
				17		
				18		
				19		
				20		

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TRENCH T-8

PROJECT NO.	PROJECT NAME	ELEVATION	DATE	PAGE	TRENCH NO.
4266A-01	NEVADA COUNTY OPS. CENTER	NA	5-23-17	1 OF 1	T-8

EXCAVATION METHOD	SAMPLING METHOD	GROUNDWATER ENCOUNTERED	CAVED
JOHN DEERE 310SE WITH 18-INCH BUCKET	GRAB-HAND-BULK	NONE	NONE

SAMPLE NO.	POCKET PEN (tsf)	DRY DENSITY (PCF)	PERCENT MOISTURE	DEPTH (FT)	USCS	DESCRIPTIONS/REMARKS
						ANGULAR CRUSHED BASEROCK TO 4" IN DIAMETER
				1	ML	STRONG BROWN (7.5YR 5/8) SANDY SILT, DAMP, LOOSE.
				2		
				3		
				4		
				5	SM	YELLOWISH RED 5YR (5/8) SILTY SAND WITH GRAVEL, DAMP, LOOSE, NON PLASTIC. FIELD ESTIMATE (70% FINE SAND, 30% LOW PLASTICITY CLAY AND SILT).
				6		
				7		
				8		
				9		COMPLETELY WEATHERED ROCK STRUCTURE VISIBLE (QUARTZ DIORITE).
				10		
				11		
				12		
				13		TRENCH TERMINATED AT 13 FEET BGS
				14		
				15		
				16		
				17		
				18		
				19		
				20		

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TRENCH T–9

PROJECT NO.	PROJECT NAME	ELEVATION	DATE	PAGE	TRENCH NO.
4266A–01	NEVADA COUNTY OPS. CENTER	NA	5–23–17	1 OF 1	T–9

EXCAVATION METHOD	SAMPLING METHOD	GROUNDWATER ENCOUNTERED	CAVED
JOHN DEERE 310SE WITH 18–INCH BUCKET	GRAB–HAND–BULK	NONE	NONE

SAMPLE NO.	POCKET PEN (tsf)	DRY DENSITY (PCF)	PERCENT MOISTURE	DEPTH (FT)	USCS	DESCRIPTIONS/REMARKS
				1	ML	YELLOWISH RED (5YR 5/8) FINE SANDY SILT WITH SUBANGULAR ROCKS TO 4" IN DIAMETER, DAMP, LOOSE. FIELD ESTIMATE: 40% FINE SAND, 60% LOW PLASTICITY CLAY AND SILT. (FILL)
				2	SM	YELLOWISH RED (5YR 5/8) SILTY SAND WITH GRAVEL, MOIST, LOOSE. FIELD ESTIMATE: 70% FINE SAND, 30% LOW PLASTICITY CLAY AND SILT.
				3		
				4		
				5		
				6		
				7		COMPLETELY WEATHERED ROCK STRUCTURE VISIBLE (QUARTZ DIORITE).
				8		
				9		
				10		
				11		
				12		TRENCH TERMINATED AT 11.5 FEET BGS
				13		
				14		
				15		
				16		
				17		
				18		
				19		
				20		

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TRENCH T–10

PROJECT NO.	PROJECT NAME	ELEVATION	DATE	PAGE	TRENCH NO.
4266A–01	NEVADA COUNTY OPS. CENTER	NA	5–23–17	1 OF 1	T–10

EXCAVATION METHOD	SAMPLING METHOD	GROUNDWATER ENCOUNTERED	CAVED
JOHN DEERE 310SE WITH 18–INCH BUCKET	GRAB–HAND–BULK	NONE	NONE

SAMPLE NO.	POCKET PEN (tsf)	DRY DENSITY (PCF)	PERCENT MOISTURE	DEPTH (FT)	USCS	DESCRIPTIONS/REMARKS
						1 – 2 INCHES FOREST DUFF
				1	SM	YELLOWISH RED (5YR 5/8) SANDY SILT WITH GRAVEL, DAMP, LOOSE. FIELD ESTIMATE: 70% MEDIUM SAND AND FINE GRAVEL, 30% LOW PLASTICITY CLAY AND SILT.
				2		
				3		
				4		
				5		
				6		COMPLETELY WEATHERED ROCK STRUCTURE VISIBLE (QUARTZ DIORITE).
				7		
				8		
				9		
				10		TRENCH TERMINATED AT 10 FEET BGS
				11		
				12		
				13		
				14		
				15		
				16		
				17		
				18		
				19		
				20		

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TRENCH T-11

PROJECT NO.	PROJECT NAME	ELEVATION	DATE	PAGE	TRENCH NO.
4266A-01	NEVADA COUNTY OPS. CENTER	NA	5-23-17	1 OF 1	T-11

EXCAVATION METHOD	SAMPLING METHOD	GROUNDWATER ENCOUNTERED	CAVED
JOHN DEERE 310SE WITH 18-INCH BUCKET	NONE	NONE	NONE

SAMPLE NO.	POCKET PEN (tsf)	DRY DENSITY (PCF)	PERCENT MOISTURE	DEPTH (FT)	USCS	DESCRIPTIONS/REMARKS
BULK-9						3 INCHES FOREST DUFF
				1	SM	YELLOWISH RED (5YR 5/8) SANDY SILT WITH GRAVEL, DAMP, LOOSE, SOIL STRUCTURE VISIBLE THROUGHOUT. FIELD ESTIMATE: 70% MEDIUM SAND AND FINE GRAVEL, 30% LOW PLASTICITY CLAY AND SILT.
				2		
				3		
SS-5				4		
				5		
				6		COMPLETELY WEATHERED ROCK STRUCTURE VISIBLE (QUARTZ DIORITE).
				7		
				8		
				9		
				10		
				11		TRENCH TERMINATED AT 11 FEET BGS
				12		
				13		
				14		
				15		
				16		
				17		
				18		
				19		
				20		

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TRENCH T–12

PROJECT NO.	PROJECT NAME	ELEVATION	DATE	PAGE	TRENCH NO.
4266A–01	NEVADA COUNTY OPS. CENTER	NA	5–23–17	1 OF 1	T–12

EXCAVATION METHOD	SAMPLING METHOD	GROUNDWATER ENCOUNTERED	CAVED
JOHN DEERE 310SE WITH 18–INCH BUCKET	GRAB–HAND–BULK	NONE	NONE

SAMPLE NO.	POCKET PEN (tsf)	DRY DENSITY (PCF)	PERCENT MOISTURE	DEPTH (FT)	USCS	DESCRIPTIONS/REMARKS
				1	SM	YELLOWISH RED (5YR 5/8) SILTY SAND WITH SUBANGULAR ROCKS TO 4" IN DIAMETER, DAMP, LOOSE. FIELD ESTIMATE: 60% FINE SAND, 40% LOW PLASTICITY CLAY AND SILT. (FILL)
				3	OL	VERY DARK BROWN (7.5YR 2.5/2) ORGANIC RICH CLAYEY SILT, MOIST, SOFT, DECOMPOSED ROOTS AND WOOD DEBRIS THROUGHOUT. FIELD ESTIMATE: 60% FINE SAND, 40% LOW PLASTICITY CLAY AND SILT. (FILL)
				5	SM	YELLOWISH RED (5YR 5/8) SILTY SAND WITH GRAVEL, MOIST, LOOSE, SOIL STRUCTURE VISIBLE THROUGHOUT. FIELD ESTIMATE: 70% FINE SAND, 30% LOW PLASTICITY CLAY AND SILT.
				6		TRENCH TERMINATED AT 6 FEET BGS
				7		
				8		
				9		
				10		
				11		
				12		
				13		
				14		
				15		
				16		
				17		
				18		
				19		
				20		

HOLDREGE & KULL

TRENCH T-13

PROJECT NO.	PROJECT NAME	ELEVATION	DATE	PAGE	TRENCH NO.
4266A-01	NEVADA COUNTY OPS CENTER	NA	5-23-17	1 OF 1	T-13

EXCAVATION METHOD	SAMPLING METHOD	GROUNDWATER ENCOUNTERED	CAVED
JOHN DEERE 310SE WITH 18-INCH BUCKET	GRAB-HAND-BULK	NONE	NONE

SAMPLE NO.	POCKET PEN (tsf)	DRY DENSITY (PCF)	PERCENT MOISTURE	DEPTH (FT)	USCS	DESCRIPTIONS/REMARKS
						3 INCHES FOREST DUFF
				1	ML	STRONG BROWN (7.5YR 5/8) SANDY SILT, DAMP, LOOSE.
				2		
				3		
				4		TRENCH TERMINATED AT 4 FEET BGS
				5		
				6		
				7		
				8		
				9		
				10		
				11		
				12		
				13		
				14		
				15		
				16		
				17		
				18		
				19		
				20		

HOLDREGE & KULL

TRENCH T–14

PROJECT NO.	PROJECT NAME	ELEVATION	DATE	PAGE	TRENCH NO.
4266A–01	NEVADA COUNTY OPS. CENTER	NA	5–23–17	1 OF 1	T–14

EXCAVATION METHOD	SAMPLING METHOD	GROUNDWATER ENCOUNTERED	CAVED
JOHN DEERE 310SE WITH 18–INCH BUCKET	GRAB–HAND–BULK	NONE	NONE

SAMPLE NO.	POCKET PEN (tsf)	DRY DENSITY (PCF)	PERCENT MOISTURE	DEPTH (FT)	USCS	DESCRIPTIONS/REMARKS
				1	SM	YELLOWISH RED (5YR 5/8) SILTY SAND WITH SUBANGULAR ROCKS TO 6" IN DIAMETER, DAMP, LOOSE. FIELD ESTIMATE: 60% FINE SAND, 40% LOW PLASTICITY CLAY AND SILT. (FILL)
				2	OL	VERY DARK BROWN (7.5YR 2.5/2) ORGANIC RICH CLAYEY SILT, MOIST, SOFT, DECOMPOSED ROOTS TO 2" DIAMETER AND WOOD DEBRIS THROUGHOUT. FIELD ESTIMATE: 50% FINE SAND, 50% LOW PLASTICITY CLAY AND SILT. (FILL)
				3		
				4		
				5		
				6		
				7		
				8		
				9		
				10	SM	YELLOWISH RED (5YR 5/8) SILTY FINE SAND, MOIST, LOOSE. FIELD ESTIMATE: 70% FINE SAND, 30% LOW PLASTICITY CLAY AND SILT.
				11		
				12		
				13		TRENCH TERMINATED AT 13 FEET BGS
				14		
				15		
				16		
				17		
				18		
				19		
				20		

HOLDREGE & KULL

APPENDIX D

Laboratory Reports

HOLDREGE & KULL
CONSULTING ENGINEERS • GEOLOGISTS

Atterberg Indices

ASTM D4318

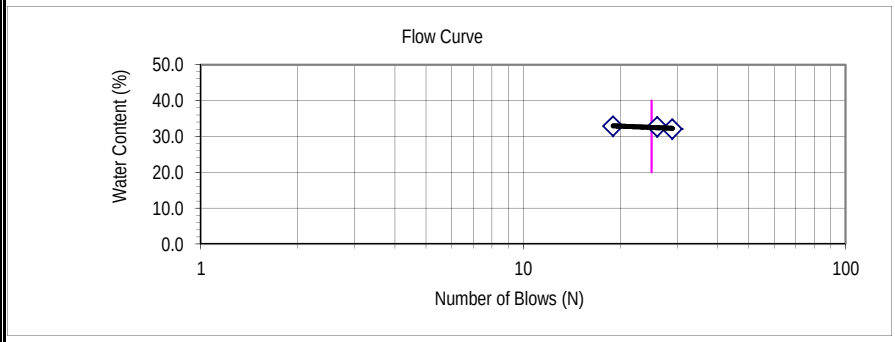
DSA File #:
DSA Appl #:

Project No.:	**4266A-01**	Project Name:	**NCOC**			Date:	**5/25/2017**
Sample No.:	**Bulk-6**	Boring/Trench:	**T-1**	Depth, (ft.):	**0-3**	Tested By:	**MLH/HLR**
Description:	**Yellowish Red (5YR 5/8) Clayey Sand**					Checked By:	**MLH**
Sample Location:						Lab. No.:	**15-17-162**

Estimated % of Sample Retained on No. 40 Sieve: 50 Sample Air Dried: yes

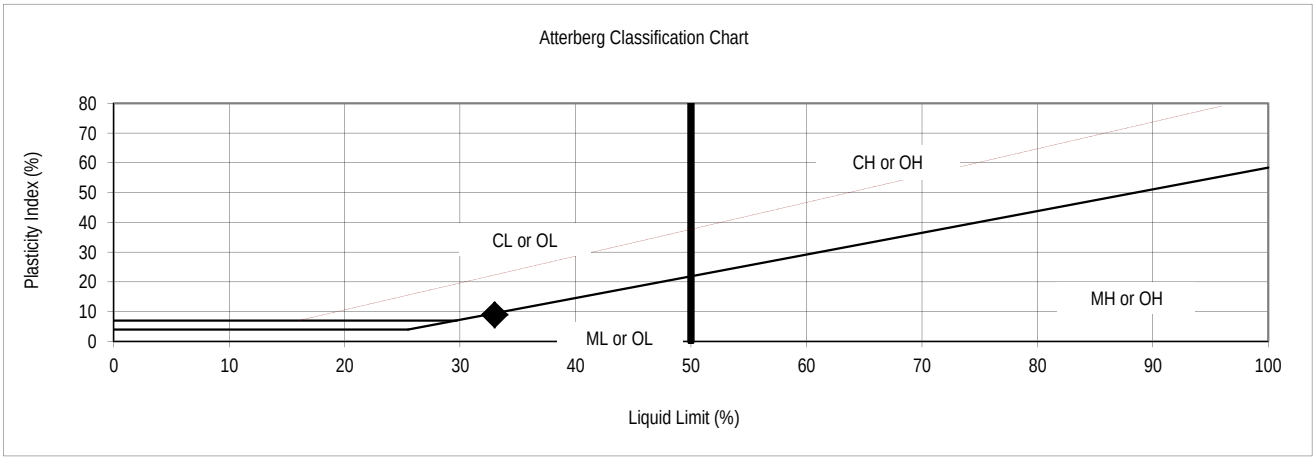
Test Method A or B: A

	LIQUID LIMIT:					PLASTIC LIMIT:		
Sample No.:	1	2	3	4	5	1	2	3
Pan ID:	2T	19	36			47	34	
Wt. Pan (gr)	21.31	22.35	21.66			21.44	22.46	
Wt. Wet Soil + Pan (gr)	34.08	32.41	38.88			28.34	30.45	
Wt. Dry Soil + Pan (gr)	30.98	29.93	34.62			26.98	28.90	
Wt. Water (gr)	3.10	2.48	4.26			1.36	1.55	
Wt. Dry Soil (gr)	9.67	7.58	12.96			5.54	6.44	
Water Content (%)	32.1	32.7	32.9			24.5	24.1	
Number of Blows, N	29	26	19					
				LIQUID LIMIT =	33	PLASTIC LIMIT =		24



Plasticity Index = 9

Group Symbol = CL



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HOLDREGE & KULL
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Atterberg Indices

ASTM D4318

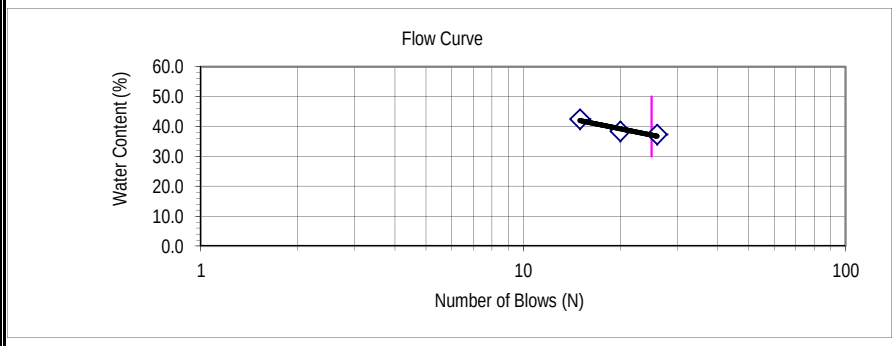
DSA File #:
DSA Appl #:

Project No.:	**4266A-01**	Project Name:	**NCOC**			Date:	**5/25/2017**
Sample No.:	**Bulk-3**	Boring/Trench:	**T-4**	Depth, (ft.):	**0-2**	Tested By:	**SJS**
Description:	**Yellowish Red (5YR 5/8) Sandy Lean Clay**					Checked By:	**MLH**
Sample Location:						Lab. No.:	**15-17-162**

Estimated % of Sample Retained on No. 40 Sieve: 50 Sample Air Dried: yes

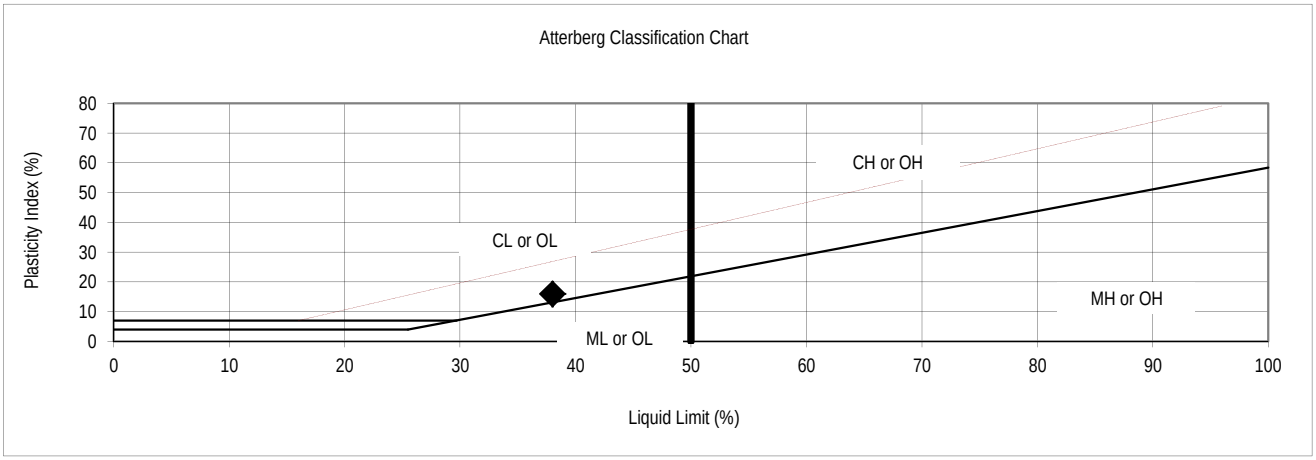
Test Method A or B: A

LIQUID LIMIT:						PLASTIC LIMIT:		
Sample No.:	1	2	3	4	5	1	2	3
Pan ID:	LC	NE	NF			AI	LE	
Wt. Pan (gr)	13.97	10.03	10.23			13.95	14.04	
Wt. Wet Soil + Pan (gr)	27.68	20.75	25.21			20.48	20.97	
Wt. Dry Soil + Pan (gr)	23.96	17.78	20.75			19.33	19.70	
Wt. Water (gr)	3.72	2.97	4.46			1.15	1.27	
Wt. Dry Soil (gr)	9.99	7.75	10.52			5.38	5.66	
Water Content (%)	37.2	38.3	42.4			21.4	22.4	
Number of Blows, N	26	20	15					
				LIQUID LIMIT =	38	PLASTIC LIMIT =		22



Plasticity Index = 16

Group Symbol = CL



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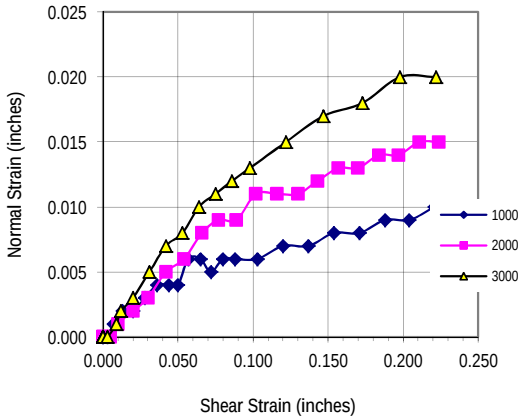
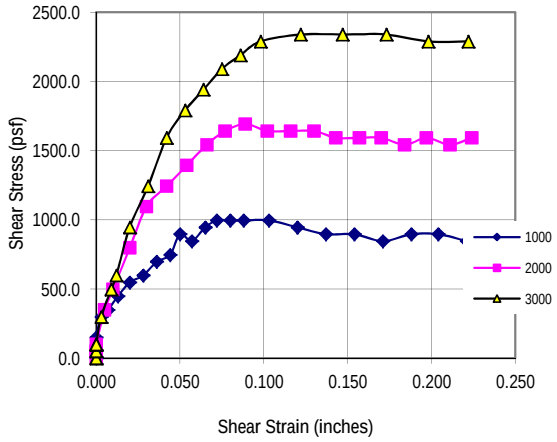
DIRECT SHEAR

TEST RESULTS

Shear Strain vs. Normal Strain



Shear Strain vs. Shear Stress



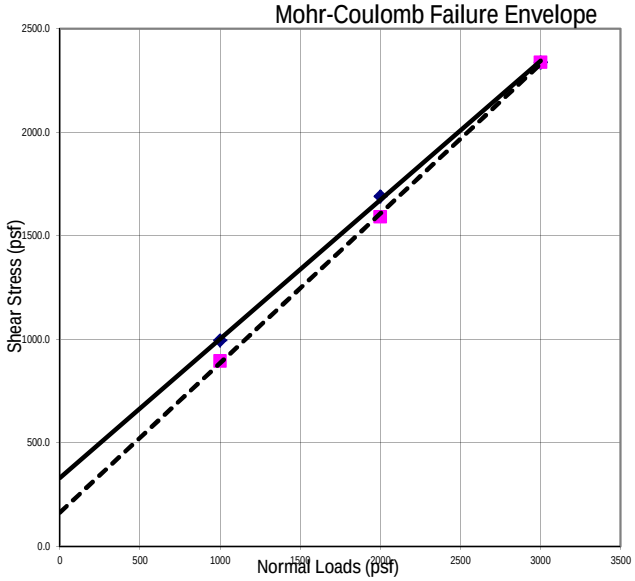
Normal Load (psf)

Normal Load (psf)

y = 0.7215x + 165.33
R² = 0.9996

y = 0.6714x + 331.57
R² = 0.9995

Mohr-Coulomb Failure Envelope



SHEAR STRENGTH TEST RESULTS		
PARAMETERS	PEAK STRENGTH:	RESIDUAL STRENGTH:
FRICTION ANGLE, (Degree)	33.9	35.8
COHESION, (psf)	331.6	165.0

HOLDREGE & KULL
CONSULTING ENGINEERS • GEOLOGISTS
792 SEARLS AVENUE
NEVADA CITY, CA 95959
(530) 478-1305 FAX 478-1019

PROJECT NAME: NCOC

PROJECT NO.: 4266A-01 DATE: 5/25/2017

BORING / TRENCH NO.: T-2 **LAB NO.** 15-17-162

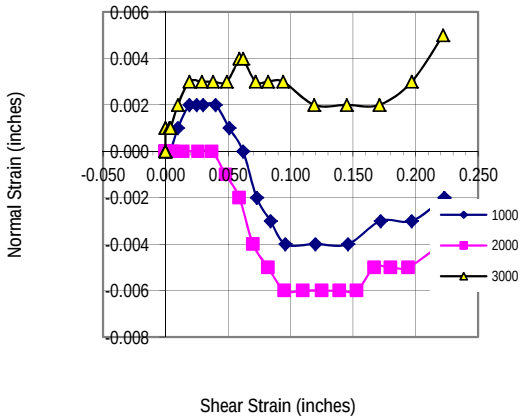
SAMPLE NO.: SS-3 **SAMPLE DEPTH (ft.):** 1.5

DESCRIPTION: Red (2.5 YR 4/8) Sandy Silt

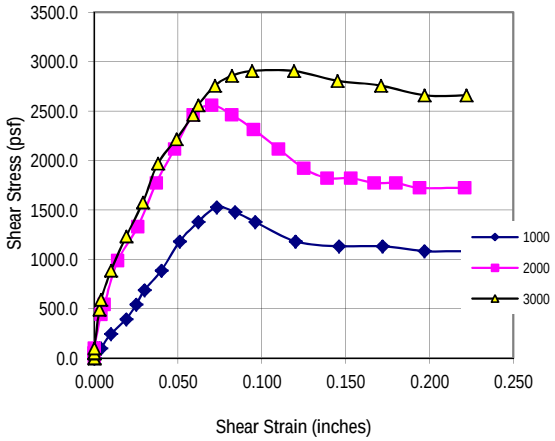
DIRECT SHEAR

TEST RESULTS

Shear Strain vs. Normal Strain



Shear Strain vs. Shear Stress



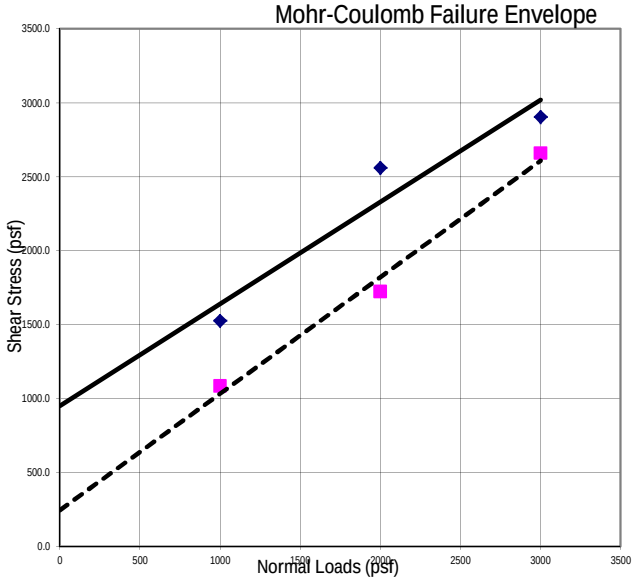
Normal Load (psf)

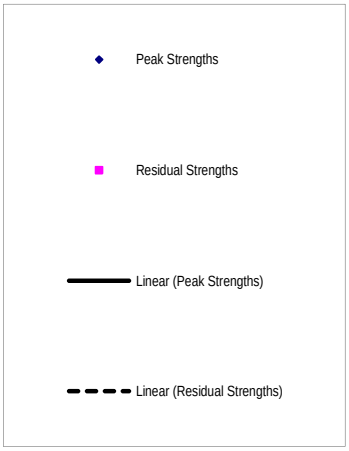
Normal Load (psf)

y = 0.7875x + 246.33
R² = 0.9884

y = 0.6891x + 951.62
R² = 0.9231

Mohr-Coulomb Failure Envelope





SHEAR STRENGTH TEST RESULTS		
PARAMETERS	PEAK STRENGTH:	RESIDUAL STRENGTH:
FRICTION ANGLE, (Degree)	34.6	38.2
COHESION, (psf)	952.0	246.0

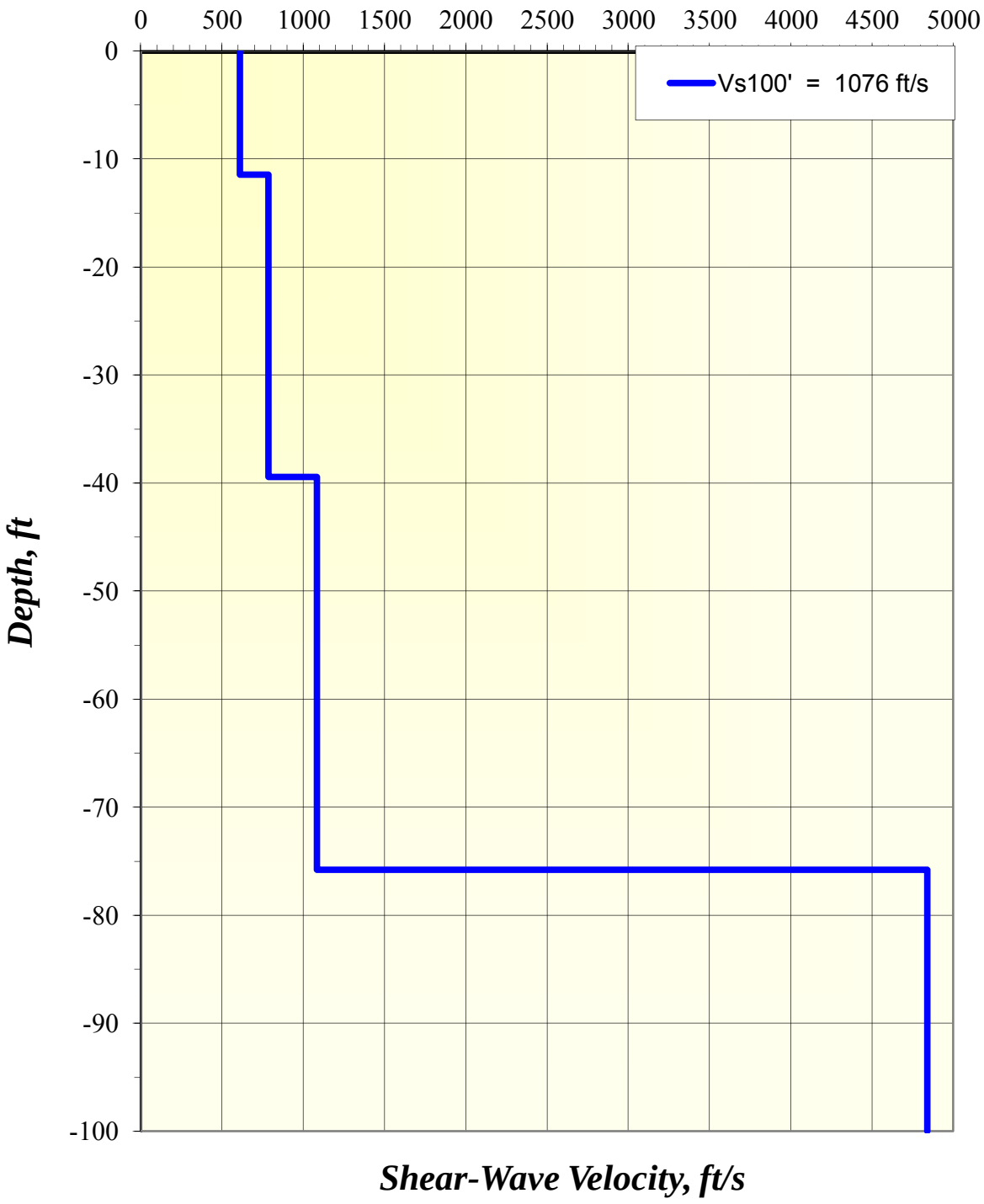
HOLDREGE & KULL
CONSULTING ENGINEERS • GEOLOGISTS
792 SEARLS AVENUE
NEVADA CITY, CA 95959
(530) 478-1305 FAX 478-1019

PROJECT NAME:	NCOC		
PROJECT NO.:	4266A-01	DATE:	5/25/2017
BORING / TRENCH NO.:	T-4	**LAB NO.**	15-17-162
SAMPLE NO.:	SS-2	**SAMPLE DEPTH (ft.):**	3
DESCRIPTION:	Red (2.5YR 4/8) Sandy Silt with Clay		

APPENDIX E

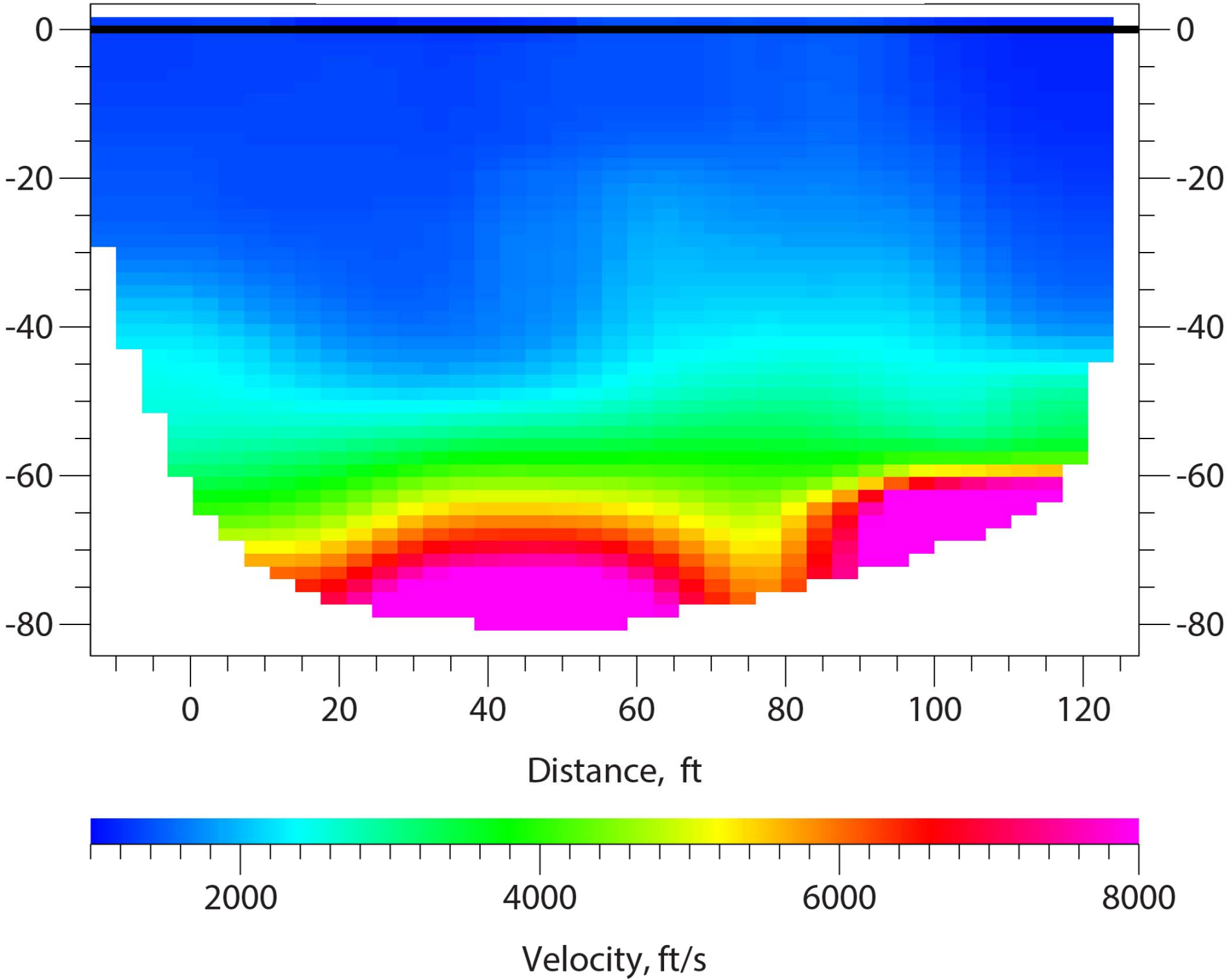
Geophysical Survey Profiles

NCOC ReMi (R-1): Vs Model

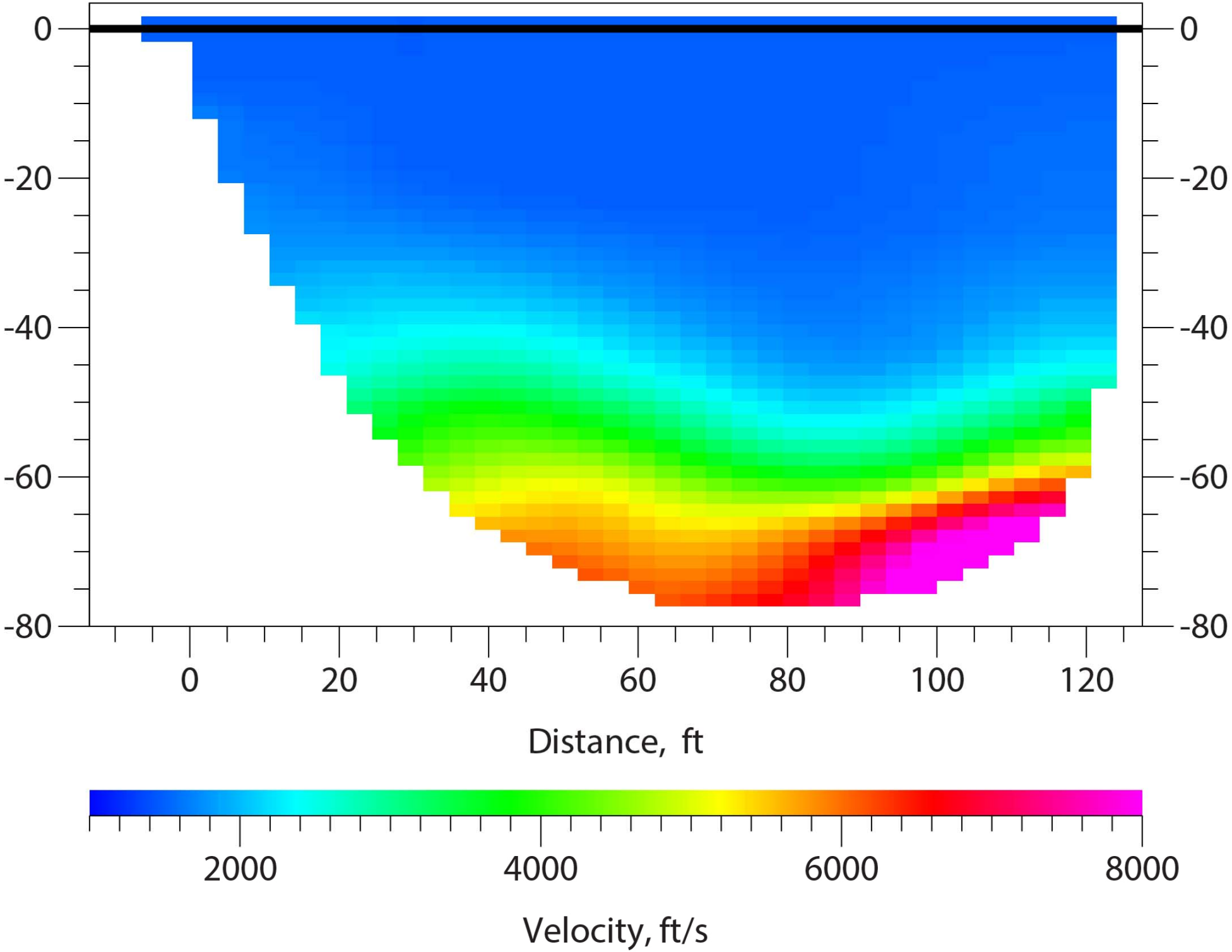


Attachment 1

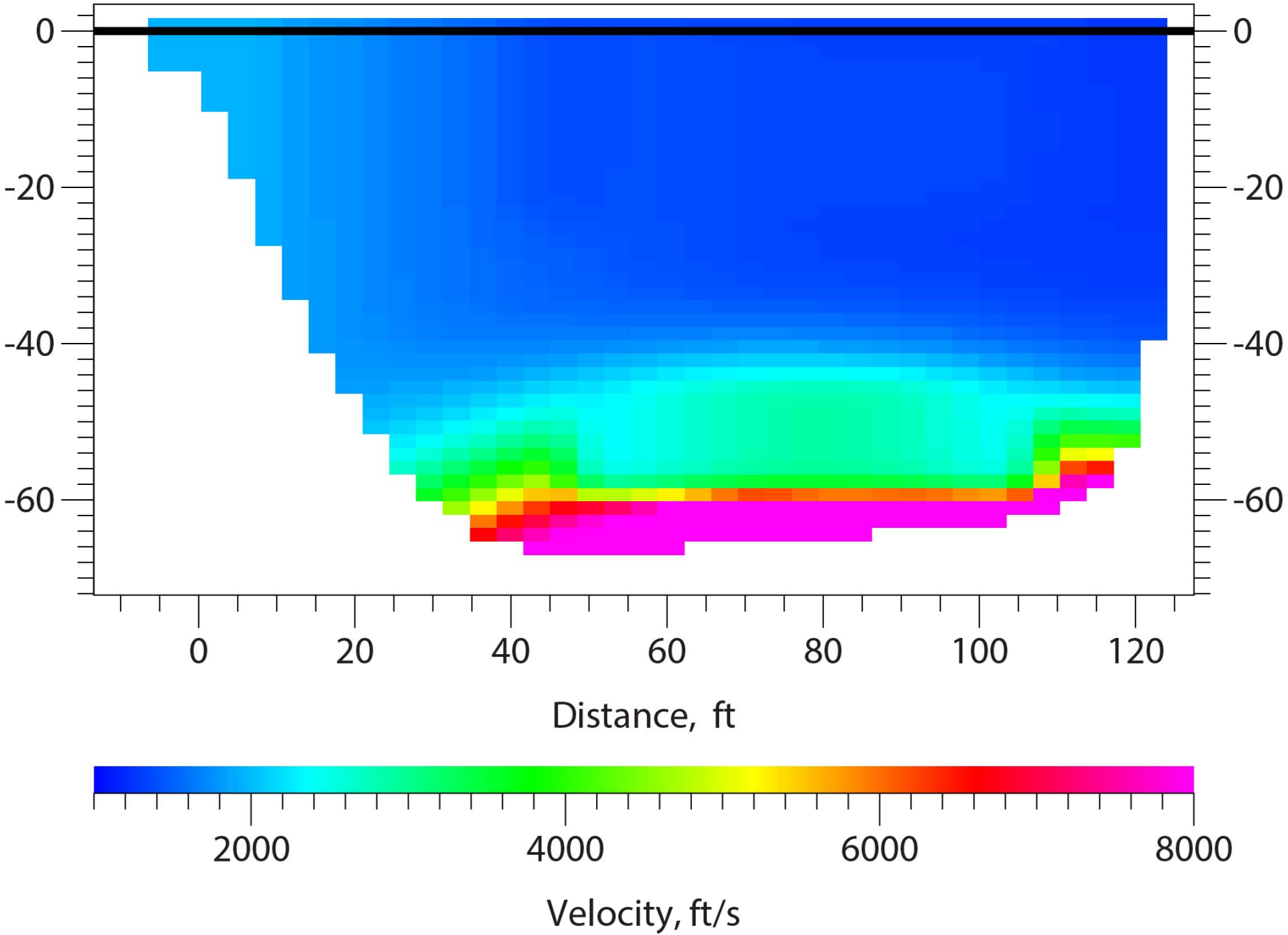
Attachment 2, Seismic Survey SR-1



Attachment 3, Seismic Survey SR-2



Attachment 4, Seismic Survey SR-3



HOLDREGE & KULL
CONSULTING ENGINEERS • GEOLOGISTS

Project No. 4266A-01
August 7, 2017

LDA Partners
222 Central Court
Stockton, CA 95204

Attention: Peter Rosado, Architect

Reference: ***Nevada County Operations Center***
12350 LaBarr Meadows Road
Grass Valley, California

Subject: ***Addendum to Geotechnical Engineering Report***

Dear Mr. Rosado:

In response to the attached memorandum from JH Lawder, Inc. (July 31, 2017), Holdrege & Kull (H&K) prepared this letter to clarify the general recommendations pertaining to concrete slabs-on-grade presented in our Geotechnical Engineering Report for the Nevada County Operations Center (June 28, 2017).

H&K has no objection to the slab-on-grade specifications prepared by the project structural engineer (JH Lawder, Inc.; July 31, 2017). During curing, thermal differences should be avoided between the deep footing and thin slab pursuant to American Concrete Institute (ACI) guidelines.

Please contact us with any comments or questions.

Sincerely,

HOLDREGE & KULL

REGISTERED PROFESSIONAL ENGINEER
JASON W. MUIR
No. 2697
Exp. 06/18
GEOTECHNICAL
STATE OF CALIFORNIA

Jason W. Muir, G.E. 2697
Associate Engineer

attached: Memorandum, JH Lawder, Inc., July 31, 2017

copies: PDF to LDA Partners /Attn: Peter Rosado, prosado@ldapartners.com
PDF to JH Lawder, Inc. /Attn: John Lawder, john@jhlawderse.com

F:\1 Projects\4266 Nevada County Corporation Yard, La Barr Meadows Rd\4266A-01 Nevada County Operations Center\Geotechnical Engineering Report\01 Report\Addendum\4266A-01 Addendum to Geotechnical Engineering Report, Nevada County Operations Center.docx

jh lawder, inc.
structural engineers

717 16TH STREET
MODESTO, CA 95354
(209) 521-1143
FAX (209) 521-1581
www.jhlawderse.com

TO: Peter Rosado **DATE:** 7/31/17 **JOB NO.** 17-001

RE: NCOC
Geotechnical Report
Recommendations
Holdrege & Kull

Number of pages to follow: 1

After reviewing the projects geotechnical report please have the following clarified:

1. Slab on grade recommendation - Section 5.2.3, Item 5 recommends the use of a 2" sand cushion over the top of the vapor barrier.

   ACI 302.2R-06 - Guide for Concrete Slabs that Receive Moisture-Sensitive Flooring Materials and PCA's Engineering Bulletin 119 "Concrete Floors and Moisture" recommends the following:
   A. Slab on grade be cast directly on the vapor barrier (without the sand cushion).
   B. The vapor barrier be ASTM E1745, Class A and have a perm rating of 0.01 or less.
   C. The vapor barrier be underlain with granular fill to provide a capillary break.

   PCA's Engineering Bulletin 119 "Concrete Floors and Moisture also recommends the concrete to have a dense matrix (by specifying a minimum of 5.75 sack/yd cement content) and placed at a low water/cement ratio (0.50 max) to reduce the permeability of the concrete.

   In order to conform to ACI and PCA's recommendations it has been my practice to specify the slab on grade as follows:
   A. Slab on grade be placed over a 15 mil Class A ASTM E1745 vapor barrier with a maximum perm rating of 0.01 which is placed over 4" drainage base. Drainage base is as specified in the Geotechnical report.
   B. Concrete is specified to be batched with a 5.75 minimum sack content, 1" ASTM C33 aggregate, and a total water/cement ratio not exceeding 0.50, and placed at a 5" max slump.
   C. Slab is to be reinforced with bar stock providing a minimum of 0.0018 steel reinforcing ratio.
   D. Slab control joints are limited to about 12' max on center each way and made with Soff-cut type saws.

   It is requested the geotechnical report takes no exception for the slab on grade section as noted above which conforms with ACI and PCA recommendations.

2. Slab on grade recommendation - Section 5.2.3, Item 8 recommends expansion joints be provided between the slab on grade and perimeter foundations.

   The building is a pre-engineered metal building. The industry standard is to have the column base plates bear direction on the finish surface of the concrete slab.

   Requiring the expansion joint between the slab and perimeter footings will be problematic as follows:

   A. The slab on grade and footings are of integral construction. Column blockouts are not used since the column bases bear on the finish surface of the slab. Typical footings at columns are 24" thickened slabs which can be 24" to 36" wide by 24" to 84" in length (parallel with the slab edge).
   B. Hairpins are provided around the column anchor bolts and extend 20' into the slab on grade to resist the column outward thrusts.
   C. A continuous footing (turned down slab edge) is provided at the perimeter of the slab and is reinforced with vertical reinforcing which hooks to lap 12" minimum with the slab on grade reinforcing.

   As noted it Item 1 above there will be a slab control joint parallel with and within about 12' from the slab edge.

   It is requested the geotechnical report takes no exception to providing an industry standard slab and foundation system for the pre-engineered metal building.

Let me know if you have any questions.

John

APPENDIX C

STORM WATER POLLUTION PREVENTION PLAN

NEVADA COUNTY OPERATIONS CENTER
BEAR RIVER MILL YARD

Grass Valley, CA

RISK LEVEL: 2

Legally Responsible Person (LRP):

Trisha Tillotson
950 Maidu Avenue
Nevada City, CA 95959
T: (530) 265-1411

Project Address:
12350 La Barr Meadows Road
Grass Valley, CA 95945

SWPPP Prepared by:
SCO Planning, Engineering & Surveying Inc.
140 Litton Drive, Suite 240
Grass Valley, CA 95945-5079
T (530) 272-5841 / F (530) 272-5880
Steven Kline, P.E., QSD/QSP

SWPPP Preparation Date:

August 2018

WDID No.: To Be Determined

Estimated Project Dates:

Start of Construction: **February 15, 2019**
Completion of Construction: **May 10, 2020**

SWPPP AMENDMENT LOG

The following summarizes any/all revisions made to the revised version of Storm Water Pollution Prevention Plan (SWPPP).

Project Name: **Nevada County Bear River Mill Operations Center**

Project Number/ WDID No.: _____

Amendment No.	Date	Brief Description of Amendment, include section and page number	Amendment Requester	Prepared and Approved By

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SWPPP Attachments

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Attachment D BMP Consideration Checklist
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Attachment G Field Monitoring Requirements for Risk Level 2
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Section 1 SWPPP Certifications and Approval

1.1 Legally Responsible Person Approval and Certification

Owner/Developer
Approval and Certification of the
Storm Water Pollution Prevention Plan

Project Name: **NEVADA COUNTY OPERATIONS CENTER**

Project Number/WDID No.: _____

"I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to ensure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system or those persons directly responsible for gathering the information, to the best of my knowledge and belief, the information submitted is true, accurate and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

_____ _____
Owner/Developer's Signature Date

_____ _____
Owner/Developer's Name and Title Telephone Number

1.2 SWPPP Certification by Qualified SWPPP Developer (QSD)

Qualified SWPPP Developer (QSD)
Certification of the
Storm Water Pollution Prevention Plan

Project Name: **NEVADA COUNTY OPERATIONS CENTER**

Project Number/ WDID No.: _____

"I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to ensure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system or those persons directly responsible for gathering the information, to the best of my knowledge and belief, the information submitted is true, accurate and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

QSD's Signature	*Date*
Steven Kline, P.E.	No. 21461
QSD's Name and Title	*QSD Certificate Number*
Senior Engineer, SCO Planning & Engineering	(530) 272-5841
Title and Affiliation	*Telephone Number*
steve@scopeinc.net	
Email	

1.3 Electronic Certification via SMARTS

I. All Permit Registration Documents (PRDs) and Notice of Terminations (NOTs) shall be electronically signed, certified, and submitted via Storm water Multi-Application Reporting and Tracking System (SMARTS) to the State Water Board. Either the Legally Responsible Person (LRP) or a person legally authorized to sign and certify PRDs and NOTs on behalf of the LRP (the LRP's Approved Signatory) must submit all information electronically via SMARTS.
   a. The LRP's Approved Signatory must be one of the following:
      i. For a corporation: a responsible corporate officer. For the purpose of this section, a responsible corporate officer means:
         1. a president, secretary, treasurer, or vice-president of the corporation in charge of a principal business function, or any other person who performs similar policy or decision-making functions for the corporation; or
         2. the manager of the facility if authority to sign documents has been assigned or delegated to the manager in accordance with corporate procedures;
      ii. For a partnership or sole proprietorship: a general partner or the proprietor, respectively;
      iii. For a municipality, State, Federal, or other public agency: either a principal executive officer or ranking elected official. The principal executive officer of a Federal agency includes the chief executive officer of the agency or the senior executive officer having responsibility for the overall operations of a principal geographic unit
   b. Changes to Authorization. If an approved signatory's authorization is no longer accurate, a new authorization satisfying the requirements of paragraph (a) of this section must be submitted via SMARTS prior to or together with any reports, information or applications to be signed by an approved signatory.

II. All Annual Reports, or other information required by the General Permit (other than PRDs and NOTs) or requested by the Regional Water Board, State Water Board, U.S. EPA, or local storm water management agency shall be certified and submitted by the LRP or the LRP's approved signatory as described above.

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Section 2 Introduction and Project Description

2.1 Introduction and Project Description

This Stormwater Pollution Prevention Plan (SWPPP) is designed to comply with California's General Permit for Stormwater Discharges Associated with Construction and Land Disturbance Activities (General Permit) Order No. 2009-0009-DWQ as amended in 2010 and 2012 (NPDES No. CAS000002) issued by the State Water Resources Control Board (State Water Board). A Copy of the General Permit is included herein as Attachment S. Refer to Section 5 for SWPPP objectives.

This SWPPP is for the following project: **Nevada County Bear River Mill Operations Center**
APN: 22-331-05, 06, 07, 09 & 12
WDID #:

The projects geographic location can be seen on the Site Map in Appendix B and is:

Latitude 39°10'59" N
Longitude 121°03'01" W

The proposed Nevada County Operations Center is located east of State Route 49 and west of La Barr Meadows Road, approximately one tenth of a mile south of the southern city limits of Grass Valley in Nevada County, California. The property comprises four parcels (see book 15 map 40 records of Nevada County, CA.

The total project area encompasses 39.26 acres encompassing improvements including a 28,334 square foot (sf) office building, 88,984 sf equipment storage area, 184,969 sf of parking lots and landscaped islands, 35,319 sf new asphalt driveway and road improvements, 5,871 sf gravel road, 28,951 sf onsite septic area, 1,018 sf concrete trash area, drainage facilities (two retention ponds and a storm-drain collection network), onsite septic facilities and public utility easements.

Adjacent development includes Nevada County bark beetle tree grinding operation north, single family residential lots and La Barr Meadows Road east with light industrial and single-family residences east of La Barr Meadows Road, single-family residences south, California State Highway 49 west with single-family residences west of the highway and industrial development east and south adjacent to LaBarr Meadows Road.

Access to the site is from both La Barr and Highway 49. La Barr will be improved with turn lanes to access the site via a paved driveway. Minor access is provided with a gravel road off Highway 49 that will mainly be used for maintenance equipment through a manually operated gate. Both La Barr Meadows Road and California State Highway 49 allow north-south traffic ingress and egress.

2.2 Site Topography and Drainage Characteristics

Project Site Topography/Soils/Vegetation

The existing on-site elevations ranges from 2,430 to 2,550 feet above mean sea level (MSL). The property generally slopes to the north, northeast and northwest from a high point at the southern property boundary. Site topography is generally characterized by a gentle north-northeast trending natural ridge line.

According to the *Geotechnical Engineering Report, Nevada County Operations Center, 12350 La Barr Meadows Rd,* by: Holdrege & Kull, dated June 28, 2017, a typical soil profile based on 9 of 14 investigatory trenches all in natural soil on this site, would consist of ***"...approximately three to four feet of strong brown, medium dense, sandy silt underlain by yellowish-red, dense, silty sand with gravel. Completely weathered granodiorite rock texture was often apparent at depths of approximately six fee bgs..."*** (below ground surface) *"…Locally less weathered rock may be present based on areas of isolated rock outcrop."* The remaining 5 trenches were excavated in imported fill areas revealing soil mixed with organic foliage and sawmill debris suitable for reuse precluding engineered fill. This "mulch" can be used in landscape areas or left in place except in development areas where it will be relocated to suitable locations.

Vegetation across the project site was typical of mixed conifer and Sierra Nevada foothills. Tree cover at the site was variably dense to sparse, and includes ponderosa and sugar pines, Douglas fir, oak and underbrush including manzanita, ceanothus, weeds, grasses, and dense blackberry thickets.

Project Drainage

The project lies within Wolf Creek watershed with most flows reaching Wolf Creek. The existing drainage predominantly consists of overland sheet flow with some minor channeling. A southern hill is the high point sloping north, east and west in a conical fashion with minor ridges and valleys generally located centrally oriented north-south. East flow encounters State Highway 49 before entering Wolf Creek. Storm-water, sheet flow and minor channeled flows westward and northwestward, on the west side of the site reaches a tributary of Wolf Creek to the north either overland through season drainage swales or via LaBarr Meadows Road. Ultimately storm-water reaches Wolf Creek from this project.

The proposed drainage condition, surface drainage from impervious asphalt surfaces, roof runoff and concrete will be directed toward the northwest via a storm drain network to retention ponds. This system is designed to accommodate a 20-year, 1-hour storm event, as required by the City of Grass Valley. Natural sheet flow being naturally channeled is accommodated through culverts where occurs. Overflow from the retention system follows its natural course. Refer to the project drainage report and civil improvement plans for further details on post-construction runoff, treatment and sizing. See pre- and post-development drainage exhibits in the Appendix.

Table 2.1 Construction Site Estimates

Table 2.1 Construction Site Estimates

Construction site area	39.26	acres
Percent impervious before construction	0	%
Runoff coefficient before construction	0.28	
Percent impervious after construction	20	%
Runoff coefficient after construction	0.45	
Essential Retention Volume	7,020	cubic feet
Provided Retention Volume	7,020	cubic feet

2.3 Findings of Construction Site Sediment and Receiving Water Determination

A construction site risk assessment has been performed for the project and the resultant risk level is **Risk Level 2**.

The risk level was determined by GoogleEarth tools provided on the SMARTs website. The risk level is based on project duration, location, proximity to impaired receiving waters and soil conditions. A copy of the Risk Level determination submitted on SMARTS with the PRDs is included in **Attachment C**.Table 3.1 and Table 3.2 summarize the sediment and receiving water risk factors and document the sources of information used to derive the factors.

Table 3.1 Summary of Sediment Risk

RUSLE Factor	**Value**	**Method for establishing value**
REF	34.89	EPA Rainfall Erosivity Factor Calculator
K	0.2	GoogleEarth
LS	4.58	GoogleEarth
Total Predicted Sediment Loss (tons/acre)		**31.96 tons/acre**
Overall Sediment Risk Low Sediment Risk < 15 tons/ acre Medium Sediment Risk >= 15 and < 75 tons/acre High Sediment Risk >= 75 tons/acre		☐ **Low** ☒ **Medium** ☐ **High**

Table 3.2 Summary of Receiving Water Risk

Receiving Water Name	**303(d) Listed for Sediment Related Pollutant(1)**	**TMDL for Sediment Related Pollutant(1)**	**Beneficial Uses of COLD, SPAWN, and MIGRATORY(1)**
Wolf Creek	☒ Yes ☐ No	☐ Yes ☒ No	☐ Yes ☒ No
Overall Receiving Water Risk			☐ **Low** ☒ **High**
(1) If yes is selected for any option the Receiving Water Risk is High			

Risk Level 2 sites are subject to both the narrative and numeric effluent standards. The narrative effluent limitations require stormwater discharges associated with construction activity to minimize or prevent pollutants in storm-water and authorized non-storm-water using controls, structures and best management practices. Discharges from Risk Level 2 site are subject to NALs. Discharges from Risk Level 2 sites that have a direct discharge to the receiving water are subject to Receiving Water Monitoring Triggers for pH and turbidity. NALs are shown in Table 3.3. This SWPPP has been prepared to address Risk Level 3 requirements (General Permit Attachment E). Refer to **Attachment C** for Risk Determination and **Attachment G-2** for Risk Level Requirements.

Table 3.3 Numeric Action Levels

Parameter	**Unit**	**Numeric Action Level Daily Average**
pH	pH units	Lower NAL = 6.5 Upper NAL = 8.5
Turbidity	NTU	250 NTU

2.4 Project Schedule/Water Pollution Control Schedule

The following is a tentative construction schedule that marks the significant project dates for implementation of the Expansion Project.

- Rainy season dates: October 15 to May 1
- Mobilization: June 2018.
- Major grading/excavation dates: July 15, 2018 to September 30, 2018
- Submittal date for SWPPP amendments: September 30, 2018
- Submittal of Annual Report: September 1, 2019
  September 1, 2020.
- Dates for implementation of rainy season temporary soil stabilization BMPs: To be completed by October 10th of each year (winterization deadline).
- All BMPs shall be implemented throughout the construction season during rainy season and non-rainy season as depicted by construction activity.
- Standard Business Hours of Work: 7AM to 7PM, Monday thru Friday

2.5 Contact Information/List of Responsible Parties

Owner's Representative – Legally Responsible Person (LRP)

Trisha Tillotson
950 Maidu Avenue
Nevada City, CA 95959
T: (530) 265-1411

Qualified SWPPP Developer

Steven Kline, P.E., QSD/QSP
SCO Planning, Engineering and Surveying Inc.
140 Litton Drive, Suite 240
Grass Valley, CA 95945-5079
T (530) 272-5841 / F (530) 272-5880

Qualified SWPPP Practitioner

Qualified SWPPP Practitioner (QSP) shall be a State certified individual assigned to the project by the Contractor or Owner prior to construction. The QSP for this project is:

Name: _____
Company: _____
Address: _____
_____
Phone: _____

A QSP is a person responsible for non-storm water and storm water visual observations, sampling and analysis. The QSP shall have primary responsibility and significant authority for the implementation, maintenance, inspection and amendments to the approved SWPPP. The QSP will be available at all times throughout the duration of the project. Duties of the Contractor's QSP include but are not limited to:

- Ensuring full compliance with the SWPPP, the NPDES General Permit and the approved plans.
- Ensuring implementation of all elements of the SWPPP, including but not limited to:
  - Implementation of prompt and effective erosion and sediment control measures
  - Implementing all non-storm water management and materials and waste management activities such as: monitoring discharges (dewatering, diversion devices); general site clean-up; vehicle and equipment cleaning, fueling and maintenance; spill control; ensuring that no materials other than storm water are discharged in quantities which will have an adverse effect on receiving waters or storm drain systems; etc.
- Pre-storm inspections.

- Prepare Rain Event Action Plans
- Extended storm event inspections
- Post-storm inspections
- Routine inspections as dictated by construction activities
- Coordination with QSD for updates/amendments to the SWPPP, as needed
- Conduct training
- Preparing monitoring reports
- Submitting Notices of Discharge or reports of Illicit Connections or Illegal Discharges
- Ensuring elimination of all unauthorized discharges
- Ensuring proper disposal of hazardous waste
- Any and all water quality sampling/analyses
- The QSP shall be assigned authority by the Owner/Developer/Contractor to mobilize crews in order to make immediate repairs to control measures and halt all construction activity if storm water pollution prevention measures are not being taken
- Coordinate with the Owner/Developer/Contractor to assure all of the necessary corrections/repairs are made in a timely fashion

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5.1.7 Erosion Control

A site-specific Storm Water Pollution Prevention Plan (SWPPP) will be required pursuant to the State Water Resources Control Board (SWRQCB) General Permit for Storm Water Discharges Associated with Construction and Land Disturbance Activities (the Construction General Permit).

Best management practices (BMPs) for erosion and sediment control should be incorporated into the design and construction of this project. As a minimum, the following controls should be installed prior to and during grading to reduce erosion.

1. Erosion and sediment control measures can be categorized as temporary or permanent. Temporary measures should be installed to provide short-term protection until the permanent measures are installed and effective. Typical temporary measures include properly installed silt fences, straw bales, wattles, water bars, detention basins, covering of exposed soil, channel linings and inlet protection. Permanent erosion and sediment control measures may include rock slope protection (RSP), rock lined ditches and inlet/outlet protection, rock energy dissipaters, infiltration/detention basins and vegetation.
2. Prior to commencement of site work, fiber rolls and silt fences should be installed down slope of the proposed area of disturbance to reduce migration of sediment from the site. Fiber rolls on slopes are intended to reduce sediment discharge from disturbed areas. If a single layer of fiber rolls is not sufficient to reduce migration of sediment, a second layer should be placed no more than 10 feet above or below the first layer. The fiber rolls should remain in place until construction activity is complete and until revegetated slopes become established.
3. Existing vegetation should be protected and undisturbed where possible, and revegetation should consist of native brush and grass species. All areas disturbed by construction should be revegetated. Graded portions of the site should be seeded as soon as possible to allow vegetation to become established prior to the wet season.
4. Following seeding, jute netting or erosion control blankets should be placed and secured over the slopes steeper than 2:1, H:V, to keep seeds and straw from being washed or blown away. Tackifiers or binding agents may be used in lieu of jute netting.
5. Slope faces should be temporarily protected against erosion resulting from direct rain impact until permanent vegetation can be established. Soil exposed in permanent slope faces should be hydroseeded or hand seeded/strawed with an appropriate seed mixture compatible with the soil and climate conditions of the site as recommended by the local Resource Conservation District.
6. Under no circumstances should surface water be allowed to run over slope faces. Surface water drainage ditches should be established as necessary to intercept and redirect concentrated surface water away from cut and fill slope faces. Interceptor (brow) ditches should be considered at the tops of slopes in order to collect and divert runoff which otherwise would flow over the slope face. The intercepted water should be

discharged into natural drainage courses or into other collection and disposal structures.

Section 3 SWPPP Requirements

3.1 Compliance with Other Plans Permits or Agreements

All work associated with this project shall comply with all requirements of the General Permit and other permits and/or agreements listed below. A copy of each of the following permits is included in **Attachment S**:

1. State Water Resources Control Board (SWRCB) Order No. 2009-009-DWQ National Pollutant Discharge Elimination System (NPDES) General Permit No. CAS000002, Storm Water Discharges Associated with Construction Activities and Land Disturbance Activities

2. County of Placer Improvements and Engineering Standards

3. Town of Truckee Storm Water Management Program

In addition, the project shall also comply with the requirements of the following documents, which are made a part of this SWPPP by reference:

- CASQA – California Storm Water BMP Handbook, July 2012.
- State of California, Department of Transportation (Caltrans), Standard Specifications, latest edition.
- Plans, Specifications for Nevada County Operations Center, prepared by SCO Planning Engineering and Surveying, Inc., dated June 2018.
- Grading Permit requirements for local jurisdiction
- Geotechnical Engineering Report for Brunswick One LLC Property prepared by Holdrege and Kull dated January 17, 2006.

3.2 Permit Registration Documents

Permit Registration Documents (PRDs) will be submitted to the State Water Resources Control Board (SWRCB) via the Stormwater Multi Application and Report Tracking System (SMARTS) by the Legally Responsible Person (LRP). Once these components have been submitted and are deemed complete by the SMARTS system, a WDID number will provided by SWRCB. No grading disturbance is permitted until a WDID number is assigned.

The following PRDs are required for all projects. PRD's are included herein in this SWPPP:

- Notice of Intent (NOI);
- Risk Assessment (Construction Site Sediment and Receiving Water Risk Determination);
- Site Map;
- Annual Fee; and
- Signed Certification Statement (LRP Certification is provided electronically with SMARTS PRD submittal).

- SWPPP

3.3 SWPPP Availability and Implementation

In accordance with the General Permit (Section XIV.C), the SWPPP shall be available at the construction site during working hours while construction is occurring and shall be made available upon request by a State or Municipal inspector. When the original SWPPP is retained by a crewmember in a construction vehicle and is not currently at the construction site, current copies of the BMPs and map/drawing will be left with the field crew and the original SWPPP shall be made available via a request by radio/telephone. The SWPPP shall be implemented concurrently with the start of ground disturbing activities.

3.4 SWPPP Amendment

This SWPPP shall be amended:

- Whenever there is a change in construction or operations which may affect the discharge of pollutants to surface waters, groundwater(s) or a municipal separate storm sewer system (MS4); or
- If the SWPPP has not met permit condition. If any condition of the Permits is violated or the general objective of reducing or eliminating pollutants in storm water discharges has not been achieved, or if RWQCB determines that a Permit violation has occurred, the SWPPP shall be amended and implemented within 14 calendar days of occurrence; or
- When there is a reduction or increase in total disturbed acreage (General Permit Section II Part C).
- At the request of the RWQCB; or
- If needed, prior to the defined rainy season; or
- When deemed necessary by the QSD, QSP or LRP/owner

The following items will be included in each amendment:

- Who requested the amendment
- The location of proposed change
- The reason for change
- The original BMP proposed, if any
- The new BMP proposed

All SWPPP Amendments including changes to Project Registration Documents (PRD's) shall be uploaded via Storm Water Multi-Application Reporting and Tracking System (SMARTS) to the State Water Board. To change the acreage covered, the permittee must electronically file modifications to PRD's in accordance with requirements of the General Permit within 30 days of a reduction or increase in total disturbed area.

Amendments shall be logged at the front of this SWPPP and certifications shall be kept in Attachment F. The SWPPP text shall be revised replaced, and/or hand annotated as necessary to properly convey the amendment. SWPPP amendments must be made by a QSD. The

following changes have been designated by the QSD as "to be field determined" and constitute minor changes that the QSP may implement based on field conditions.

- Increase quantity of an Erosion or Sediment Control Measure
- Relocate/Add stockpiles or stored materials
- Relocate or add toilets
- Relocate vehicle storage and/or fueling locations
- Relocate areas for waste storage
- Change type of Erosion or Sediment Control Measure (may use comparable substitute)
- Minor changes to schedule or phases
- Changes in construction materials

3.5 Retention of Records

In accordance with the General Permit *(Sections I.J.69 and IV.G)*, the owner (LRP) shall maintain a paper or electronic copy of all required records for three years from the date generated or date submitted, whichever is last. These records must be available at the construction site until construction is completed. These records must be provided to the LRP by the Contractor, QSD and QSP prior to completion of the project. The LRP shall furnish the RWQCB, SWRCB, or US Environmental Protection Agency (EPA), within a reasonable time, any requested information to determine compliance with this General Permit.

Copies of documents shall also be provided to the QSD during construction. Documents will be kept at the project site and at the QSD's office during construction. After construction, all documents will be kept at the LRP's office.

3.6 Required Non-Compliance Reporting

The General Permit identifies several areas of non-compliance reporting. It is the responsibility of the QSP to properly document reportable discharges or other violations of the General Permit and to notify the LRP and QSD. It is the responsibility of the permittee (LRP) to provide the required non-compliance reporting. Exceedances and violations should be reporting using the SMARTS system and include the following:

- Numeric Action Level (NAL) exceedances (NAL Exceedance Report upon request of the RWQCB);
- Self-reporting of any other discharge violations or to comply with RWQCB enforcement actions; and
- Discharges which contain a hazardous substance more than reportable quantities established in 40 CFR §§ 117.3 and 302.4, unless a separate NPDES Permit has been issued to regulate those discharges.

In the event of the exceedance of a NAL, QSP shall document the subsequent site evaluation and provide copies of documentation to the LRP and QSD and shall include all reportable exceedances in the SWPPP. QSP shall submit all storm event sampling results to the State Water Board no later than 10 days after the end of the storm even in which the NAL exceedance took place. Discharges and corrective actions must be documented and include the following items:

- The date, time, location nature of o9peration and type of unauthorized discharge.
- The cause or nature of the notice or order.
- The control measures (BMPs) deployed before the discharge event, or prior to receiving notice or order.
- The date of deployment and type of control measures (BMPs) deployed after the discharge event, or after receiving the notice or order, including additional measures installed or planned to reduce or prevent re-occurrence.

Include the results of an NAL exceedance site evaluation along with other non-compliance events in SWPPP **Attachment R**.

3.7 Annual Report

QSP shall perform the required data collection and shall provide copies of necessary reporting elements to the QSD and LRP. The QSD will prepare the annual report and the LRP will certify the annual report.

In accordance with the General Permit the Annual Report shall be prepared, certified, and electronically submitted to SMARTS no later than September 1 of each year. Reporting requirements are identified in Section XVI of the General Permit. Annual reports will be filed in SMARTS and in accordance with information required by the on-line forms.

3.8 Changes to Permit Coverage

In accordance with the General Permit (Section II.C), the permittee (LRP) can reduce or increase the total acreage covered under the General Permit when a portion of the project is complete and/or conditions for termination of coverage have been met; when ownership of a portion of the project is sold to a different entity; or when new acreage is added to the project.

To change the acreage covered, the permittee (LRP) must electronically file modifications to PRDs (revised NOI, site map, SWPPP revisions) as appropriate, and certification that new landowners have been notified of applicable requirements to obtain permit coverage (including name, address, phone number, and e-mail address of new landowner) in accordance with requirements of the General Permit within 30 days of a reduction or increase in total disturbed area. Any updates to PRDs submitted via SMARTS shall be included in this SWPPP. All SWPPP revisions/amendments shall be documented as described in Section 200 of this SWPPP.

3.9 Notice of Termination

To terminate coverage under the General Permit, a Notice of Termination (NOT) must be submitted electronically via SMARTS. A “final site map” and photos are required to be submitted with the NOT. Filing a NOT certifies that all General Permit requirements have been met. The NOT is submitted when the construction project is complete and within 90 days of meeting all General Permit requirements for termination and final stabilization (Section II.D) including:

- The site will not pose any additional sediment discharge risk than it did prior to construction activity.
- All construction related equipment, materials and any temporary BMPs no longer needed are removed from the site.
- Post-construction storm water management measures are installed and a long-term maintenance plan that is designed for a minimum of five years has been developed.

The NOT must demonstrate, through photos, Revised Universal Soil Loss Equation (RUSLE) results, or results of testing and analysis that the project meets all requirements of Section II.D.1 of the General Permit by one of the following methods:

- 70% final cover method (no computational proof required); or
- RUSLE/RUSLE2 method (computational proof required); or
- Custom method (discharger demonstrates that site complies with final stabilization).

Conditions for Termination of Coverage and procedure for Notice of Termination (NOT) is included in **Attachment O.**

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Section 4 Body of SWPPP

4.1 Objectives

This SWPPP has five main objectives:

1. All pollutants, their sources, including sediment sources associated with construction, construction site erosion and all other activities associated with construction activity are controlled;

2. Where not otherwise required to be under a Regional Water Quality Control Board (RWQCB) permit, all non-stormwater discharges are identified and either eliminated, controlled, or treated;

3. Site BMPs are effective and result in the reduction or elimination of pollutants in stormwater discharges and authorized non-stormwater discharges from construction activity to the Best Available Technology/Best Control Technology (BAT/BCT) standard;

4. Identify post-construction BMP's, which are those measures to be installed during construction that are intended to reduce or eliminate pollutants after construction is completed.

5.) Identify and provide methods to implement BMP inspection, visual monitoring, Rain Event Action Plan (REAP) and Construction Site Monitoring Program (CSMP) requirements to comply with the General Permit.

This SWPPP conforms to the required elements of the General Permit, Order No. 2009-009-DWQ, (included in **Attachment S**) issued by the State of California, State Water Resources Control Board (SWRCB). This SWPPP will be modified and amended to reflect any amendments to the Permit or any changes in construction or operations that may affect the discharge of pollutants from the construction site to surface waters, ground waters or the storm drain system. The SWPPP will also be amended if it is in violation of any condition of the Permit or has not achieved the general objective of reducing pollutants in storm water discharges. The SWPPP shall be readily available on-site for the duration of the project.

4.2 Vicinity Map

A Vicinity Map showing the project location can be found in **Attachment A**.

4.3 Pollutant Source Identification and BMP Selection

4.3.1 Inventory of Materials and Activities that May Pollute Storm Water

The following is a list of construction materials and activities which will be used/performed which may have the potential to contribute pollutants, other than sediment, to storm water runoff (control practices for each activity are identified in the Water Pollution Control Plan (WPCPs) and/or in Sections 5.3.4 through 5.3.9):

- Vehicle fluids, including oil, grease, petroleum and coolants
- Asphaltic emulsions associated with asphaltic-concrete paving operations
- Base and subbase material
- Joint and curing compounds
- Solvents, thinners and acids
- Sandblasting materials
- Raw landscaping materials and wastes (topsoil, plant materials, herbicides, fertilizers, mulch, pesticides)
- BMP materials (sandbags, liquid copolymer)
- Treated lumber (materials and waste)
- PCC rubble
- General litter

Construction activities that have the potential to contribute sediment to storm water discharges include:

- Clear and grub operations
- Grading operations
- Paving Operations
- Structure Construction/Painting
- Concrete Operations
- Landscaping Operations

The Site Plan (Water Pollution Control Drawings) which show existing and proposed drainage features, geographic features, construction site perimeter and general topography can be found in **Attachment B**. Narrative descriptions of the BMPs are listed in **Attachment P**. All Non-Stormwater Discharges shall be eliminated, controlled or treated as described in Section 4.3.8 and in the narrative descriptions of the BMPs listed in **Attachment P**.

4.3.2 Existing (pre-construction) Control Measures

The following are existing (pre-construction) control measures encountered within the project site:

- Existing vegetation.

4.3.3 Nature of Fill Material and Existing Data Describing the Soil

The site soil typically consists of approximately 6" of top soil that of loose silty sand containing organic material (topsoil). The topsoil will likely be underlain by medium dense to dense silty soand with gravel and poorly graded gravel with silt and sand. A more detailed description of subsurface soil conditions is presented in the Geotechnical Engineering Report (see Section 3.1).

4.3.4 Erosion Control

Erosion control, also referred to as soil stabilization, consists of source control measures that are designed to prevent soil particles from detaching and becoming transported in storm water runoff. Erosion control BMPs protect the soil surface by covering and/or binding soil particles. This project will incorporate erosion control measures required by the contract documents and other measures selected by the Owner or Contractor. This project will implement the following practices for effective temporary and final erosion control during construction:

- Preserve existing vegetation where required and when feasible.
- Apply temporary erosion control to remaining active and non-active areas as required by the contract documents. Re-apply as necessary to maintain effectiveness.
- Implement temporary erosion control measures at regular intervals throughout the defined rainy season to achieve and maintain the contract's disturbed soil area requirements. Implement erosion control measures prior to the defined rainy season.
- Stabilize non-active areas as soon possible after the cessation of construction activities.
- Control erosion in concentrated flow paths by applying pine needles or wood chips, creating stabilized diversion paths and lining/ stabilizing swales/channels as required by the permit.
- Apply full revegetation methods and seed to areas deemed substantially complete by the Owner prior to the defined rainy season.
- At completion of construction, implement permanent erosion control methods to all remaining disturbed soil areas.

Sufficient erosion control materials will be maintained on-site to allow implementation in conformance with Permit requirements and as described in this SWPPP. This includes implementation requirements for active areas and non-active areas that require BMP deployment prior the onset of rain.

The BMP objectives for Control Erosion and the Discharge of Sediment are as follows:

- Control Site Perimeter: Delineate site perimeter to prevent disturbing areas outside the project limits. Divert upstream run-on safely around or through the construction project. Local codes usually state that such diversions must not cause downstream property damage or be diverted into another watershed. Runoff from the project site should be free of excessive sediment and other constituents. Control tracking at points of ingress to and egress from the project site.

- Minimize Disturbed Areas: Phase clearing and grading to limit exposed area to that which can be protected; only clear land which will be actively under construction in the near term; minimize new land disturbance during the rainy season; and avoid clearing and disturbing sensitive areas (e.g., steep slopes and natural watercourses) and other areas where site improvements will not be constructed.
- Stabilize Disturbed Areas: Provide temporary stabilization of disturbed soils for inactive portion(s) of the site. An inactive area is an area of the project that has been disturbed and is not scheduled to be re-disturbed for at least 14 days. Provide permanent stabilization during finish grade and landscape the site.
- Protect Slopes and Channels: Safely convey runoff from the top of the slope and stabilize disturbed slopes as quickly as possible. Avoid disturbing natural channels. Stabilize temporary and permanent channel crossings as quickly as possible and ensure that increases in runoff velocity caused by the project do not erode the channel.
- Retain Sediment: Retain sediment-laden waters from disturbed, active areas within the site.

The following soil stabilization BMP consideration checklist indicates the BMPs that shall be implemented to control erosion on the construction site. Implementation and locations of temporary soil stabilization BMPs are shown on the Site Plan in **Attachment B**. The BMP working details that will be adhered to are found in **Attachment P** of this SWPPP. The following BMP checklist and narrative explains how the selected BMPs will be incorporated into the project. Specific field applicability shall be determined by site conditions and the construction schedule.

EROSION CONTROL BMPs						
BMP No.	**BMP**	**BMP Manual Minimum Requirement**	**Project Specific Minimum Requirement**	**Check If Used**	**Check If Not Used**	**If Not Used, State Reason**
EC-1	Scheduling	X		X		
EC-2	Protection of Existing Vegetation	X		X		
EC-3	Hydraulic Mulch	X		X		
EC-4	Hydroseeding	X		X		
EC-5	Soil Binder	X			X	Using EC-3, 4 & 6
EC-6	Straw Mulch	X		X		
EC-7	Geotextiles, Plastic Covers and Erosion Control Blankets / Mats	X		X		
EC-8	Wood Mulching			X		
EC-9	Earth Dikes / Drainage Swales and Lined Ditches			X		
EC-10	Outlet Protection/Velocity Dissipation Devices			X		
EC-11	Slope Drains			X		
EC-12	Stream Bank Stabilization				X	Not applicable to project
EC-14	Compost Blanket				X	Not applicable to project
EC-15	Soil Preparation/ Roughening			X		
EC-16	Non-vegetative Stabilization			X		

Implementation of Erosion Control BMPs

BMP's shall be implemented to meet the minimum requirements for the Risk Level category described in Section 2.3 of this SWPPP, and included in **Attachment G**. BMPs will be deployed in a sequence to follow the progress of grading and construction. As the locations of soil disturbance change, erosion and sedimentation controls will be adjusted accordingly to control storm water runoff at the downgrade perimeter and at storm drain inlets. BMPs will be mobilized as follows:

- Year-Round

- The Qualified SWPPP Practitioner (QSP) will monitor weather using National Weather Service reports to track conditions and alert crews to the onset of rainfall events.
- Disturbed soil areas will be stabilized with temporary erosion control or with permanent erosion control as soon as possible after grading or construction is complete.

- During the Rainy Season
  - Disturbed areas will be stabilized with temporary or permanent erosion control before rain events.
  - Disturbed areas that are substantially complete will be stabilized with permanent erosion control (soil stabilization) and vegetation (if within seeding window for seed establishment).
  - Prior to forecast storm events, temporary erosion control BMPs will be deployed and inspected.
- During the Non-Rainy Season
  - The project schedule will sequence construction activities with the installation of both erosion control and sediment control measures. The construction schedule shall be arranged as much as practicable to leave existing vegetation undisturbed until immediately prior to grading.

4.3.5 Sediment Control

Sediment controls are temporary or permanent structural measures that are intended to complement and enhance the selected erosion control measures and reduce sediment discharges from active construction areas. Sediment controls are designed to intercept and settle out soil particles that have been detached and transported by the force of water. This project will incorporate sediment control measures required by the contract documents and other measures selected by the Contractor.

Sediment control BMPs will be installed at all appropriate locations along the site perimeter and at all operational storm drain inlets and outlets during the rainy season. During the non-rainy season, adequate sediment control materials will be available to control sediment discharges at the downgrade perimeter in the event of storms.

The Contractor shall maintain a ten percent (10%) volume overage stockpile of temporary sediment and erosion control materials on the site during the rainy and non-rainy seasons throughout the project duration. A rapid response to failures or emergencies is required by the General Permit (see **Attachment S**- Other Plans and Permits) and is required for both active and non-active areas.

The following sediment control BMP consideration checklist indicates BMPs that shall be implemented to control sediment on the construction site. Implementation and location of temporary sediment control BMPs are shown on the WPCDs in **Attachment B**. BMP fact sheets can be found in **Attachment P** of this SWPPP. The following BMP checklist and narrative explains how the selected BMPs shall be incorporated into the project:

SEDIMENT CONTROL BMPS						
BMP No.	**BMP**	**BMP Manual Minimum Requirement**	**Project Specific Minimum Requirement**	**Check If Used**	**Check If Not Used**	**If Not Used, State Reason**
SE-1	Silt Fence	X		X		
SE-2	Desilting Basin				X	Sediment Trap used as alternative.
SE-3	Sediment Traps			X		
SE-4	Check Dams			X		
SE-5	Fiber Rolls	X		X		
SE-6	Gravel Bag Berms	X		X	X	Fiber Rolls/Silt fence used as alternative.
SE-7	Street Sweeping and Vacuuming	X		X		
SE-8	Sand Bag Barrier			X		
SE-9	Straw Bale Barrier				X	Straw bales not allowed.
SE-10	Storm Drain Inlet Protection	X		X		
SE-11	Active Treatment Systems				X	Not applicable to this project
SE-12	Temporary Silt Dike				X	Not applicable to this project
SE-13	Compost Socks and Berms				X	Not applicable to this project
SE-14	Biofilter Bags				X	Not applicable to this project

- **Silt Fence**

  Either silt fences or fiber rolls will be used at downstream locations on the project site. An overage pile of silt fences shall be stored onsite by the contractor at all times for use in unforeseen situations**.**

- **Sediment Trap**

  The locations for proposed detention basins, infiltration basins, and bioretention landscape areas along the boundaries of the project will be used as temporary sediment traps to capture storm runoff and settle sediments before stormwater is discharged from the site. The sediment traps will also be used to treat excess water from dewatering operations prior to release. Sediment traps shall not be deeper than two feet below existing ground due to high groundwater elevation. Sediment traps should also be lines with vegetation of gravel to assist with pollutant removal.

- **Check Dams**

  Check dams shall be composed of sand bags, fiber rolls, or gravel and shall be placed perpendicular to direction of flow every 30 feet along ditches.

- **Fiber Rolls**

  Fiber rolls are approved for use on this project. However, materials shall be non-invasive fiber or straw. An overage pile of fiber rolls shall be stored on-site by the Contractor always for use in unforeseen situations. The Environmental Site Manager shall have the authority to specify field locations for appropriate areas of use for fiber rolls.

- **Road Cleaning BMP – Street Sweeping and Vacuuming**

  Road sweeping, and vacuuming will occur during soil hauling and as necessary to keep street surfaces clear of soil and debris. Washing of sediment tracked onto streets into storm drains shall not occur unless sweeping and vacuuming has occurred first and all storm drain inlet BMPs are in place.

- **Storm Drain Inlet Protection**

  All existing storm drain inlets that may be exposed to runoff from the construction site, and any storm drains shown on the site map in **Attachment B**, shall have storm drain inlet protection as described in the BMP fact sheet in **Attachment P**. Filter berms shall be places around drain inlet to remove sediment before it enters the drainage system.

Implementation of Temporary Sediment Controls

BMP's shall be implemented to meet the minimum requirements for the Risk Level category described in Section 3.3 of this SWPPP and included in **Attachment G**.

- During the rainy season, temporary sediment controls will be implemented at the draining perimeter of disturbed soil areas, at the toe of slopes, at storm drain inlets and at outfall areas.

- During the non-rainy season, temporary sediment controls will be implemented at the draining perimeter of disturbed soil areas and at storm drain downstream from disturbed areas prior to anticipated rain events.

- As shown on the WPCDs, a combination of fiber rolls and silt fence will be deployed along the toe of exterior slopes to filter storm water runoff.

- Storm drain inlet protection will be used at all operational storm drain inlets during the rainy and non-rainy season as shown on the WPCDs.

- During the non-rainy season, in the event of a predicted storm, the following temporary sediment control materials will be maintained on-site; fiber rolls, silt fences, and filter fabric.

4.3.6 Tracking Control

The following tracking control BMP consideration checklist indicates the BMPs that shall be implemented to reduce sediment tracking from the construction site onto private or public roads. Implementation and locations of sediment tracking BMPs are shown on the WPCDs in **Attachment B** and/or described in this section. The BMP working details that will be adhered to are found in **Attachment P** of this SWPPP. BMP's shall be implemented to meet the minimum requirements for the Risk Level category described in Section 3.3 of this SWPPP, and in **Attachment G**. The following list of BMPs and narrative explains how the selected BMPs shall be incorporated into the project.

TRACKING CONTROL BMPs						
BMP No.	**BMP**	**BMP Manual Minimum Requirement**	**Project Specific Minimum Requirement**	**Check If Used**	**Check If Not Used**	**If Not Used, State Reason**
TC-1	Stabilized Construction Entrance/Exit		X	X		
TC-2	Stabilized Construction Roadway				X	Not applicable to project
TC-3	Entrance/Outlet Tire Wash		X	X		
SE-7	Street Sweeping and Vacuuming	X		X		

BMPs to Reduce Sediment Tracking:

- **Stabilized Construction Entrance/Exit**
  - A stabilized construction entrance/exit will be constructed and maintained at construction site entrances and exits, equipment yard, PCC batch plants and crushing plants, water filling area for water trucks and project office location, as shown on the site map.
  - The site entrance/exit will be stabilized to reduce tracking of sediment from construction traffic. The entrance shall be designated and graded to prevent runoff from leaving the site. Stabilization material will be 3 to 6-inch aggregate. The entrance shall be flared where it meets the existing road to provide an adequate turning radius. During dirt-hauling activities that extend over a one-week time period, a site entrance/exit will be installed to reduce tracking of sediment.

- **Entrance/Outlet Tire Wash**

  An entrance/outlet tire wash station will be used if needed to ensure that sediment tracking to public streets is minimized.

4.3.7 Wind Erosion Control

The following wind erosion control BMP consideration checklist indicates the BMPs that shall be implemented to control wind erosion on the construction site. Implementation and locations of wind erosion control BMPs are shown on the WPCDs in **Attachment B** and/or described in this section. The BMP working details that will be adhered to are found in

Attachment P of this SWPPP. BMPs shall be implemented to meet the minimum requirements for the Risk Level category described in Section 3.3 of this SWPPP and included in **Attachment G**. The following list of BMPs and narrative explains how the selected BMPs shall be incorporated into the project:

WIND EROSION CONTROL BMPs						
BMP No.	**BMP**	**BMP Manual Minimum Requirement**	**Project Specific Minimum Requirement**	**Check If Used**	**Check If Not Used**	**If Not Used, State Reason**
WE-1	Wind Erosion Control	X	X	X		

- **Wind Erosion Control**

  Proper dust control shall be implemented on the site, as described in the BMP fact sheet in **Attachment P**. Exposed soils shall be watered daily to suppress dust during grading operations. All exposed surfaces that will not have gravel, concrete, or asphalt as part of the project shall be vegetated or stabilized as soon as feasibly possible.

4.3.8 Non-Storm Water Control

An inventory of construction activities and potential non-storm water discharges is provided in Section 4.3.1. Objective for managing Non-Stormwater Discharges and Materials are as follows:

- Practice Good Housekeeping: Perform activities in a manner to keep potential pollutants from coming into contact with stormwater to eliminate or avoid exposure. When exposure cannot be avoided, prevent contaminated stormwater from being transported off-site.
- Contain Materials and Wastes: Store construction, building, and waste materials in designated areas that are protected from rainfall and contact with stormwater runoff. Dispose of construction waste in designated areas and keep storm-water from flowing onto or off of these areas. Prevent spills and clean up spilled materials.

The following BMP consideration checklist indicates the BMPs that have been selected to control non-storm water pollution on the construction site. Implementation and locations of some non-storm water control BMPs are shown on the WPCDs in **Attachment B**.
All waste materials generated on-site shall be removed from the site prior to any anticipated storm event. The BMP working details that will be adhered to are found in **Attachment P** of this SWPPP. BMPs shall be implemented to meet the minimum requirements for the Risk Level category described in Section 2.3 of this SWPPP and included in **Attachment G**. The following list of BMPs and narrative explains how the selected BMPs will be incorporated into the project:

NON-STORM WATER MANAGEMENT BMPs						
BMP No.	**BMP**	**BMP Manual Minimum Requirement**	**Project Specific Minimum Requirement**	**Check If Used**	**Check If Not Used**	**If Not Used, State Reason**
NS-1	Water Conservation Practices	X		X		
NS-2	Dewatering Operations				X	
NS-3	Paving and Grinding Operations			X		
NS-4	Temporary Stream Crossing				X	Stream crossings not proposed.
NS-5	Clear Water Diversion				X	Clear water diversion not proposed.
NS-6	Illicit Connection/ Discharge	X		X		
NS-7	Potable Water/Irrigation			X		
NS-8	Vehicle and Equipment Cleaning	X		X		
NS-9	Vehicle and Equipment Fueling	X		X		
NS-10	Vehicle and Equipment Maintenance	X		X		
NS-11	Pile Driving Operations				X	Pile driving operations not proposed.
NS-12	Concrete Curing			X		
NS-13	Concrete Finishing			X		
NS-14	Material and Equipment Use Over Water				X	Equipment use over water not proposed.
NS-15	Demolition Adjacent to Water				X	Demolition adjacent to water not proposed.

- **Illicit Connection/Illegal Discharge Detection and Reporting**

  The Contractor will implement BMPs in accordance with the Illicit Connection/Illegal Discharge Detection and Reporting requirements throughout the duration of the project.

- **Paving Operations**

  BMPs for Paving and Grinding Operations, will be implemented to prevent paving materials from being discharged off-site. Covers will be placed over each inlet adjacent to paving operations. The covers will consist of filter fabric placed over and tucked under, each inlet grate. Following paving operations, the area will be swept, inlet covers will be removed and the inlets will be inspected for and cleaned of paving materials.

- **Vehicle and Equipment Operations**
  - In order to prevent and control leaks from equipment and vehicles and to minimize the possibility of toxic pollutant discharge, the following BMPs will be implemented:
    - Major repair or maintenance of equipment/vehicles will be transported offsite.
    - Minor equipment maintenance will be performed in a designated and protected fueling area.
    - On-site vehicles and equipment will be inspected regularly for leaks and, if necessary, will be repaired immediately.
    - Segregate and recycle wastes, such as greases, used oil or oil filters, antifreeze, cleaning solutions and hydraulic and transmission fluids and store used materials in a secure storage area.

4.3.9 Waste Management and Materials Pollution Control

An inventory of construction activities, materials and wastes is provided in Section 4.3.1. The following BMP consideration checklist indicates the BMPs that have been selected to control construction site wastes and materials. Implementation and locations of some materials handling and waste management BMPs are shown on the Site Plan (**Attachment B**). The BMP working details that will be adhered to are found in **Attachment P** of this SWPPP. In the narrative description of Solid Waste Management, a list of waste disposal facilities and type of waste to be disposed at each facility is provided. BMP's shall be implemented to meet the minimum requirements for the Risk Level category described in Section 2.3 of this SWPPP and included in **Attachment G**. The following list of BMPs and narrative explains how the selected BMPs will be incorporated into the project:

WASTE MANAGEMENT AND MATERIALS POLLUTION CONTROL BMPs						
BMP No.	**BMP**	**BMP Manual Minimum Requirement**	**Project Specific Minimum Requirement**	**Check If Used**	**Check If Not Used**	**If Not Used, State Reason**
WM-1	Material Delivery and Storage	X	X	X		
WM-2	Material Use	X	X	X		
WM-3	Stockpile Management	X	X	X		
WM-4	Spill Prevention and Control	X	X	X		

WASTE MANAGEMENT AND MATERIALS POLLUTION CONTROL BMPs						
BMP No.	**BMP**	**BMP Manual Minimum Requirement**	**Project Specific Minimum Requirement**	**Check If Used**	**Check If Not Used**	**If Not Used, State Reason**
WM-5	Solid Waste Management	X	X	X		
WM-6	Hazardous Waste Management	X		X		
WM-7	Contaminated Soil Management			X		
WM-8	Concrete Waste Management	X		X		
WM-9	Sanitary/Septic Waste Management	X	X	X		
WM-10	Liquid Waste Management				X	No liquid waste onsite

- **Spill Prevention and Control**

  The Contractor shall at a minimum implement the following spill and leak response procedures. This includes discharges of any pollutant including sediment. **All** spills and leaks shall be **immediately** reported to the QSP for assistance on evaluating, correcting and reporting the incident.

Standard Specifications

General

It is the responsibility of the general contractor and subcontractors to identify spills, contain, control, cleanup, remediate (if necessary) and notify all appropriate parties and regulatory agencies.

Small Scale Cleanup and Notification Measures

A small-scale spill is one that can be cleaned up with spill response materials stages on-site, can be managed by the contractor's employees and within the workday that the spill occurred.

- To the extent that work can be accomplished safely, all work will stop until the spill has been fully cleaned up.
- Notify site management and owner (LRP) of the spill. Collect and communicate the following information:
  - Name and company
  - Cellular number where you can be reached on-site.
  - Where you are located on-site?
  - What material has spilled?
  - Where has the material spilled?
  - How much material has spilled?
  - How much material has the potential to continue spilling?
  - Has the material entered a vegetated area or storm-water conveyance?
  - Has the source of the spill been stopped?
  - What cleanup actions have already been taken?
  - Has the spill been contained?
  - Has anyone been injured or exposed requiring EMS response?
- Notify the Lahontan RWQCB (530) 542-5400 if necessary. See Section 4.5, Non-Compliance Reporting.
- Notify the California Fish and Wildlife (if necessary). See Section 400.5, Non-Compliance Reporting.
- The subcontractor foreman or superintendent is responsible for the control, containment, cleanup and disposal activities.
- Use a rag for small spills on paved surfaces.
- Damp mop for general cleanup.
- Absorbent materials for larger spills.
- If the spilled material is hazardous, the used cleanup materials are also hazardous and must be disposed of as hazardous waste.

- If material has spilled from a leaking container, vehicle or piece of equipment, take immediate action to stop the leak and remove and contain the item from service until properly repaired.
- Spills shall be covered and protected from storm water run-on to the extent that it does not compromise cleanup activity.
- Do not bury or wash spills with water.
- Contain, store, properly label and dispose of used cleanup materials, contaminated materials and recovered spill material that is no longer suitable for the intended purpose (see Hazardous Waste Tech Note).

Large Scale Spill Cleanup and Notification Measures

A large-scale spill is one of hazardous material that cannot be controlled by personnel on-site. The following steps should be taken:

- If the spill exceeds the ability of site personnel to contain it take reasonable defensive actions to prevent the material from entering vegetated areas or stormwater conveyances if possible **without putting personnel at risk**.
- Notify site management owner (LRP) of the spill. Collect and communicate the following information:
  - Your name and company.
  - Cellular number where you can be reached on-site
- In the event of material spill, identification, notification and cleanup response will occur immediately following the accident event
- Keep ample supplies of spill control and cleanup materials on-site, near storage, unloading and maintenance areas.
- Inspect and verify that BMPs are in place prior to the commencement of associated activities. While activities associated with the BMP are under way, inspect daily.
- Update your spill prevention, control and countermeasure plan and stock cleanup materials as changes occur in the types of chemicals on-site.

Management Response

If failure to report and correct a spill or leak is discovered, site management will review, retrain or remove individuals from the site accordingly.

- **Waste Management**

  BMPs for Solid Waste Management and Hazardous Waste Management will be implemented to minimize storm water contact with waste materials and prevent waste discharges. Solid wastes will be loaded directly into trucks for off-site disposal. When on-site storage is necessary, solid wastes will be stored in watertight dumpsters in the general storage area of the Contractor's yard. AC and PCC rubble will be stockpiled in the general storage area and will be surrounded with sediment controls and covered when necessary. Solid waste, including rubble stockpiles, will be removed and disposed off-site at least weekly. Concrete washout done onsite will only be done in a designated area that is lined to prevent leaching into the soil, and bermed on all sides, as described in the Concrete Waste Management BMP. The designated washout area shall be located at least 50 feet away from open ditches or storm water conveyance systems. Hazardous wastes will be stored in the shipping containers or covered containment area discussed above for materials storage. Hazardous wastes containers shall be clearly marked and segregated from other non-waste materials.

- **Contaminated Soil Management**

  When contaminated soils are encountered, the Resident Engineer will be notified, the contaminated soils will be contained, covered if stockpiled, and disposed of per the Contaminated Soil Management BMP and the contract documents. Employees will be instructed to recognize evidence of contaminated soil, such as buried debris, discolored soil and unusual odors.

- **Sanitary and Septic Waste Management**

  The Contractor will implement Sanitary and Septic Waste Management and portable toilets will be located and maintained at the Contractor's yard for the duration of the project. Maintenance will be provided by a designated local company and wastes will be disposed off-site. The toilets will be located away from concentrated flow paths and traffic flow.

4.4 Water Pollution Control Drawings (WPCDs)

The Water Pollution Control Drawings can be found in **Attachment B** of the SWPPP.

4.5 Construction BMP Maintenance, Inspection and Repair

Inspections will be conducted as follows and as described in the BMP narrative's. BMPs shall be maintained, inspected and repaired to meet the minimum requirements for the Risk Level category described in Section 2.3 of this SWPPP and included in **Attachment G.**

All inspection, maintenance repair and sampling activities at the project location shall be performed or supervised by a Qualified SWPPP Practitioner (QSP) representing the discharger. The QSP may delegate any or all of these activities to an employee appropriately trained to do the required task(s) which include:

1. Perform weekly inspections and observations, and at least once each 24-hour period during extended storm events, to identify and record BMPs that need maintenance to operate effectively, that have failed, or that could fail to operate as intended.

2. Upon identifying failures or other shortcomings, as directed by the QSP, Risk Level 2 dischargers shall begin implementing repairs or design changes to BMPs within 72 hours of identification and complete the changes as soon as possible. If a rain event is predicted sooner, the corrective actions should be initiated, and if possible completed, before the forecasted rain event.
3. For each inspection required, complete an inspection checklist, using a form provided by the State Water Board or Regional Water Board or in an alternative format.

   Checklists shall remain onsite with the SWPPP and at a minimum, shall include:

   a) Inspection date and date the inspection report was written.
   b) Weather information, including presence or absence of precipitation, estimate of beginning of qualifying storm event, duration of event, time elapsed since last storm, and approximate amount of rainfall in inches.
   c) Site information, including stage of construction, activities completed, and approximate area of the site exposed.
   d) A description of any BMPs evaluated and any deficiencies noted.
   e) If the construction site is safely accessible during inclement weather, list the observations of all BMPs: erosion controls, sediment controls, chemical and waste controls, and non-storm water controls. Otherwise, list the results of visual inspections at all relevant outfalls, discharge points, downstream locations and any projected maintenance activities.
   f) Report the presence of noticeable odors or of any visible sheen on the surface of any discharges.
   g) Any corrective actions required, including any necessary changes to the SWPPP and the associated implementation dates.
   h) Photographs taken during the inspection, if any.
   i) Inspector's name, title, and signature.

Copies of the completed checklists will be kept with the SWPPP in **Attachment H**. See Section 3.5, Retention of Documents.

4.6 Rain Event Action Plan

Rain Event Action Plans (REAP) shall be prepared and implemented by the QSP for each qualifying site and storm event. REAP requirements are stated in General Permit Attachments D, Section H and are generally summarized below.

REAPs developed by a QSP, are required for all Risk Level 2 and 3 dischargers for each construction phase. The QSP will need to customize the REAP for each rain event. Completed REAPs must be maintained on site and kept with the SWPPP in **Attachment M.**

The QSP must develop the REAP 48-hours in advance of any precipitation event forecast to have a 50% or greater chance of producing precipitation in the project area. The REAP must be on site and be implemented 24 hours in advance of any the predicted precipitation event.

The REAP is designed to protect all exposed portions of project sites and to ensure that the discharger has adequate materials, staff, and time to implement erosion and sediment control

measures that are intended to reduce the amount of sediment and other pollutants that could be generated during the rain event.

At minimum the REAP must include the following site and phase-specific information:

1. Site Address;
2. Calculated Risk Level (2 or 3);
3. Site Stormwater Manager Information including the name, company, and 24-hour emergency telephone number;
4. Erosion and Sediment Control Provider information including the name, company, and 24-hour emergency telephone number;
5. Stormwater Sampling Agent information including the name, company, and 24-hour emergency telephone number;
6. Activities associated with each construction phase;
7. Trades active on the construction site during each construction phase;
8. Trade contractor information; and
9. Suggested actions for each project phase.

A template REAP is provided in **Attachment M** of this SWPPP.

4.7 Training

In accordance with the General Permit (Section VII), all elements of the SWPPP shall be developed by a QSD and implemented by a QSP. The QSP may delegate tasks to trained employees provided adequate supervision and oversight is provided. The QSP shall be responsible for implementing a training program for construction personnel.

Personnel at the site shall receive training appropriate for individual roles and responsibilities on the project. Appropriate personnel shall receive training on SWPPP implementation, BMP inspection and maintenance, and record keeping. Document all training activities (formal and informal) and retain a record of training activities in SWPPP **Attachment K**. Training documentation must also be submitted in the Annual Report.

4.8 List of Contractors and Subcontractors

In accordance with the General Permit, the SWPPP shall include a list of names of all contractors, subcontractors, and individuals who will be directed by the QSP.

This list shall be included as **Attachment J** and kept with the SWPPP at the project site. The list shall be prepared by QSP and updated accordingly by the QSP during construction.

4.9 Post-Construction Storm Water Management

This project complies with Municipal Separate Storm Sewer System (MS4) permit approved Stormwater Management Plan (SWMP) for the Town of Truckee. The project qualifies for a MS4 exemption to the runoff reduction requirements of the General Permit.

4.9.1 Post-Construction Control Practices

Post construction BMPs are permanent measures installed during construction, designed to reduce or eliminate pollutant discharges from the site after construction is completed.

This site is located in an area subject to a Phase II Municipal Separate Storm Sewer System (MS4) permit approved Stormwater Management Plan. Post construction runoff reduction requirements have been satisfied through the MS4 program, this project is exempt from provision XIII A of the General Permit.

The following source control post construction BMPs to comply with General Permit Section XIII.B and local requirements have been identified for the site:

- Final Paving, Hardscaping and Landscaping;
- All slopes will be fully revegetated and seeded with the specified seed mix, planted and protected with Pine needle mulch, tub grindings or other mulches approved by the revegetation inspectors or landscape architect; and
- Permanent water quality treatment facilities for removal of potential pollutants from impervious surfaces. Treatment facilities being used for this project include infiltration trenches, infiltration basins, pervious concrete, and retention ponds.

Post construction storm water pollution prevention will be addressed using both source and treatment controls combined with monitoring.

4.9.2 Operation/Maintenance After Project Completion

A plan for the post construction funding and maintenance of these BMPs has been developed to address at minimum five years following construction. The post construction BMPs that are described above shall be funded and maintained by the Tahoe Donner Association. All operation and maintenance shall conform to the local Phase II Municipal Separate Storm Sewer System (MS4) permit approved Stormwater Management Plan (SWMP). Design details for post-construction BMPs are included in the Improvement Plans and Project Drainage Report.

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Section 5 Construction Site Monitoring Program

5.1 Purpose

In accordance with the General Permit (Attachments C, D, E; Section I.1.a) this SWPPP includes a written site specific Construction Site Monitoring Program (CSMP). The CSMP has been initially prepared by the QSD and shall be revised as necessary by the QSD and QSP to reflect project revisions. All tasks associated with implementation of this program including inspection, observation, and sample collection shall be performed by the QSP.

The purpose of this CSMP is to address the following objectives:

- To demonstrate that the site follows the applicable discharge prohibitions, Numeric Action Levels (NALs), of the Construction General Permit;
- To determine whether non-visible pollutants are present at the construction site and are causing or contributing to exceedances of water quality objectives;
- To determine whether immediate corrective actions, additional BMP implementation, or SWPPP revisions are necessary to reduce pollutants in stormwater discharges and authorized non-stormwater discharges; and
- To determine whether BMPs included in the SWPPP and/or Rain Event Action Plan (REAP) are effective in preventing or reducing pollutants in stormwater discharges and authorized non-stormwater discharges.

5.2 Applicability of Permit Requirements

This CSMP has been developed to meet the specific requirements and objectives identified in the General Permit for **Risk Level 2**. The General Permit requires the following types of monitoring for this Risk Level:

- Visual inspections of Best Management Practices (BMPs);
- Visual monitoring of the site related to qualifying storm events;
- Visual monitoring of the site for non-stormwater discharges;
- Sampling and analysis of construction site runoff for pH and turbidity;
- Sampling and analysis of construction site runoff for non-visible pollutants when applicable; and
- Sampling and analysis of non-stormwater discharges when applicable.

Numeric Action Levels (NAL's) required for Risk Level 2:

- Turbidity: 250 NTU
- pH: 6.5-8.5

Refer to **Attachment G** for Field Monitoring Requirements for Risk Level 2.

5.3 Monitoring Requirements

In general, monitoring shall be taken at the upstream and downstream location of any mainline storm drain or conveyance that passes through the project site area. Multiple samples shall be collected downstream, in accordance with permit requirements, and one sample shall be collected upstream of areas identified by the visual observations to be potentially contaminated by pollutants. For additional information, refer to **Attachment G**, Field Monitoring Requirements for Risk Level 2.

5.4 Safety

All applicable construction safety regulations and OSHA requirements shall be adhered to when conducting monitoring or sampling.

This project is not required to collect samples or conduct visual observations (inspections) under the following conditions:

- During dangerous weather conditions such as flooding and electrical storms.
- Outside of scheduled site business hours.

Scheduled site business hours are: Monday Friday, 7 a.m. to 5 p.m.

If monitoring (visual monitoring or sample collection) of the site is unsafe because of the dangerous conditions noted above, the QSP shall document the conditions for why an exception to performing the monitoring was necessary. The exemption documentation shall be filed in **Attachment I** "BMP Inspection Checklist."

5.5 Weather and Rain Event Tracking

Visual monitoring and inspections requirements of the General Permit are triggered by a qualifying rain event. *The General Permit defines a qualifying rain event as any event that produces ½ inch of precipitation.* A minimum of 48 hours of dry weather will be used to distinguish between separate qualifying storm events.

5.5.1 Weather Tracking

The QSP should daily consult the National Oceanographic and Atmospheric Administration (NOAA) for the weather forecasts. These forecasts can be obtained at http://www.srh.noaa.gov/. Weather reports should be printed and maintained with the SWPPP in **Attachment T**, "Weather Records".

5.5.2 Rain Gauge

The QSP shall install one rain gauge on the project site. Locate the gauge in an open area away from obstructions such as trees or overhangs. Mount the gauge on a post at a height of 3 to 5 feet with the gauge extending several inches beyond the post. Make sure that the top of the gauge is level. Make sure the post is not in an area where rainwater can indirectly splash from sheds, equipment, trailers, etc.

The rain gauge(s) shall be read daily during normal site scheduled hours. The rain gauge should be read at approximately the same time every day and the date and time of each reading recorded. Log rain gauge readings in **Attachment T** "Weather Records". Follow the rain gauge instructions to obtain accurate measurements.

Once the rain gauge reading has been recorded, accumulated rain shall be emptied and the gauge reset.

Alternatively, an automatic rain gauge station may be used.

For comparison with the site rain gauge, the nearest appropriate governmental rain gauge(s) is located at Station ID GHCND:USS0020K13S (39.3°, -120.2°). Information at this station can be found at: http://www.ncdc.noaa.gov/cdo-web/datasets/GHCND/stations/GHCND:USS0020K13S/detail

5.6 Monitoring Locations

Monitoring locations will be at the storm water discharge locations, storm water storage areas, and BMP locations shown on the **Water Pollution Control Plan** in **Attachment B,** as well as any known run-on locations. Monitoring is described further in Section 5.7 to 5.9.

BMP locations are shown on the **Water Pollution Control Plan** in **Attachment B.**

There will ultimately be one (1) storm water containment area on the project site. Stormwater discharge locations will be at the outfall points of the storm water containment areas. Storm water containment areas and associated storm water discharge locations are shown in the **Water Pollution Control Plan** in **Attachment B**.

Whenever changes in the construction site might affect the appropriateness of sampling locations, the sampling locations shall be revised accordingly. All such revisions shall be implemented as soon as feasible and the SWPPP shall be amended. Temporary changes that result in a one-time additional sampling location do not require a SWPPP amendment.

5.7 Visual Monitoring (Inspections)

Risk Level3 – Visual Monitoring (Inspection) Requirements for Qualifying Rain Events

The General Permit requires that the construction site be inspected within 48 hours prior to a predicted qualifying rain event, and within 48 hours after a qualifying rain event.

Visual observations (inspections) shall be conducted during business hours only. Stored or contained storm water that will likely discharge after operating hours due to anticipated precipitation shall be observed prior to the discharge during operating hours.

Risk Level 3 dischargers shall maintain on-site records of all visual observations (inspections), personnel performing the observations, observation dates, weather conditions, locations observed, and corrective actions taken in response to the observations.

Pre-Rain Event Inspection

The purpose of the pre-rain event inspection is to make sure the site and the BMPs are ready for the predicted rain. Within 2 business days (48 hours) prior to each qualifying rain event, Risk Level 3 dischargers shall visually observe (inspect):

- All stormwater drainage areas to identify any spills, leaks, or uncontrolled pollutant sources;

- All BMPs to identify whether they have been properly implemented per the SWPPP and/or REAP;
- Stormwater storage and containment areas to detect leaks and ensure maintenance of adequate freeboard; and
- The presence or absence of floating and suspended materials, a sheen on the surface, discolorations, turbidity, odors, and source(s) of any observed pollutants within stored stormwater.

Rain Event Inspection

During extended rain events BMP inspections will be conducted to identify and record:

- BMPs that are properly installed;
- BMPs that need maintenance to operate effectively;
- BMPs that have failed; or
- BMPs that could fail to operate as intended.

If the construction site is not accessible during the rain event, the visual inspections shall be performed at all relevant outfalls, discharge points, downstream locations. The inspections should record any projected maintenance activities.

Post-Rain Event Inspection

The purpose of the post-rain event inspection is to observe the discharge locations and the discharge of any stored or contained rainwater; determine if BMPs functioned as designed; and identify if any additional BMPs are required. Within two business days (48 hours) after each qualifying rain event (0.5 inches of rain), Risk Level 2 dischargers shall conduct post rain event observation to visually inspect:

- All stormwater discharge locations;
- The discharge of stored or contained stormwater that is derived from and discharged subsequent to a qualifying rain event; and
- All BMPs to determine if they were adequately designed, implemented, and effective.
- After assessing BMPs it should be noted on the inspection form whether the BMPs need maintenance, identify additional BMPs and revise the SWPPP accordingly.

Field Inspection Logs shall be kept onsite with the SWPPP document in **Attachment H** and copies of all inspection logs shall be provided to the QSD and LRP. **See Attachment H: Field Inspection Log for Risk Level 2.**

5.8 Water Quality Sampling and Analysis

At a minimum, **Risk Level 3** sites are required to collect:

- Samples of runoff and contained rainwater (when it is released) from qualifying storm events and analyze samples for pH and turbidity.
- Samples of non-stormwater (authorized and unauthorized) to characterize the discharge.
- Additional monitoring that may be required by the RWQCB.
- Water quality samples if there is a BMP breach, malfunction, leakage, or spill. Water quality samples should be taken for nonvisible pollutants that may have been discharged from the site as identified in the site pollutant source assessment (see Section 600.7 of this document).
- Particle size analysis may be needed if a Risk 3 project is using a sediment basin or if needed to justify a site-specific risk level calculation using RUSLE. The particle size analysis provides the information needed to determine the K-factor.

Refer to General Permit (included in this SWPPP as **Attachment S**) for specific details about sample collection frequency; sample constituents; sample collection methodologies (including clean sample collection techniques); and use of pH and turbidity field meters and field quality assurance/quality control. Refer to **Attachment G,** Field Monitoring Requirements for Risk Level 2 for additional requirements.

In conformance with the General Permit, a minimum of forty-eight (48) hours of dry weather will be used to distinguish between separate rain events.

Field Sampling Logs shall be kept onsite with the SWPPP document in **Attachment N** and copies of all sampling logs shall be provided to the QSD and LRP. **See Attachment N:** Field Sampling Log and Chain of Custody Form.

Effluent Sampling: Turbidity and pH

The General Permit requires that dischargers sample every day of every storm event that generates runoff except when the runoff occurs outside of scheduled site business hours. A minimum of three samples are required each day of discharge. The three samples must be representative of the quality of the cumulative discharge from the site. It is advisable to try to collect samples throughout the day (e.g. during the first hour, mid-point, and last hour of each working day). However, it is essential that a minimum of three samples be collected to calculate daily averages. Dischargers should consider taking three discrete measurements at the first sampling event of the day to guarantee that the minimum number of samples is obtained; thereafter one sample can be obtained at the mid-point and end of the day. All sample results (even if more than three are obtained) must be included in the calculation of the daily average or storm event average.

Field meters to measure pH and turbidity allow immediate feedback to the QSP to take action based on the results. For this reason, the use of field meters is preferable to sending pH and turbidity samples to analytical laboratories. Individuals collecting samples need to be appropriately qualified and trained to collect samples and calibrate the field instruments. Continuous monitoring for pH and turbidity is another option that can be employed to provide a more complete representation of effluent quality. All sites are required to monitor runoff for non-visible pollutants in the event of a BMP failure, breach, or spill. An area unaffected by the failure, breach, or spill must also be sampled to serve as the basis of comparison. All sampling shall be documented and recorded in accordance with General Permit requirements (refer to Section 3.5 Retention of Records). All reportable discharges, NAL exceedances shall be reported and properly documented (refer to Section 3.6 Required Non-Compliance Reporting).

5.9 Sampling and Analysis Plan for Non-Visible Pollutants

This Sampling and Analysis Plan (SAP) for Non-Visible Pollutants describes the sampling and analysis strategy and schedule for monitoring non-visible pollutants in storm water discharges from the project site and off-site activities directly related to the project, in accordance with the requirements of the General Permit.

5.9.1 Scope of Monitoring Activities

The following construction materials, wastes or activities, as identified in Section 4.3.1, are potential sources of non-visible pollutants to storm water discharges from the project. Storage, use and operational locations are shown on the WPCDs in **Attachment B**.

- Solvents, thinners

- Treated wood
- Soil stabilizers
- Fertilizers, herbicides and pesticides
- Oils associated with paving and grinding activities

5.9.2 Monitoring Strategy

Water Quality Monitoring

Water quality monitoring is required during storm events. Water quality monitoring shall include visual monitoring of discharge to determine the need for water sampling. Water sampling is required if there is any breach, malfunction, leakage, or spill observed which could result in the discharge of pollutants to surface waters that would not be visually detectable in storm water.

One sample shall be collected downstream and one sample collected upstream of areas identified by the visual observations to be potentially contaminated by pollutants.

Training of Sample Personal

The General Permit requires dischargers to designate and train personnel to collect, maintain, and ship water quality samples in accordance with the Surface Water Ambient Monitoring Program (SWAMP) 2008 Quality Assurance Program Plan (QAPP), available at http://www.swrcb.ca.gov/water_issues/programs/swamp/tools.shtml#qa. Training records of designated contractor sampling personnel are provided in **Attachment K.**

Sample Collection Method

Samples shall be collected in a clean quart jar. Each consecutive sample shall be collected in the same location to ensure consistency between test samples. Each sample shall be sealed at the sampling site. Each jar shall be permanently marked with the date, location and time the sample was collected. The sample shall be inspected by the person taking the sample. The upstream sample shall be compared visually to the downstream sample for color and clarity. Indication of any chemicals shall also be noted on the report form. A summary of differences between the two (2) samples shall be noted in a summary column.

Analytical Constituents

All non-stormwater discharges that flow through a disturbed area shall, at minimum, be monitored for turbidity.

All non-stormwater discharges that flow through an area where they are exposed to pH altering materials shall be monitored for pH.

The QSP shall identify additional pollutants to be monitored for each non-stormwater discharge incident based on the source of the non-stormwater discharge. If the source of an unauthorized non-stormwater discharge is not known, monitoring for pH, turbidity, MBAS, TOC, and residual chlorine or chloramines is recommended to help identify the source of the discharge.

Non-stormwater discharge run-on shall be monitored, at minimum, for pH and turbidity. The QSP shall identify additional pollutants to be monitored for each non stormwater discharge incident based on the source of the non stormwater discharge. If the source of an unauthorized non-stormwater discharge is not known, monitoring for pH, turbidity, MBAS, TOC, and residual chlorine or chloramines is recommended to help identify the source of the discharge.

Sampling Schedule

Samples for the applicable non-visible pollutant(s) shall be collected during the first two (2) hours of discharge from rain events that result in a sufficient discharge for sample collection. Samples shall be collected during daylight hours (sunrise to sunset) and shall be collected regardless of the time of year, status of the construction site or day of the week.

Collection of discharge samples for non-visible pollutant monitoring will be triggered when any of the following conditions are observed during the required inspections conducted before or during rain events:

- Materials or wastes containing potential non-visible pollutants are not stored under watertight conditions. Watertight conditions are defined as (1) storage in a watertight container, (2) storage under a watertight roof or within a building or (3) protected by temporary cover and containment that prevents storm water contact and runoff from the storage area.

- Materials or wastes containing potential non-visible pollutants are stored under watertight conditions, but (1) a breach, malfunction, leakage or spill is observed, (2) the leak or spill is not cleaned up prior to the rain event and (3) there is the potential for discharge of non-visible pollutants to surface waters or a storm drain system.

- Soil amendments that have the potential to change the chemical properties, engineering properties or erosion resistance of the soil have been applied and there is the potential for discharge of non-visible pollutants to surface waters or a storm sewer system.

- Storm water runoff from an area contaminated by historical usage of the site has been observed to combine with storm water runoff from the site and there is the potential for discharge of non-visible pollutants to surface waters or a storm sewer system.

In the event that non-stormwater discharges run-on to the project site from offsite locations, and this run-on has the potential to contribute to a violation of a NAL, the run-on will also be sampled.

Sampling Locations

Sampling locations will be based on field conditions and construction activities that occurred prior to the rain event. The following is a list of potential reasons that may trigger sampling requirements;

- Samples of runoff that drain areas where soil amendments that have the potential to change the chemical properties, engineering properties or erosion resistance of the soil will be applied.

- Samples of runoff that drain areas contaminated by historical usage of the site.

- Samples of run-on to the project site with the potential to combine with discharges being sampled for non-visible pollutants. These samples are intended to identify sources of potential non-visible pollutants that originate off the project site.

5.9.3 Monitoring Preparation and Sample Collection

Non-stormwater discharge samples will be collected by:

Contractor	☐ Yes	☐ No
Consultant	☐ Yes	☐ No
Laboratory	☐ Yes	☐ No

Samples on the project site will be collected by the following contractor sampling personnel:

Name/Telephone Number	
Alternate(s)/Telephone Number:	

An adequate stock of monitoring supplies and equipment for monitoring non-visible pollutants will be available on the project site prior to a sampling event. Monitoring supplies and equipment will be stored in a cool-temperature environment that will not come into contact with rain or direct sunlight. Sampling personnel will be available to collect samples in accordance with the sampling requirements found in the General Permit.

Supplies maintained at the project site will include, but are not limited to, surgical gloves, sample collection equipment, coolers, appropriate number and volume of sample bottles, identification labels, re-sealable storage bags, paper towels, personal rain gear, and ice.

Field Sampling Log forms and Chain of Custody (COC) forms are found in **Attachment N**. Field Sampling Logs shall be kept onsite with the SWPPP document in **Attachment N** and copies of all sampling logs shall be provided to the QSD and LRP.

Samples on the project site will be collected by the following contractor sampling personnel:

The contractor will obtain and maintain the field testing instruments, as identified in Section 6.9.2, for analyzing samples in the field by sampling personnel.

Samples will be analyzed by:

Laboratory Name:

Street Address:

City, State Zip:

Telephone Number:

Point of Contact:

The QSP or his/her designee will contact Western Environmental Testing Laboratory, 24 hours prior to a planned non-stormwater discharge or as soon as an unplanned non-stormwater discharge is observed to ensure that adequate sample collection personnel, supplies for non-stormwater discharge monitoring are available and will be mobilized to collect samples on the project site in accordance with the sampling schedule.