DISTRICT WAREHOUSE FREEZER GENERATOR

1305 E Vine St, Lodi, CA 95240

3431008

Lodi Unified School District

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BID SET

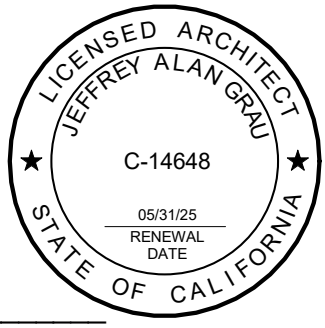


April 30, 2024

HMC Architects

DISTRICT WAREHOUSE FREEZER GENERATOR
LODI UNIFIED SCHOOL DISTRICT

April 30, 2024
HMC # 3431008



HMC ARCHITECTS
Architect



CAPITAL ENGINEERING CONSULTANTS, INC.
Mechanical/Plumbing Engineers



CAPITAL ENGINEERING CONSULTANTS, INC.
Electrical Engineer

TABLE OF CONTENTS

DIVISION 00 - PROCUREMENT AND CONTRACTING REQUIREMENTS

DOCUMENT **[INSERT DISTRICT FRONT ENDS]**

DIVISION 01 - GENERAL REQUIREMENTS

SECTION
01 1100 - Summary of Work
01 3119 - Project Meetings
01 3300 - Submittal Procedures (Including Submittal Transmittal, Substitution Request, RFI, Electronic Data Request, Megger Grounding Test Certificate, Certification of Compliance for Building Materials,
01 3516 - Alteration Project Procedures
01 3543 - Environmental Procedures
01 4213 - Abbreviations and Acronyms
01 4216 - Definitions and Standards
01 4516 - Field Quality Control Procedures
01 4523 - Testing and Inspection Services
01 5000 - Temporary Facilities and Controls
01 6116 - Volatile Organic Compound (VOC) Restrictions *Cal-Green only*
01 7329 - Cutting and Patching
01 7419 - Construction Waste Management and Disposal
01 7419A - Contractor's Construction Waste and Recycling Plan
01 7419B - Contractor's Reuse, Recycling and Disposal Report
01 7700 - Closeout Procedures
01 7836 - Warranties (Including Contractor Standard Warranty Form, Subcontractor Standard Warranty Form, Special Extended Warranty Form)
01 8113 - Sustainable Design Requirements*Cal-Green, Consultant to edit*

DIVISION 02 - EXISTING CONDITIONS - NOT USED

DIVISION 03 - CONCRETE - NOT USED

DIVISION 04 - MASONRY - NOT USED

DIVISION 05 - METALS - NOT USED

DIVISION 06 - WOOD, PLASTICS, AND COMPOSITES - NOT USED

DIVISION 07 - THERMAL AND MOISTURE PROTECTION - NOT USED

DIVISION 08 - OPENINGS - NOT USED

DIVISION 09 - FINISHES - NOT USED

DIVISION 10 - SPECIALTIES - NOT USED

DIVISION 11 - EQUIPMENT - NOT USED

DIVISION 12 - FURNISHINGS - NOT USED

DIVISION 13 - SPECIAL CONSTRUCTION - NOT USED

DIVISION 14 - CONVEYING EQUIPMENT - NOT USED

DIVISION 21 - FIRE SUPPRESSION - NOT USED

TABLE OF CONTENTS

DIVISION 22 - PLUMBING

SECTION 22 0050 - Basic Plumbing Materials and Methods
22 1000 - Plumbing Piping Systems

DIVISION 23 - HEATING, VENTILATING AND AIR CONDITIONING (HVAC) - NOT USED

DIVISION 26 - ELECTRICAL

SECTION 26 0000 - Electrical General Requirements
26 0500 - Basic Materials and Methods
26 0511 - Requirements for Electrical Installations
26 0519 - Low Voltage Electrical Power Conductors and Cable
26 0526 - Grounding and Bonding for Electrical Systems
26 0529 - Hangers and Supports for Electrical Systems
26 0533 - Raceway and Boxes for Electrical Systems
26 2213 - Low-Voltage Distribution Transformers
26 2726 - Wiring Devices
26 2816 - Enclosed Switches and Circuit Breakers
26 3213 - Spark Ignited Engine-Driven Generator Set
26 3623 - Automatic Transfer Switch

DIVISION 27 - COMMUNICATIONS - NOT USED

DIVISION 28 - ELECTRONIC SAFETY AND SECURITY - NOT USED

DIVISION 31 - EARTHWORK - NOT USED

DIVISION 32 - EXTERIOR IMPROVEMENTS

SECTION 32 1200 - Asphalt Concrete Paving
32 1600 - Site Concrete
32 3113 - Chain Link Fences and Gates

DIVISION 33 - UTILITIES - NOT USED

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Work included.
2. Work by others.
3. Dimensional tolerances for accessibility.
4. Contractor’s use of premises.
5. Work sequence.
6. Extended liquidated damages.
7. Owner occupancy.
8. Existing utilities.
9. Asbestos.

1.2 WORK INCLUDED

A. Under a single contract construct the warehouse generator project for Lodi Unified School District located in Lodi, CA. Work includes:

1. Generator and gas regulator,
2. Fenced enclosure,
3. Other work as shown in the documents and as required for a complete an operational project.

1.3 WORK BY OTHERS

A. Work on the Project which will be executed prior to start of Work of this Contract, and which is excluded from this Contract, is as follows:

1. Owner will remove furniture, supplies, drapes and salvageable items. Owner will not remove finishes or expose structure in support of Contractor's work.

B. Work in the Project which will be executed after completion of Work of this Contract, and which is excluded from this Contract, as follows:

1. NONE

C. Work on this Project which will be executed during the Work of this Contract which the Contractor shall coordinate with and facilitate:

1. NONE

1.4 DIMENSIONAL TOLERANCES FOR ACCESSIBILITY

A. While it is recognized that construction practices generally permit a level of reasonable dimensional tolerance, the installation of any items subject to compliance with the

Americans with Disabilities Act Accessibility Guidelines and Chapter 11B of the California Building Code (CBC), which are not shown with dimensional tolerances, on the drawings or in the CBC, shall be considered absolute. These dimensions will be strictly enforced. Items found to be out of tolerance may require modification and/or replacement at contractor's expense.

1.5 CONTRACTOR'S USE OF PREMISES

A. Specific roads for access to and from building sites will be agreed on with the Owner. All traffic and materials delivery shall be confined to these roads.

B. Specific areas for storage of materials and site fabrication will be agreed upon. Contractor's activities shall be confined to these areas.

C. Work shall proceed in such manner as to not interfere with Owner's activities in and about nearby facilities. Exceptions will be made only after previous agreement between Owner, Architect and Contractor.

D. Fire alarm, intercom, intrusion alarm and other such tests shall be conducted outside of school hours and shall be coordinated with site personnel, if such tests occur after occupancy.

1.6 WORK SEQUENCE

A. Construct work in stages to accommodate Owner's use of premises during construction period; coordinate construction schedule and operations with Owner's Representative.

1. Do not close off use of existing facilities until completion of addition will permit alternative usage of new facilities, unless otherwise directed by Owner.
2. Stages of construction are those indicated on drawings.

B. Schedule and construct work in stages to accommodate Owner's use of the premises before and after the primary construction period. Coordinate the construction schedule and operations with the Owner's representative. The three stages of the construction process following the bid award shall be:

1. Pre-construction Stage: Pre-construction activities shall occur from the start date, to the first day of availability. Activities shall include, but are not limited to:
    a. Project scheduling/subcontractor coordination
    b. Identification of long lead materials and equipment
    c. Temporary facilities and controls
    d. Action submittals as specified, including:
        1) Shop drawing submittals
        2) Color and sample submittals
    e. Deferred approval submittals
    f. Material ordering (particularly long lead items)
    g. Material stock piling
    h. Field measuring

i. Activities to be performed by the Owner shall include:

1) Removal of equipment and personal items from the buildings (although this may not fully occur by the first day).

j. The architect and engineers will expedite all long lead item submittals as quickly as possible. Such items must be indicated as "critical" when submitted. Substitutions of finishes, materials and equipment will not be permitted due to the lack of availability unless submittals are made early and completely.

2. Construction Stage: Primary construction activities shall occur from the date of availability, through the Date of Substantial Completion. Activities shall include work as described by the construction documents.

a. It is the intention of the owner to make these buildings available on the dates indicated below. Certain units also may be available earlier than the dates shown.

b. Due to the nature of the work and the type of facilities, the schedule is fixed and cannot be altered. The premises will not be available prior to date of availability. All primary work must be completed prior to Date of Substantial Completion. Critical work, includes life safety, HVAC, plumbing, electrical service, security and general construction. Temporary measures will be required if primary work is uncompleted at start of school date.

c. As the Owner needs time for preparing classrooms for the new school session, the Contractor shall turn over spaces in an orderly sequence to allow occupancy and use of the spaces over the final 2 weeks of the construction period. This schedule must be prepared with the Owner's input.

3. Completion/Close-out Stage: Completion and close-out activities shall occur from Date of Substantial Completion to Final Completion. Activities shall include:

a. Completion of minor finish work. Minor work shall be considered completion or installation of items which will not interfere or hinder the Owner from utilizing the facility, such as touch-up painting, hardware adjustment, etc.

b. Punch list work.

c. Project close-out.

d. All work performed during this period must occur outside of normal school hours. Arrangements must be made with the owner representative and work schedules approved.

C. Delays:

1. Minor delays: Minor delays caused by parties other than the Contractor, such as the Owner, or Architect, will not be considered critical path delays and will not result in a time extension to the project schedule. Minor delays shall be defined as delays due to the need for review, clarifications, consideration, detailing, etc. which typically do not last more than 48 hours, are addressed promptly and solved without significant changes to the work, as determined solely by the Architect. Such items which may cause delay must be identified by the Contractor at the time of origin.

2. Other delays: Other delays caused by unknown or unforeseen conditions or significant changes or modifications requested by or required by the Owner,

Architect or DSA, will be permitted only if promptly submitted, reviewed and approved by the Architect and Owner. Such delays may result in time extensions to specific work or areas of work only, and not to other unaffected portions of the project. Such delays must directly affect the critical path of the work, be shown as unavoidable and be unable to be made up through rescheduling.

D. Occupancy: The project will be occupied by the School Staff as shown below. Dates are fixed and cannot be changed. The premises will be occupied whether or not the work is completed regardless of time extensions (if any). Any work performed after this date will need to be fully coordinated with the Owner and will be limited to after school hours or weekends.

E. Project Schedule:

1. The following schedule summarizes the major activity dates (Dates are approximate and actual start dates are subject to change):
   a. Bid Dates
      1) Advertise to Bid (first)
      2) Advertise to Bid (second)
      3) Pre-Bid Conference
      4) Addendum (last)
      5) Bids Due
      6) Board Award
   b. Contracts
      1) Bond Preparation
      2) Contract Execution
   c. Pre-Construction Activities
      1) Start Date
      2) Submittals and Approvals
      3) Materials Ordering/Stockpiling
   d. Construction
      1) Date of facility availability
      2) Construction
   e. Occupancy: In order to accommodate a phased occupancy by the Owner, the Contractor will turn the buildings over for occupancy as follows:
      1) Occupancy
   f. Completion/Close-out
      1) Substantial Completion Date
      2) Complete Punch List Work
      3) Final Completion
      4) Closeout

1.7 EXTENDED LIQUIDATED DAMAGES

A. At the conclusion of the Punch List Work Completion date, all items are to be 100% finalized. Should work remain uncompleted beyond this date, the Owner may re-instate liquidated damages until all such work has been accepted. In addition, work uncompleted may, at the Owner's option, be completed by others and charged against the contract amount.

1.8 OWNER OCCUPANCY

A. Owner will occupy nearby premises during construction.

B. Refer to General Conditions and Supplementary Conditions for requirements for partial occupancy by Owner.

C. Owner will not occupy buildings included in this scope of work during the primary construction period. However, occupancy will occur as shown above.

D. Owner may occupy other buildings on premises during construction and may be present on site during summer construction period.

1.9 EXISTING UTILITIES

A. It is recognized by the District and the Contractor that the location of existing utility facilities as shown on contract drawings and specifications are approximate; their exact location is unknown.

B. Recognition is given to the fact there may be additional utilities existing on the property unknown to either party to the Contract. Location of utilities as shown on drawings and specifications represent the best information obtainable from utility maps and other information furnished by the various agencies involved. The Owner warrants neither the accuracy nor the extent of actual installations as shown on the drawings and specifications.

C. Because of this uncertainty, it may become necessary for the Architect to make adjustments in the line or grade of sewers or storm drains. Installation of such adjusted lines shall be made at the regular unit price bid for the work, and no additional compensation will be paid therefore, unless the scope and character of the work has been changed.

D. The Contractor agrees and is required to coordinate and fully cooperate with the Owner and utility owners for the location, relocation, and protection of utilities. The Contractor's attention is directed to the existence of utilities, underground and overhead, necessary for all buildings within the area of work. Prior to start of trenching operations, the Contractor shall meet with Owner Representative(s) to fully review known utility locations which may affect the work.

E. In accordance with Section 4215 of the Government Code of the State of California, the Owner shall make provisions to compensate the Contractor for the costs of locating, repairing damage not due to the failure of the Contractor to exercise reasonable care, and removing or relocating such main and trunk line utility facilities not indicated in the

plans and specifications with reasonable accuracy, and for equipment on the project necessarily idled during such work. Compensation will be in accordance with the provisions of these specifications providing for change orders. Nor shall the Contractor be assessed liquidated damages for delay in completion of the project, when such delay was caused by the failure of the Owner or owner of the utility to provide for removal or relocation of such utility facilities.

F. Nothing herein shall be deemed to require compensation to the Contractor or to relieve him from being assessed liquidated damages for such delay when the presence of unidentifiable utilities can be inferred from the presence of other visible facilities, such as buildings, meter and junction boxes, on or adjacent to the site of construction, and the damage to existing utilities or delay was caused in whole or in part by a failure of the Owner to indicate the presence of such service laterals or appurtenances.

G. In the event the Contractor discovers utilities not identified in the Contract plans or specifications, the Contractor shall immediately notify the Architect and the utility owner by the most expeditious means available and later confirm in writing.

H. Existing building utilities shall not be interrupted during normal operating hours.

1.10 ASBESTOS [HAZARDOUS MATERIALS]

A. Prior to start of work, the Contractor shall obtain and review the Owner's asbestos hazardous materials reports on any existing facilities to become familiar with existing conditions.

B. If asbestos or hazardous materials identified in the report are not fully addressed in the contract documents, the contractor shall bring this to the attention of the Architect prior to start of construction for clarification.

C. Should asbestos or hazardous materials outside of the scope of work be discovered during construction operations, the contractor shall immediately notify the Project Inspector and Architect and shall suspend work in the area until necessary identification, testing and abatement (if required) is completed.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Pre-construction Meeting.
2. Regular project meetings.
3. Pre-installation meetings.

1.2 GENERAL

A. The Architect shall make arrangements for meetings, prepare agenda with copies for participants, preside at meetings, record minutes, and distribute copies to the Owner, Project Inspector, Contractor, participants, and others affected by the decisions made.

B. Attendance required: Project Superintendent, Project Manager (if any), major Subcontractors (as requested), Architect, Project Inspector, and others as appropriate to the meeting topics.

1.3 PRE-CONSTRUCTION MEETING

A. Upon issuing a notice of intent to award the contract, the Architect will schedule a pre-construction meeting.

B. Agenda: Architect and Contractor shall prepare an agenda and distribute copies at least one week in advance of the Pre-Construction meeting.

C. Architect's agenda may include, but not limited to, discussion of the following items:

1. Project description and scope of work.
2. Accepted alternates.
3. Temporary facilities and use of the site.
4. Environmental procedures.
5. Legal and code requirements.
6. Designation of personnel representing the parties to the contract; lines of communication.
7. Communication and responsibilities.
8. Submittal procedures in accordance with Section 01 3300.
9. Construction schedule and critical path.
10. Schedule of values.
11. Record drawings.
12. Progress payments.
13. Change orders and time extensions (related to critical path).
14. Inspection and testing.
15. Project closeout.

1.4 PROJECT MEETINGS

A. The Architect will schedule and run meetings at regular intervals throughout the project to review the short-term project schedule and to discuss issues requiring resolution. It is the duty of the Contractor to attend, participate in, and comply with the agreements reached and direction set at these meetings.

1.5 PRE-INSTALLATION MEETINGS

A. The Contractor shall schedule and run pre-installation meetings in accordance with the product specifications.

1.6 SPECIAL MEETINGS

A. The Architect may occasionally schedule special meetings for the purpose of discussing work requiring a significant coordination effort or for resolving issues which require more attention than they can be given in the regularly scheduled meetings. The Contractor shall attend these meetings along with representatives of subcontractors, suppliers, and/or manufacturers when appropriate for the subject matter to be discussed.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Requirements for the following:
   a. Electronic Data Transfer.
   b. Substitutions: Specific procedures for submission and approval of products other than those specified or noted on the Drawings.
   c. Procedures for processing of Contractors “Requests for Interpretation” (RFI) questions.
2. Procedures to be followed in preparing and submitting the following:
   a. Subcontractor List.
   b. Progress Schedule.
   c. Schedule of Values.
   d. Shop Drawings.
   e. Product Data/Material Lists.
   f. Samples.
   g. Requests for Information (RFI).
   h. Record Drawings.
   i. Certifications including those required for material VOC content.
   j. Maintenance/Operating Manuals.
   k. Warranties and Extended Guarantees.
   l. Extra Stock.
3. Substitution Procedures: Specific requirements for submission and approval of products other than those specified or noted on the Drawings.
4. Procedures for processing of Contractors “Requests for Interpretation” (RFI) questions.
5. Electronic Data Transfer.

1.2 RELATED REQUIREMENTS

A. Section 01 6116, Volatile Organic Compound (VOC) Restrictions; “Accessory Material VOC Content Certification Form.”

B. Section 01 7700, Closeout Procedures.

C. Section 01 7836, Warranties; guarantee/warranty forms.

D. Section 01 8113, Sustainable Design Requirements, for CAL-Green general requirements and procedures.

E. Test reports: Pertinent Specification Sections (by testing lab).

F. Individual requirements for submittals also are described in other Sections of these Specifications.

1.3 DEFINITIONS

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

B. Informational Submittals: Written and graphic information and physical samples indicated in individual Specification Sections as informational submittals that do not require Architect's responsive action.

C. Portable Document Format (PDF): An open standard file format licensed by Adobe Systems used for representing documents in a device-independent and display resolution-independent fixed-layout document format.

1.4 ADMINISTRATIVE REQUIREMENTS

A. General;

1. Shop drawings, product data, and samples are in no case to be considered Contract Documents but are to be treated only as instruments of convenience and facility to further the progress of the Work.
2. Miscellaneous systems not specifically specified but installed to meet code requirements or for other reasons are subject to Architect's review prior to installation.

B. Shop drawings, product data, samples and supporting data shall be prepared by Contractor or its suppliers but shall be submitted to Architect by Contractor as the instruments of the Contractor.

C. Coordination of Submittals:

1. Before submitting a shop drawing or any related material to Architect, Contractor shall: review each such submission for conformance with the means, methods, techniques, sequences, and operations of construction, and safety precautions and programs incidental thereto, which are the sole responsibility of the Contractor; approve each such submission before submitting it; and so stamp each such submission before submitting it. By affixing the Contractor's signature to each submittal, the Contractor certifies that this coordination has been performed.
2. Architect shall assume that no shop drawing or related submittal comprises a variation unless the Contractor advises the Architect otherwise via a written instrument which is acknowledged by the Architect in writing.

D. Grouping of Submittals:

1. Unless otherwise specified, make submittals in groups containing all associated items to assure that information is available for checking each item when it is received.

2. Partial submittals may be rejected as not complying with the provisions of the Contract. The Contractor may be held liable for delays so occasioned.

E. Architect will check submittals for conformance with design concepts of project. Approval by Architect covers only such conformance. Effort will be made by Architect to discover any errors, but responsibility for accuracy and correctness of submittals shall be with the Contractor.

F. Approval of submittals will be on a general basis only and shall not relieve the Contractor from their responsibility for proper fitting and construction of the Work, nor from furnishing materials and labor required by the Contract which may not be indicated on the submittals when approved.

G. No portion of the work requiring submittals shall be commenced until the submittal for that portion of the work has been approved by Architect. All such portions of work shall be in accordance with the approved submittals. Any work performed without approved submittals will be done so at the Contractor's own risk. Work found not to be in compliance with the approved submittals shall be removed and corrected at the Contractor's own expense.

H. The Contractor shall make corrections required by Architect and shall resubmit as required by Architect the required number of corrected copies of shop drawings, product date, or new samples until approved. Contractor shall direct specific attention in writing or on resubmittals to revisions other than the corrections required by the Architect on previous submissions. Professional services required for more than two (2) re-reviews of required submittals of shop drawings, product data, or samples are subject to charge to the Contractor.

1.5 ELECTRONIC DATA TRANSFER

A. Requests for Electronic Data will be considered upon receipt of written request by the Contractor accompanied by a signed copy of the Electronic Data Request Form (included with this section). Request should clearly outline specific Drawings desired and the intent of the request.

1. Submit Electronic Data Request Form on standard form.
2. Allow 72 hours minimum for review and consideration by Architect.

B. Electronic data files are not a part of the contract documents, but rather a convenience for the Contractor in preparation of his required submittals and layout efforts. Electronic files do not alter the content or meaning of the hard copy documents which may be a part of the Contract Documents.

C. The electronic data files will remain the property of the Architect, shall not be used for any other purpose than that purpose stated in the Electronic Data Request Form, and shall not be released by the Contractor or any subcontractor to any other party without written consent from the Architect.

D. The electronic data files are distributed for reference only. Transferring such files can alter, delete or change original information. Accuracy of the data cannot be guaranteed

as correct or complete and the Contractor accepts full responsibility for inaccuracies, regardless of cause.

E. The hard copy documents, including addenda and subsequent written changes to the documents, represent the complete work of the Contract. Electronic files should be cross-referenced to the Contract Documents by the user and verified from that the information included contains the necessary Contract information. It is the Contractor's responsibility to make any changes or revisions to the electronic data files as necessary.

F. Architect may, at his complete discretion and without explanation, approve or deny requests for electronic data.

1.6 SUBSTITUTIONS

A. Architect's Approval Required:

1. Contract is based on materials, equipment and methods described in Contract Documents. Substitutions will not be reviewed and approved prior to the award of the contract.
2. Architect will consider proposals during the submittal process for substitution of materials, equipment and methods only when such proposals are accompanied by full and complete technical data and other information required by Architect to evaluate proposed substitution. Substitution shall be submitted with completed Substitution Request Form, included with this section.
3. Do not substitute materials, equipment or methods unless such substitution has been specifically approved for this work by Architect.

B. "Or Equal": Whenever, in Contract Documents, any material, process or specified patent or proprietary name and/or by name of manufacturer is indicated, such name shall be deemed to be used for purpose of facilitating description of material and/or process desired, and shall be deemed to be followed by the words "or equal" and Contractor may offer any material or process which shall be equal in every respect to that so indicated or specified; provided, however, that if material, process or article offered by Contractor is not, in opinion of Architect, equal in every respect to that specified, then Contractor shall furnish material, process or article specified or one that in opinion of Architect is equal thereof in every respect.

C. "No Substitutions": Items indicated as "No Substitutions" shall be provided as specified and no alternates will be allowed. These items are required either due to standards implemented by the Owner or to match materials recently installed by others.

D. Coordination: Approval of substitution shall not relieve Contractor from responsibility for compliance with requirements of Drawings and Project Manual, and Contractor shall be responsible at his own expense for any changes in other parts of its own work or work of others which may be caused by approved substitution.

E. DSA Approval: Substitutions of certain items may cause such items to require a Deferred Approval by DSA. Should a DSA Deferred Approval be required, the Contractor shall provide information and documents necessary to complete the Deferred Approval process without any additional costs to the Owner, including engineering, calculation and modification of substitute products.

PART 2 - SUBMITTALS

2.1 SUBCONTRACTOR LIST

A. Provide a typed list of Subcontractors within 5 days of notice of the award of contract. Include Subcontractor name, address, phone number, license number and trade.

2.2 PROGRESS SCHEDULE

A. Prepare and submit estimated progress schedule for work within 10 calendar days after issuance of Notice to Proceed. Submit up-dated schedules:

1. At mid-point of construction.
2. When time extensions of more than two weeks are necessary.

B. Relate progress Schedule to entire Project. Indicate following:

1. Dates for starting and completion of various sub-contracts.
2. Dates for submission of required submittals.

2.3 SCHEDULE OF VALUES

A. Before first Application for Payment, submit for Architect's approval a Schedule of Values of various portions of work, aggregating total Contract sum, divided so as to facilitate payment to subcontractors, prepared in such form as Architect and Contractor may agree upon, and supported by such data to substantiate its correctness as Architect may require.

1. Breakdown shall include separation of sitework from building work for main categories including electrical, plumbing, concrete, etc. Separations shall also be provided for each building of a multiple building contract. Include proper share of overhead and profit with each item in Schedule of Values.
2. This Schedule, when approved by Architect, shall be used as basis for Contractor's applications for payment. Payment will not be released until a Schedule of Values is accepted.

B. Schedule of Values shall appear similar to the following list and generally following the Table of Contents of this Project Manual as the format for listing component items. It shall be detailed at least as shown and portions shall not be more largely grouped so as to reduce its length unless appropriate to the scope of the Work. Mobilization/Start-up is limited to 2 percent on contracts greater than $1,000,000 and 4 percent on contracts less than $1,000,000. Contract closeout to be a minimum of 1 percent.

1. Mobilization/Start-up.
2. Temporary Facilities.
3. Concrete Reinforcement.
4. Plumbing – Building.
5. Electrical – Building.
6. Grading.

7. Paving.
8. Chain Link Fencing.
9. Site Concrete.
10. Electrical – Site.
11. Plumbing – Site.
12. Labor/Supervision.
13. Cleanup.
14. Contract Closeout.

2.4 SUBMITTAL SCHEDULE

A. Contractor shall prepare and submit to Architect a "Submittal Schedule" when required by the General Conditions showing scheduled dates of submittals and date required for return of submittals to Contractor.

B. Contractor shall provide in Schedule the minimum specified working days for Architect to review and check submittals provided it is not a deferred approval item. Based on the number and complexity of submittals at any one time, Architect's review period may be longer than the days specified.

C. Dates on "Submittal Schedule" shall be agreed upon by both Architect and Contractor.

2.5 PROJECT DIRECTORY

A. After execution of the Contract but prior to commencement of Work, Contractor shall submit to Architect a Project Directory listing subcontractors and vendors on the Project and giving a brief description of their scope of work, firm name, contact person, address, phone number, e-mail address, and fax number if used.

2.6 SHOP DRAWINGS

A. Submit shop drawings as a copy of the original set maintained by the Contractor. Shop drawings are to include the name of the project, the name of Contractor and are to be numbered consecutively. Provide legible and complete copies in every respect. Provide quantity as described below. Do not reproduce the Contract Drawings in lieu of Contractor or subcontractor produced shop drawings.

B. If shop drawings show variations from Contract requirements because of standard shop practice or other reason, make specific mention of such variations in letter of transmittal, as well as on Drawings, in order that (if acceptable) suitable action may be taken for proper adjustment of the Contract Documents. Unless specific changes have been noted and approved, no deviations from Contract Documents will be accepted.

2.7 PRODUCT DATA / MATERIAL LISTS

A. Manufacturer's Standard Schematic Drawings:

1. Modify Manufacturer’s drawings to delete information which is not applicable to the Project.

2. Supplement standard information to provide additional information which is applicable to the Project.

B. Manufacturer's catalog sheets, brochures, diagrams, schedules, performance charts, illustrations and other standard descriptive data.

1. Clearly mark each copy to identify pertinent materials, products or models. Mark out or remove extraneous information.
2. Show dimensions and clearances required.
3. Show performance characteristics and capacities.
4. Show wiring diagrams and controls.

2.8 SAMPLES

A. Samples: Physical examples to illustrate materials, equipment or workmanship, and to establish standards by which completed work is judged.

1. Include identification on samples including product and material and location of proposed work.

B. Samples shall be of sufficient size and quantity to clearly illustrate:

1. Functional characteristics of product or material, with integrally related parts and attachment devices.
2. After review, samples may be used in construction of project.

2.9 REQUESTS FOR INFORMATION (RFI)

A. Requests for additional information (RFI's) beyond that set-forth in the Contract Documents will be considered when the request is in writing and fully documented. Requests shall state the source and reason for the request; identify specific references within the Contract Documents pertinent to the request; and supply supporting information to assist the Architect in his/her response. Verbal responses to such requests are to be considered informational; official response will only be given in writing.

1. Submit RFI's on standard form, included with this Section, and numbered consecutively.
2. Allow a minimum of 72-hours for review by Architect. Additional time may be required for more complex issues.
3. Provide suggested solution on standard RFI form where indicated.
4. Provide detailed cost estimate for RFI's that are anticipated to exceed $500 in extra costs to the Owner.

B. Because RFI's are used for clarification or Construction Document interpretation purposes, the response will be issued back to the Contractor in the space provided on the standard RFI form. More complex issues requiring Contract Document revisions and/or which may result in a change in cost to the Contract will be handled using a Construction Change Document (CCD). RFI’s and CCD’s will not be used to address simple or minor coordination or construction issues which can normally be addressed quickly and easily by the Contractor or in conjunction with the Contractor and Architect.

RFI's deemed unnecessary or frivolous by the Architect will be returned to the Contractor for reconsideration or will be rejected. RFI's so returned shall be removed from the RFI log and noted as unnecessary.

2.10 CERTIFICATIONS

A. Where specifically indicated by pertinent Specification Sections, submit proper certification of recognized producer or association in lieu of or in addition to testing. Certification shall attest to product's compliance with requirements of Contract Documents.

B. Certifications for this project shall also include:

1. Megger Grounding Test Certificate:
   a. Submit completed Megger Grounding Test Certificate (included with this section) with Testing Agency reports attached, as specified in Division 26.
2. Certificate of Chlorination and Sterilization:
   a. Submit completed Certificate of Chlorination and Sterilization (included with this Section) with Local Jurisdiction approvals and Testing Agency reports attached, as specified in Divisions 22 and 33.
3. Certificate of Compliance for Building Materials:
   a. Submit completed Certification of Compliance for Building Materials (included with this section).

2.11 MAINTENANCE / OPERATION MANUALS

A. General: Contractor shall incorporate in Maintenance/Operation Manual(s) brochures, manufacturer's catalogs and written instructions for equipment and materials needing regular care or maintenance. These items include carpets, resilient flooring, architectural finishes, mechanical and electrical equipment and other items as required elsewhere in Contract Documents. Prepare manuals in durable plastic loose leaf binders sized to accommodate 8-1/2 x 11 sheets with following minimum information:

1. Identification on or readable through, front cover stating general nature of manual.
2. Neatly typewritten index of contents.
3. Site plan and building plans indicating location of equipment referenced (reduced scale).
4. Complete instructions regarding operation and maintenance of equipment involved.
5. Complete nomenclature of replaceable parts, their part numbers, current cost and name and address of nearest vendor of parts.
6. Copy of warranties issued, in a separate binder as specified in this Section.
7. Copy of approved shop drawings (reduced scale) with data concerning changes made during construction.

B. Extraneous Data:

1. Where contents of manuals include manufacturer's catalog pages, clearly indicate precise items included in the Project installation and delete, or otherwise clearly indicate, manufacturer's data with which the Project installation is not concerned.

C. Materials shall be organized in a logical and consistent manner, by Specification Section number, with separating tabs clearly marked.

D. When submitting electronic file via Newforma, materials shall be organized in order ascending by Specification Section number and including clear separation within one pdf file, following format prescribed in paragraphs A and B of this Article.

2.12 WARRANTIES AND GUARANTEES

A. Contractor Standard Guarantee:

1. Furnish Owner with its Standard Guarantee for work executed under this Contract, including approved extra work, to be absolutely free of defects of workmanship and materials for a period of two (2) years from the date of filing of the Notice of Completion.
2. Under the terms of its warranty, Contractor shall guarantee to repair and make good defects and repair damage to other work caused thereby which may occur during the Warranty period at no cost to the Owner.
3. Guarantees and warranties between Contractor and manufacturers and between Contractor and suppliers shall not affect the Guarantee and Warranty between Contractor and Owner.
4. Contractor’s Standard Guarantee shall be submitted on the Guarantee/Warranty form included in Section 01 7836, Warranties.

B. Subcontractor Standard Guarantee:

1. Contractor shall countersign and furnish Owner with a Subcontractor Standard Guarantee from each Subcontractor for their work executed under this Contract, and approved extra work, to be free of defects of workmanship and materials for a period equal to the Contactor Standard Guarantee.
2. Under the terms of its warranty, Subcontractor shall guarantee to repair and make good defects and repair damage to other work caused thereby which may occur during the Warranty period at no cost to the Owner.
3. Subcontractors individual Standard Guarantee shall be submitted on Guarantee/Warranty form included in Section 01 7836, Warranties.

C. Special or Extended Guarantee/Warranty:

1. In addition to the Contractor’s and Subcontractor’s Standard Guarantees, furnish Owner with special or extended warranties in excess of the Standard Warranty term of the Contract where specified in the respective Sections of the Specifications.
2. Where special or extended guarantees are related to work of a Subcontractor, the written Guarantee/Warranty form prepared by the Contractor shall be co-signed by the respective responsible subcontractor and a separate and addition

Guarantee/Warranty form shall be prepared by the Subcontractor and co-signed by the Contractor.

3. Each Special or Extended Guarantee/Warranty shall be submitted on the forms included in Section 01 7836, Warranties.

D. Provide a binder with the executed Guarantee/Warranty forms placed in the order in which they occur in the Project Manual. Include an Index listing each Specification Section, specific items covered and length of warranty for each item.

E. When submitting electronic file via Newforma, materials shall be organized in order ascending by Specification Section number and including clear separation within one pdf file.

2.13 RECORD DRAWINGS AND SPECIFICATIONS

A. The Contractor shall prepare and maintain on a current basis an accurate and complete set of Record Drawings and Annotated Specifications showing clearly the following:

1. Changes, revisions, and substitutions during construction, including, without limitation, field changes.
2. Addenda, Construction Change Documents and Clarifications issued by the Architect.
3. The final location of mechanical equipment, ducts, outlets, structural members, walls, partitions, and other significant features. Note both vertical and horizontal dimensions of concealed installations.
4. Installed locations of underground work and utilities, including storm drain piping, plumbing, electrical and stubs for future connections. Note both vertical and horizontal locations of underground facilities from permanent monuments such as building corners or other permanent structures, and finish grades.
5. In the event of a specification that allows Contractor to elect one of several brands, makes, or types of material or equipment, the annotations shall show which of the allowable items the Contractor has furnished.

B. The Contractor shall update the Record Drawings and Specifications as often as necessary to keep them current but no less often than weekly, and up-dated monthly, prior to and pursuant to approval of the progress payment application.

1. Record drawings and specifications are to remain on site and available for inspection by the District Representative, Project Inspector and the Architect.
2. Changes shall be made in an accurate and legible manner by a qualified draftsperson acceptable to Architect.
3. Symbols and designations used in preparing Record Drawings shall match those used in the Contract Drawings.

C. At project completion, the Record Drawings and Annotated Specifications shall be submitted by the Contractor for Owner’s Project Inspector and Architect review and comment.

1. These will be returned to the Contractor for revisions. Once corrections have been completed the Inspector shall sign and date the record set coversheet noting it as acceptance of the completed Record Drawings and Specifications.
2. Prior to Application for Final Payment, the original Record Drawings and Specifications are to be resubmitted to the Architect along with a scanned electronic file set in PDF format with each drawing bookmarked, matching the Drawing titles.
3. When submitting electronic file via Newforma, materials shall be organized in order ascending by Sheet Number as shown on the Drawing Sheet Index within one pdf file.

D. Conditions of Payments:

1. At the end of each month the Project Inspector will review the record drawings and specifications. If the records are incomplete, or incorrect, an appropriate amount of dollars, equivalent to the cost of uncovering the work to determine the locations of piping and the like, may be deducted from the next progress payment. The deducted sum will be withheld until the record drawings are updated and/or corrected.
2. Written confirmation from the District Representative that the record drawings and specifications have been properly updated weekly shall be submitted with each pay application request, and the existence of such properly updated records shall be a condition precedent to payment.
3. On completion of the Contractor's portion of the Work and prior to Application for Final Payment, the Contractor shall provide one complete set of approved Record Drawings and Specifications to the Owner, in format as specified, certifying them to be a complete and accurate reflection of the actual construction conditions of the Work. Delays in the submission of complete record documents may subject the Contractor to liquidated damages.

2.14 EXTRA STOCK

A. Provide extra stock and materials, as described in the individual Specification Sections, to the Owner at time of final acceptance.

B. Materials shall be inventoried in writing, neatly packaged, with labels clearly identifying contents and quantities.

C. Contractor shall obtain written acceptance of delivery from Owner.

PART 3 - EXECUTION

3.1 GENERAL SUBMISSION REQUIREMENTS

A. This project is using Newforma Info Exchange for transmission and processing of project documentation. The Contractor is responsible for making contract submissions through this web accessed system. No supplementary software is required for use. User names and passwords will be granted at the beginning of the project.

B. Contractor is responsible for the scheduling of submittals in order to avoid detrimental impact to the construction schedule and to support the timely sequence of the Work.

1. Allow a minimum of 15-working days for submittal review by the Architect. Complex submittals or submittals which are not provided as complete packages may take longer than 15-working days for review.
2. Contractor shall allow time for potential rejection and re-submittal of submittals which are being offered as substitution to the specified products.

C. Contractor shall review submittals for completeness, coordination and conflicts between subcontractors and other Work in the Contract Documents.

1. Subcontractors shall make submittals to Contractor.
2. Submittals made by subcontractors which are not thoroughly reviewed by the Contractor will be returned. Submittals which vary significantly from the Contract Documents and are not so identified prior to submission, will be returned to the Contractor without review.

D. Mechanical and electrical submittals, excluding underground work, shall each be packaged together so that products/components for these two major disciplines are transmitted to the Architect as a single submittal package for review.

E. Submittals shall be accompanied by Submittal Transmittal, included at the end of this Section, addressed to the Architect. Each submittal transmittal shall:

1. Be consecutively numbered.
2. Re-submittals to have same submittal number as the original submittal with an alphanumeric suffix.
3. Indicate Specification Section number. Separate submittals are required for each Specification Section involved.
4. Include proper number of copies, as required in “Number of Copies Required” below.
5. Contain index of items submitted, properly identified with Drawing numbers, etc.
6. Substitutions shall be accompanied by a completed Substitution Request Form (included with the Project Manual).

F. Electronic Submittals.

1. Product data submitted electronically shall be submitted in .pdf format. Submittals shall be organized in a logical format grouping items and subsections together. The first page of each item or subsection must be bookmarked and properly labeled. If multiple fixtures or products are included in a single submittal, each item and corresponding information shall be separately grouped and bookmarked as noted above. This formatting and bookmarking shall also apply to other data submitted electronically like warranties/guarantees, maintenance & operations manuals and certifications.
2. Shop drawings submitted electronically shall be submitted in .pdf format. Shop drawings shall be organized in a logical format grouping sections together (plans, elevations, details, schedules, etc.). Each sheet of the shop drawings shall be

bookmarked and properly labeled. Plan references and detail callouts shall be hyperlinked to properly jump to the referenced page or detail.

G. Number of Copies Required - Contractor shall submit following number of copies:

1. Subcontractor List: 1-electronic copy in PDF.
2. Progress Schedule: 1-electronic copy in PDF.
3. Schedule of Values: 1-electronic copy in PDF.
4. Shop Drawings: 1-electronic copy in PDF format.
5. Product Data/Material Lists: 1-electronic copy in PDF format.
6. Samples: As specifically indicated in the respective Specification Section or, if not indicated, two more than the Contractor requires to be returned.
7. Samples for Color/Pattern Selection: One set of manufacturer's complete range for initial selection; and 4 samples as requested of selected color/pattern for inclusion in final color boards.
    a. As color selection is dependent on multiple submittals, it is critical that items requiring color decisions be submitted as early as possible and at the same time.
    b. Selections will not be finalized until color dependent/selection submittals are received.
8. Substitution Request: 1-electronic copy in PDF.
9. Request for Information: 1-electronic copy in PDF.
10. Electronic Transfer: 1-electronic copy in PDF.
11. Certifications: 1-electronic copy in PDF.
12. Maintenance/Operations Manuals: After approved via Newforma submittal, 1-hard copy plus 1-electronic copy in format acceptable to the Owner.
13. Guarantees/Warranties: After approved via Newforma submittal, 1-hard copy, plus 1-electronic copy in format acceptable to the Owner. Refer to Section 01 7836, Warranties, for forms and additional requirements for assembly of guarantees/warranties.
14. Record Drawings: After approved via Newforma submittal, 1-hard copy plus 1-electronic copy in format acceptable to the Owner.

H. Submittals shall include the following, as applicable:

1. Date and revision dates.
2. Project title and number.
3. The names of Architect, Contractor, Subcontractor and supplier or manufacturer.
4. Identification of product or material.
5. Relation to adjacent structure or material.
6. Field dimensions, clearly identified as such.
7. Specification section number.
8. A blank space for Architect's stamp.

9. Contractor's stamp on each, initialed or signed, certifying that submittal was reviewed, field measurements have been verified and submittal is in compliance with the applicable Specification Section and the overall Contract Documents.

I. Incomplete, inaccurate or non-complying submittals requiring revisions, re-submittal and additional review time, shall not be considered as a basis for Contract time extension.

3.2 PROCEDURES FOR ACTION SUBMITTALS

A. Action Submittals are identified in the respective Specification Section and shall be submitted in accordance with the specified web based access system.

B. Number of Copies: As specified under Article “General Submission Requirements.”

C. Architect's Review:

1. General:
   a. Except for finish, color, and other aesthetic matters left to Architect's decision by Contract Documents, Architect's review is only for Contractor's convenience in following work and does not relieve Contractor from responsibility for deviations from requirements of Contract Documents.
   b. Do not construe Architect's review as a complete check or relief from responsibility for errors or omissions of any sort in shop drawings or schedules or from necessity of furnishing work required by Contract Documents that may not have been shown on shop drawings.
   c. Architect's review of a separate item does not indicate review of complete assembly in which it functions.
   d. Review comments of the Architect (or its consultants) will be shown when it is returned to the Contractor. The Contractor shall make and distribute such copies as are required for its purposes.

D. Processing:

1. Architect will review Action Submittals in accordance with agreed upon "Submittal Schedule" and will return them to Contractor with Architect's stamp.
2. Notations by Architect which increase Contract cost or time of completion shall be brought to Architect's attention before proceeding with work. Failure to do so will result in the increased costs being borne by the Contractor.
3. Each submittal will be stamped indicating appropriate action to be taken by the Contractor.
4. If for any reason the Contractor cannot comply with the notations, Contractor shall re-submit submittal. In the transmittal letter accompanying the re-submittal, clearly describe the reason(s) for not being able to comply with the notations.

E. Action and Distribution:

1. Architect will stamp submittals and Contractor shall comply with action noted on the Architect’s “Submittal Review” stamp.

2. Unless otherwise directed for mutually agreed or required by the Architect's stamp, Architect will return submittals to the Contractor via the specified web access system.
3. If corrections are required, the Contractor is responsible for making the necessary corrections and re-submitting the shop drawings in a timely fashion as to not affect the project schedule.
4. The Contractor shall secure final acceptance prior to commencing work involved.

F. Consultants' Review:

1. Submittals requiring review by Architect's or Owner's consultants shall be uploaded to the specified web access system for distribution by the Architect.
2. Processing shall be in accordance with consultants stamp.
   a. If action required by consultants stamp is not clear, Contractor shall immediately notify the Architect for a clarification.
   b. If returned submittal also includes the Architect's stamp, processing shall be in accordance with the Architect's stamp.

G. Revisions:

1. If revisions are required, the Contractor is responsible for making the necessary changes pertinent to by comments noted on the submittal and re-submitting the shop drawings in a timely fashion as to not affect the project schedule.
2. If the Contractor considers any required revision to be a change, they shall so notify the Architect.
3. Show each revision by number, date, and subject in a revision block on the submittal.
4. If for any reason Contractor cannot comply with the notations, Contractor shall resubmit submittal.

H. Revisions after Review: When a submittal has been reviewed by the Architect, resubmittal for substitution of materials or equipment will not be considered unless accompanied by an acceptable explanation as to why the substitution is necessary.

3.3 PROCEDURES FOR INFORMATIONAL SUBMITTALS

A. Informational Submittals are identified in the respective Specification Section and shall be submitted in accordance with the specified web based access system.

B. Number of Copies: As specified under Article "General Submission Requirements."

C. 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.

D. Test and Inspection Reports: Comply with requirements specified in Section 01 4523, Testing and Inspection Services.

3.4 PROCEDURES FOR CLOSEOUT AND MAINTENANCE MATERIAL SUBMITTALS

A. Closeout and maintenance material submittals are identified in the respective Specification Section and shall be submitted as specified or, if not specified, in accordance instructions provided by the Architect.

B. Comply with the additional requirements specified in Section 01 7700, Closeout Procedures.

3.5 FORMS

A. The following submittal forms are included as part of this Section.

1. Submittal Transmittal.
2. Substitution Request.
3. Request for Information.
4. Electronic Data Request.
5. Megger Grounding Test Certificate.
6. Certification of Chlorination and Sterilization.
7. Certification of Compliance for Building Materials.

END OF SECTION

District Warehouse Freezer Generator
Lodi Unified School District

SUBMITTAL NO.: ____

Architect's Project # 3431008

DATE: ____

DSA File/Appl. # XX-XX/XX-XXXXXX

Re-Submittal of Original No.: ____

1. SUBMITTAL TRANSMITTAL

Attention: Jennifer Huang

HMC Architects

Contractor: Company

Contact: Name

Sub Contractor:

Contact: ____

Please submit only one trade per submittal! **Description of submitted materials:**

Quantity submitted	Specification Section		Description of contents (e.g. product data, shop drawings, samples)
	Section #	Section Title	

Contractor Statement: (read and acknowledge)
This submittal has been reviewed and approved with respect to the means, methods, techniques, and procedures of construction, safety precautions, and program incidentals thereto. This submittal complies with the contract documents and comprises no variations thereto, unless accompanied by a substitution request.

By: ____ **Date**: ____
Name

2. RE-TRANSMITTAL TO CONTRACTOR:

Distribution: Contractor, Owner, Project Inspector, RGA, Other

☐ NO EXCEPTIONS TAKEN ☐ REJECTED ☐ FURNISH AS CORRECTED
☐ SUBMIT SPECIFIED ITEM ☐ REVISE AND RESUBMIT ☐ NO ACTION REQUIRED

Corrections or comments made on the shop drawings during this review do not relieve the Contractor from compliance with requirements of the Drawings and Specifications. This general check is only for the review of conformance with the design concept of the project and general compliance with the information given in the Contract Documents. The Contractor is responsible for confirming and correlating all quantities and dimensions, selecting fabrication processes and techniques of construction, coordinating his work with that of all the other trades, and performing his work in a safe and satisfactory manner.

HMC ARCHITECTS By: ____ Date: ____

Additional Comments:

See Specification Section 01 3300 for use of this form

District Warehouse Freezer Generator
Lodi Unified School District

SUBSTITUTION REQUEST NO.: ☐

Architect's Project # 3431008
DSA File/Appl. # XX-XX/XX-XXXXXX

Date: _____

1. SUBSTITUTION REQUEST

Attention: Jennifer Huang

HMC Architects

Contractor: Company

Contact: Name

Please submit only one product per request!

Include with a specified product Submittal

Sub Contractor:

Contact: _____

2. PROPOSED SUBSTITUTIONS: The undersigned requests consideration of the following substitution:

Specified Item: _____ **Page No.:** _____ **Paragraph No.:** _____

Proposed Item: _____

3. REASON FOR REQUEST:

4. REQUIREMENTS FOR SUBSTITUTIONS:

Attached data includes product description, specifications, drawings, photographs, performance and test data adequate for evaluation of request; applicable portions of data are clearly identified. Attached data also includes a description of changes to Contract Documents, which proposed substitution will require for its proper installation.

The undersigned certifies that the following paragraphs, unless modified by attachments, are correct:

1. The proposed substitution does not affect dimensions shown on drawings and does not require design changes in the Contract Documents.
2. The undersigned will pay for changes to the building design, including engineering design, detailing and construction costs caused by the requested substitution.
3. The proposed substitution will have no adverse effect on the work, the schedule or specified warranty requirements.
4. Maintenance and service parts will be readily available for the proposed substitution.

The undersigned further states that the function, appearance and quality of the proposed substitution are equivalent or superior to the specified item.

_____ _____

Signature - Contractor/Subcontractor Date

5. TRANSMITTAL TO CONTRACTOR:

Distribution: Contractor, Owner, Project Inspector, RGA, Other

☐ **ACCEPTED** ☐ **ACCEPTED AS NOTED** ☐ **REJECTED**

HMC ARCHITECTS By: _____ Date: _____

Comments:

District Warehouse Freezer Generator
Lodi Unified School District

RFI NO.: ☐

Architect's Project # 3431008
DSA File/Appl. # XX-XX/XX-XXXXXX

Date: _____

1. REQUEST FOR INFORMATION

Attention: Jennifer Huang

From: Contractor: Company
Contact: Name
Sub Contractor: _____
Contact: _____

HMC Architects

Identify related specific references within the Contract Documents and supporting information:

Dwg./Document No.: _____

Building/Site Location: _____

2. Existing Condition (source / reason for the request):

3. Recommended Contractor Action(s) for resolution:

4. Project Inspector Acknowledgment:

Date Reviewed: _____

5. Owner / A/E Resolution(s):

Date of Response: _____ By: _____

Attachments: _____

Extra Work Involved in the Above Described Change? *Yes* ☐ *No* ☐

Distribution: Contractor, Owner, Project Inspector, HMC, Other
See Specification Section 01300 for use of this form

HMC, Other

District Warehouse Freezer Generator
Lodi Unified School District

E-DATA REQUEST NO.: ☐

Architect's Project # 3431008
DSA File/Appl. # XX-XX/XX-XXXXXX

Date: _____

1. ELECTRONIC DATA REQUEST

Attention: Jennifer Huang

From: Contractor: Company
Contact: Name

HMC Architects

Sub Contractor:
Contact: _____

2. DATA REQUESTED - Provide list of specific drawings requested (include sheet numbers):

3. REASON FOR REQUEST - Provide clear explanation of why information is desired and for what purpose it will be utilized:

4. ACKNOWLEDGEMENT OF RESPONSIBILITY:

The electronic data files requested are distributed for reference only. Transferring such files can alter, delete or change original information. Accuracy of the data cannot be guaranteed as correct or complete and the Contractor accepts full responsibility for any and all inaccuracies, regardless of cause.

The hard copy documents, including addenda and subsequent written changes to the documents, represent the complete work of the contract and all electronic files should be cross-referenced and verified from that information as electronic files may not contain all contract information. It is the Contractor's responsibility to make any changes or revisions necessary.

This electronic data is furnished without guarantee of compatibility with your hardware or software. It is the Contractor's responsibility to notify the Architect in the event a compatibility problem or disk defect is encountered and a replacement disk is necessary.

This electronic data, in its present form, remains the property of HMC Architects and shall not be used for any other purpose than to provide background information for the project noted above. It is not to be released to any other party without the written consent of HMC Architects.

Accepted by: _____
Signature - Contractor/Subcontractor

Representing: _____
Contractor/Subcontractor Company Name

MEGGER GROUNDING TEST CERTIFICATE

This certifies that a Megger Grounding Test for the **District Warehouse Freezer Generator** for the **Lodi Unified School District**, of **San Joaquin** County, California was conducted on the _____ day of _____ , **2024**, per CCR Title 24, Sections 200 H and J. The undersigned verifies that the resistance to ground was 25 ohms or less, as required, and is found to be acceptable.

Project Name: _____

DSA File No.: _____ DSA Application No.: _____

Address: _____

_____

_____

General Contractor's Signature: _____

Electrical Contractor's Signature: _____

Testing Agency's Signature: _____

District Inspector's Signature: _____

SEPARATE CERTIFICATE IS REQUIRED FOR EACH SITE

CERTIFICATION OF COMPLIANCE FOR BUILDING MATERIALS

This is to certify, in accordance with the Environmental Protection Agency requirements, that the materials and equipment used in the construction of the **District Warehouse Freezer Generator** for the **Lodi Unified School District** of **San Joaquin** County, California, are asbestos free and are, therefore, not subject to monitoring for asbestos contamination.

Project Name: _____

Address: _____

Contractor: _____

Address: _____

Signature: _____

Title: _____

Date: _____

SEPARATE CERTIFICATE IS REQUIRED FOR EACH SITE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Alteration requirements for modernizations, remodels, and additions.

1.2 RELATED REQUIREMENTS

A. Section 01 1100, Summary of Work.

B. Section 01 7329, Cutting and Patching.

1.3 REFERENCES AND STANDARDS

A. California Building Code (CBC), edition as noted on the drawings, as adopted by the California Division of the State Architect (DSA).

B. California Green Building Standards Code (CALGreen), edition as noted on the Drawings, as adopted by the California Division of the State Architect (DSA).

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Contractor to coordinate and conduct a meeting with the demolition contractor to verify which systems, if any, are to be protected and maintained. Such systems shall be clearly identified and marked to avoid unnecessary damage or removal.
2. Coordinate work of alterations and renovations to expedite completion sequentially and to accommodate Owner occupancy.

1.5 QUALITY ASSURANCE

A. Manufacturer and Installer Qualifications: As specified in the product specifications.

B. Use only new materials and products, unless existing materials or products are specifically shown otherwise on the Drawings to be salvaged and re-used.

C. Single Source Responsibility: Use materials and products of one manufacturer whenever possible.

D. All materials, components, assemblies, workmanship and installation are to be observed by the Owner's Inspector of Record. Work not so inspected is subject to uncovering and replacement.

1.6 FIELD CONDITIONS

A. Make and be responsible for all field dimensions necessary for proper fitting and completion of work. Report discrepancies to Architect before proceeding.

PART 2 - PRODUCTS

2.1 PRODUCTS FOR PATCHING AND EXTENDING WORK

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 inspection and testing products where necessary, referring to existing work as a standard.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Inspect conditions of uncovered work affecting installation of products or performance work.

B. Verify that specified items may be installed in accordance with the approved design.

C. Beginning of restoration work means acceptance of existing conditions.

D. In event of discrepancy, immediately notify Architect. Do not proceed in discrepant areas until discrepancies have been fully resolved.

3.2 PREPARATION

A. Close openings in exterior surfaces to protect existing work and salvage items for weather and extremes of temperature and humidity. Insulate ductwork and piping to prevent condensation in exposed areas.

B. Cut, move or remove items as necessary for access to alterations and renovation work.

C. Remove debris and abandoned items from area and from concealed spaces.

D. Remove unsuitable material not marked for salvage, such as rotted wood, corroded metals, and deteriorated masonry and concrete.

E. Prepare surface, and remove surface finishes to provide for proper installation of new work and finishes including blocking, framing, insulation, etc.

F. Replace materials as specified for finished work.

3.3 INSTALLATION

A. Complete Project in all respects including operational mechanical and electrical work.

B. Remove, cut and patch work in a manner to minimize damage and to provide a means of restoring products and finishes to original condition, and installation of concealed work, as specified in Section 01 7329, Cutting and Patching,

C. Refinish visible existing surfaces to remain in renovated rooms and spaces, to specified condition for each material, with a neat transition to adjacent finishes.

D. Install products as specified in individual specifications Sections.

E. Where materials or equipment are removed, but no new finish is scheduled, patch and repair any damage to match existing wall surface.

3.4 TRANSITIONS

A. Where new work abuts or aligns with existing, perform a smooth and even transition. Patched work is to match existing adjacent work in texture and appearance.

B. When finished surfaces are cut so that a smooth transition with new work is not possible, terminate existing surface along a straight line at a natural point of division and make recommendation to Architect.

3.5 ADJUSTMENTS

A. Where removal of partitions or walls results in adjacent spaces becoming one, rework floors, walls and ceilings to a smooth plane without breaks, steps or bulkheads.

B. Where a change of plane of 1/8" or more occurs, submit recommendation for providing a smooth transition for Architect review.

C. Trim existing doors as necessary to clear new floor finish. Refinish trim as required.

D. Fit work at penetrations of surfaces as specified in Section 01 7329.

3.6 FINISHES

A. Finish surfaces as specified in individual Product Sections.

B. Finish patches to produce uniform finish and texture over entire area. When finish cannot be matched, refinish entire surface to nearest intersections.

3.7 REPAIR OF DAMAGED SURFACES

A. Patch or replace portions of existing surfaces which are damaged, lifted, discolored, or showing other imperfections.

B. Repair substrate prior to patching finish.

C. In the event of damage, make all repairs and replacements necessary to the approval of the Architect at no additional cost to the Owner.

3.8 CLEANING

A. Upon completion of installation, remove manufacturer's temporary labels and marks of identification. Thoroughly clean surfaces and remove foreign material. Leave entire work in neat, orderly, clean and acceptable condition.

3.9 PROTECTION

A. Protect work and materials of this Section prior to and during installation, and protect the installed work and materials of other trades.

B. Exposed finishes shall be free from scratches, dents, permanent discolorations and other defects in workmanship or material.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Special environmental, sustainable, and “green” building practices related to indoor air quality, resource efficiency supplementing the Pollutant Control requirements specified under Section 01 8113.10, Sustainable Design Requirements, and to ensure healthy indoor air quality in final Project.

B. Contractor is required to comply with sustainable building practices during construction and when considering materials for substitutions. Refer to Article “Design Requirements.”

1.2 RELATED REQUIREMENTS

A. Section 01 6116, Volatile Organic Compound (VOC) Restrictions.

B. Section 01 7419, Construction Waste Management and Disposal.

C. Section 01 8113, Sustainable Design Requirements.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Submittal Procedures:

1. Informational Submittals shall be submitted in accordance with Section 01 3300, Submittal Procedures.
2. Sustainable Design Submittals shall comply with the additional requirement of Section 01 8113, Sustainable Design Requirements.
3. Closeout Submittals shall be submitted in accordance with Section 01 7700, Closeout Procedures.

1.4 DESIGN REQUIREMENTS

A. Owner has established general environmental goals for design and for construction of the Project.

1. In addition to the Contractor, the Contractor’s construction team, including subcontractors, suppliers, and manufacturers, are encouraged to participate where possible to realize the Owner’s environmental goals.
2. Intent is for environmental goals to be achieved in a manner which ultimately provides a safe and healthy environment for building occupants with minimal impact on the local, regional and global environment.

B. Environmental Goals:

1. Refer to specific Specifications Sections for more detailed construction requirements related to specific materials and systems.

1.5 INFORMATIONAL SUBMITTALS

A. Certificates:

1. Prior to Final Completion, submit a certificate signed by corporate office holder of Contractor, subcontractor, supplier, vendor, installer or manufacturer primarily responsible for the manufacturing of the product, indicating materials provided are essentially the same, and contain essentially the same components as products and materials tested.
2. Comply with requirements specified in Specification Section 01 7700, Closeout Procedures.

1.6 CLOSEOUT SUBMITTALS

A. Submit data relating to Environmental Issues.

1. Submit environmental product certifications, in two forms:
   a. Two CD-ROMs organized by CSI Division Format.
   b. Three three-ring binders organized by CSI Division Format with Table of Contents and with dividers for each Division.

1.7 QUALITY ASSURANCE

A. Environmental Project Management and Coordination: Contractor to identify one person on Contractor's staff to be responsible for environmental issues compliance and coordination.

1. Experience: Environmental project manager shall have experience relating to sustainable building construction.
2. Responsibilities: Carefully review the Contract Documents for environmental issues, coordinate work of trades, subcontractors, and suppliers; instruct workers relating to environmental issues; and oversee Project Environmental Goals.
3. Meetings: Discuss Environmental Goals at following meetings.
   a. Pre-construction meeting.
   b. Pre-installation meetings.
   c. Regularly scheduled job-site meetings.
   d. Special sustainability issues meetings.

B. Environmental Issues Criteria: Comply with requirements listed in the Specification Sections.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Deliver materials in recyclable or in reusable packaging such as cardboard, wood, paper, or reusable blankets, which will be reclaimed by supplier or manufacturer for recycling.

1. Minimize packaging materials to maximum extent possible while still ensuring protection of materials during delivery, storage, and handling.

2. Unacceptable Packaging Materials: Polyurethane, polyisocyanate, polystyrene, polyethylene, and similar plastic materials such as “foam” plastics and “shrink-fit” plastics.
3. Reusable Blankets: Deliver and store materials in reusable blankets and mats reclaimed by the manufacturers or suppliers for reuse where the reclamation program exists or where a program can be developed for such reuse.
4. Pallets: Where pallets are used, suppliers shall be responsible to ensure pallets are removed from site for reuse or for recycling.
5. Corrugated Cardboard and Paper: Where paper products are used, recycle as part of the construction waste management recycling program, or return to the material’s manufacturer for use by the manufacturer or supplier.
6. Sealants, Paint, Primers, Adhesives, and Coating Containers: Return to the supplier or manufacturer for reuse where such program is available.

B. Comply with the additional requirements specified in Section 01 7419, Construction Waste Management and Disposal.

1.9 FIELD CONDITIONS

A. No smoking will be permitted in indoor Project site locations, in accordance with California Labor Code (Section 400-6413.5).

B. Environmental Product Certification:

1. Include certification that indicates cleaning materials comply with requirements of these Specifications.

C. Construction Ventilation and Preconditioning:

1. Temporary Construction Ventilation: Maintain sufficient temporary ventilation of areas where materials are being used that emit VOCs. Maintain ventilation continuously during installation, and until emissions dissipate following installation. If continuous ventilation is not possible utilizing the building’s HVAC system(s) then ventilation shall be supplied using open windows and temporary fans, sufficient to provide no less than three air changes per hour.
   a. Period after installation shall be sufficient to dissipate odors and elevated concentrations of VOCs. Where no specific period is stated in these Specifications, a time period of 72 hours shall be used.
   b. Ventilate areas directly to outside; ventilation to other enclosed areas is not acceptable.
2. During dust producing activities, including drywall installation and finishing, turn ventilation system off, and openings in supply and return HVAC system shall be protected from dust infiltration. Provide temporary ventilation as required.
3. Preconditioning: Prior to installation, allow products which have odors and significant VOC emissions to off-gas in dry, well-ventilated space for 14 calendar days to allow for reasonable dissipation of odors and emissions prior to delivery to Project site and installation.
   a. Condition products without containers and packaging to maximize off-gassing of VOCs

b. Condition products in ventilated warehouse or other building. Comply with substitution requirements for consideration of other locations.

D. Protection:

1. Moisture Stains: Materials with evidence of moisture damage, including stains, are not acceptable, including both stored and installed materials; immediately remove from site and properly dispose.
   a. Take special care to prevent an accumulation of moisture on installed materials and within packaging during delivery, storage, and handling to prevent development of molds and mildew on packaging and on products
   b. Immediately remove from site and properly dispose of materials showing signs of mold and signs of mildew, including materials with moisture stains.
   c. Replace moldy materials with new, undamaged materials.

PART 2 - PRODUCTS

2.1 SUBSTITUTIONS

A. Requests for substitutions shall comply with requirements specified in Specification Section 01 3300, Submittals, and with the following additional information required where environmental issues are specified:

1. Indicate how each proposed substitution complies with requirements for VOCs.
2. Owner, in consultation with Architect reserve the right to reject proposed substitutions where data for VOCs is not provided or where emissions of individual VOCs are higher than for the specified materials.
3. Comply with the specified recycled content and other environmental requirements.

PART 3 - EXECUTION

3.1 CLEANING

A. Clean interior and exterior surfaces exposed to view; remove temporary labels, stains, and foreign substances; polish transparent and glossy surfaces using cleaning and maintenance products that conform to standards as described in Part 1 of this Section.

B. Clean equipment and fixtures to sanitary condition using cleaning and maintenance products that conform to standards as described in Part 1 of this Section.

C. Products used for cleaning shall comply with Proposition 65 and the additional restrictions for volatile organic compounds specified in Section 01 6116.

D. Remove and properly dispose of recyclable materials using construction waste management program described in Section 01 7419, Construction Waste Management and Disposal.

3.2 PROTECTION

A. Protect interior materials from water intrusion or penetration where interior products are not intended for wet applications and are exposed to moisture.

B. Protect installed products using methods that do not support growth of mold and mildew.

1. Immediately remove from site materials with mold or mildew.

END OF SECTION

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PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Standard reference abbreviations use in the Project Manual.
2. Requirements for standard references use in the various Specification Sections.

1.2 STANDARD SPECIFICATIONS

A. The contract Documents contain references to various standard specifications, codes, practices, and requirements for materials, work quality, installation, inspections and tests published and issued by the organizations, societies, and associations. Such references are hereby made part of the Contract Documents to the extent required.

B. When standard specifications are included by abbreviation and number only, it is assumed that the Contractor is familiar with and has ready access to the specified standards.

C. When the effective date of a reference standard is not given, it shall be understood that the current edition or latest revision thereof and any amendments or supplements thereto in effect on the date of original issue of these Contract Documents, as indicated on the cover, shall govern the Work.

D. Reference standards are not furnished with the contract Documents, because the Contractor, subcontractors, manufacturers, suppliers, and the trades involved are assumed to be familiar with their requirements

E. Contractor shall obtain its own copies of required specified referenced publications.

F. The specification or standard referred to shall have full force and effect as though printed in these specifications.

G. In addition to those standards specifically referenced in the Specifications, comply with the accepted industry standards and trade association recommendations for the respective portions of Work.

H. In the case of difference between referenced standards and the Contract Documents, the most stringent requirements prevail.

1.3 STANDARD SPECIFICATION ABBREVIATIONS

A. In addition to abbreviations indicated on the Drawings, references in the Project Manual to trade associations, technical societies, recognized authorities, and other institutions may include the following organizations, which are sometimes referred to by only the corresponding abbreviations. Not all abbreviations are listed, and not all listed abbreviations are used.

B. Initialisms and Acronyms:

ABBREVIATIONS AND ACRONYMS
SECTION 01 4213
3431008

1.	AA	Aluminum Association
2.	AAMA	American Architectural Manufacturers Association
3.	AASHTO	American Association of State Highway and Transportation Officials
4.	AATCC	American Association of Textile Chemists and Colorists
5.	ABAA	Air Barrier Association of America
6.	ACI	American Concrete Institute
7.	ACS	Access Compliance Section (DSA)
8.	ACSE	American Society of Civil Engineers
9.	ADA	American with Disabilities Act
10.	AGA	American Galvanizers Association
11.	AIA	American Insurance Association (successor to NBFU)
12.	AISC	American Institute of Steel Construction
13.	AISI	American Iron and Steel Institute
14.	AITC	American Institute of Timber Construction
15.	ALSC	American Lumber Standards Committee
16.	ANSI	American National Standards Institute
17.	APA	The Engineered Wood Association
18.	ASHRAE	American Society of Heating, Refrigerating, and Air Conditioning
19.	ASTM	ASTM International
20.	AWI	Architectural Woodwork Institute
21.	AWPA	American Wood Protection Association
22.	AWS	American Welding Society
23.	BHMA	Builders Hardware Manufactures Association
24.	CALGreen	California Green Building Standards Code
25.	CBC	California Building Code
26.	CEC	California Electrical Code
27.	CFC	California Fire Code
28.	CLFMI	Chain Link Fence Manufacturing Institute
29.	CMC	California Mechanical Code
30.	CPC	California Plumbing Code
31.	CRA	California Redwood Association
32.	CRI	Carpet and Rug Institute
33.	CRSI	Concrete Reinforcing Steel Institute
34.	CS	Commercial Standard of National Bureau of Standards (US Dept of Commerce)
35.	DHI	Door and Hardware Institute
36.	DSA	Division of the State Architect
37.	DTSC	Department of Toxic Substances Control
38.	EPA	Environmental Protection Agency
39.	FDA	U.S. Food and Drug Administration

40.	FLS	Fire & Life Safety (DSA)
41.	FM	Factory Mutual
42.	FS	Federal Specification of General Services Administration
43.	FSC	Forest Stewardship Council
44.	GA	Gypsum Association
45.	HMMA	Hollow Metal Manufacturers Association
46.	ICC-ES	International Code Council Evaluation Service
47.	ISO	International Organization for Standards
48.	MIA	Masonry Institute of America
49.	MMPA	Moulding and Millwork Producers Association
50.	MPI	Master Painters Institute
51.	NAAMM	National Association of Architectural Metal Manufactures
52.	NAAWS	North American Architectural Woodwork Standards
53.	NBFU	National Board of Fire Underwriters (See AIA)
54.	NBHA	National Builders Hardware Association
55.	NEC	National Electric Code of NFPA
56.	NEMA	National Electrical Manufacturers Association
57.	NFPA	National Fire Protection Association
58.	NFSHSA	National Federation of State High School Associations
59.	NRCA	National Roofing Contractors Association
60.	OSHA	Occupational Safety and Health Administration
61.	PCA	Portland Cement Association
62.	PCI	Precast Concrete Institute
63.	PI	Project Inspector
64.	PLIB	Pacific Lumber Inspection Bureau
65.	RIS	Redwood Inspection Service (Grading Rules)
66.	SCAQMD	South Coast Air Quality Management District
67.	SEI	Structural Engineering Institute
68.	SDI	Steel Door Institute
69.	SJI	Steel Joist Institute
70.	SMACNA	Sheet Metal and Air Conditioning Contractors National Association
71.	SMF	Office of the State Fire Marshal
72.	SPR	Simplified Practice Recommendation (US Dept. of Commerce)
73.	SSMA	Steel Stud Manufacturers Association
74.	SSPC	The society for Protective Coatings
75.	SWPPP	Storm Water Pollution Prevention Plan
76.	TCNA	Tile Council of North America
77.	Title 19	California Code of Regulations - Public Safety
78.	Title 24	California Code of Regulations - Building Codes
79.	TMS	The Masonry Institute

80.	UL	Underwriter's Laboratories, Inc.
81.	WCLIB	West Coast Lumber Inspection Bureau (successor to WCLA)
82.	WDMA	Window and Door Manufacturers Association
83.	WI	Woodwork Institute
84.	WRCLA	Western Red Cedar Lumber Association
85.	WWPA	Western Wood Products Association

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Definitions of terms and requirements pertaining to the contract documents,

1.2 RELATED REQUIREMENTS

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

1.3 DESCRIPTION OF REQUIREMENTS

A. General Explanation: A substantial amount of specification language consists of definitions for terms found in other contract documents, including the drawings. (Drawings must be recognized as diagrammatic in nature and not completely descriptive of the requirements indicated thereon.) Certain terms used in contract documents are defined in this Section. Definitions and explanations contained in this section are not necessarily either complete or exclusive, but are general for the work to the extent that they are not stated more explicitly in another element of the Contract Documents.

B. General Requirements: The provisions or requirements of Division 1 sections apply to entire work of Contract and, where so indicated, to other elements which are included in project.

C. Governing Regulations: Refer to General and Supplementary Conditions for requirements related to compliance with governing regulations.

D. Abbreviations: The language of specifications and other contract documents is of the abbreviated type in certain instances, and implies words and meanings which will be appropriately interpreted. Specific abbreviations have been established, principally for lengthy technical terminology and primarily in conjunction with coordination of specification requirements with notations on drawings and in schedules. These are frequently defined in sections at first instance of use. Trade association names and titles of general standards are frequently abbreviated.

1.4 DEFINITIONS

A. Approve: Where used in conjunction with Architect's/ Engineer's response to submittals, requests, applications, inquiries, reports and claims by Contractor, the meaning of term "approved" will be held to limitations of Architect's/Engineer's responsibilities and duties as specified in General and Supplementary Conditions. In no case will "approval" by Architect/Engineer be interpreted as a release of Contractor from responsibilities to fulfill requirements of contract documents.

B. Directed, Requested, etc.: Where not otherwise explained, terms such as "directed", "requested", "authorized", "selected", "approved", "required", "accepted", and

"permitted" mean "directed by Architect", "requested by Architect", and similar phrases. However, no such implied meaning will be interpreted to extend the Architect's responsibility into the Contractor's area of construction supervision.

C. Furnish: Except as otherwise defined in greater detail, term "furnish" is used to mean supply and deliver to project site, unloaded, ready for assembly, installation, etc., as applicable in each instance. See Also “Provide”.

D. Indicated: The term "indicated" is a cross-reference to graphic representations, notes or schedules on drawings, to other paragraphs or schedules in the specification, and to similar means of recording requirements in contract documents. Where terms such as "shown", "noted", "scheduled", and "specified" are used in lieu of "indicated", it is for purpose of helping reader locate cross-reference, and no limitation of location is intended except as specifically noted.

E. Install: Except as otherwise defined in greater detail, term "install" is used to describe operations at project site including unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning and similar operations, as applicable in each instance. See also “Provide”.

F. Installer: The term "installer" is defined as the entity (person or firm) engaged by the Contractor, its subcontractor or sub-subcontractor for performance of a particular unit of work at the project site, including installation, erection, application and similar required operations. It is a general requirement that such entities (installers) be expert in the operations they are engaged to perform.

G. Minimum Quality/Quantity: In every instance, the quality level or quantity shown or specified is intended to be the minimum for the work to be performed or provided. Except as otherwise specifically indicated, the actual work may either comply exactly with that minimum (within specified tolerances), or may exceed that minimum within reasonable limits. In complying with these requirements, indicated numeric values are either minimums or maximums as noted, or as appropriate for context of the requirements. Refer instances of uncertainty to Architect for decision before proceeding.

H. Project Site: The term "project site" is defined as the space available to the Contractor for performance of the work, either exclusively of or in conjunction with others performing other work as part of the project. The extent of the project site is shown on the drawings, and may or may not be identical with the description of the land upon which the project is to be built.

I. Provide: Except as otherwise defined in greater detail, term "provide" means furnish and install, complete and ready for intended use, as applicable in each instance.

J. Specialists, Assignments: In certain instances, specification test requires (or implies) that specific work is to be assigned to specialists or expert entities, who must be engaged for the performance of that work. Such assignments shall be recognized as special requirements over which the Contractor has no choice or option. These requirements should not be interpreted so as to conflict with the enforcement of building codes and similar regulations governing the work; they are also not intended to interfere with local union jurisdiction settlements and similar conventions. Such assignments are intended

to establish which party or entity involved in a specific unit of work is recognized as "expert" for the indicated construction processes or operations. Nevertheless, the final responsibility for fulfillment of the entire set of contract requirements remains with the Contractor.

K. Testing Laboratory: The term "testing laboratory" is defined as an independent entity engaged to perform specific inspections or tests of the work, either at the project site or elsewhere, and to report, and (if required) interpret results of those inspections or tests.

L. Trades: Except as otherwise indicated, the use of titles, such as "carpentry" in specification text, implies neither that the work must be performed by an accredited or unionized tradesperson of corresponding generic name (such as "carpenter"), nor that specified requirements apply exclusively to work by tradespersons of that corresponding generic name.

1.5 DRAWING SYMBOLS:

A. General: Except as otherwise indicated, graphic symbols used on drawings are those symbols recognized in the construction industry for purposes indicated.

B. Mechanical/Electrical Drawings: Graphic symbols used on mechanical and electrical drawings are generally aligned with symbols recommended by more specific symbols as recommended by other recognized technical associations including ASME, ASPE, IEEE and similar organizations. Refer instances of uncertainty to the Architect/Engineer for clarification before proceeding.

1.6 INDUSTRY STANDARDS:

A. General Applicability of Standards: Except to the extent that more explicit or more stringent requirements are written directly into the contract documents, applicable standards of the construction industry have the same force and effect (and are made a part of the contract documents by reference) as if copied directly into the contract documents, or as if published copies where bound herewith. Refer to other contract documents for resolution of overlapping and conflicting requirements which result from the application of several different industry standards to the same unit of work. Refer to individual unit of work sections for indications of which specialized codes and standards the Contractor must keep at the project site, available for reference.

B. Referenced Standards (referenced directly in contract documents or by governing regulations) have precedence over non-referenced standards which are recognized in industry for applicability to work.

C. Non-referenced Standards are hereby defined as having no particular applicability to the work, except as a general requirement of whether the work complies with standards recognized in the construction industry.

D. Publication Dates: Except as otherwise indicated, where compliance with an industry standard is required, comply with standard in effect as of date of contract documents.

E. Copies of Standards: The contract documents require that each entity performing work be experienced in that part of the work being performed. Each entity is also required to be familiar with recognized industry standards applicable to that part of the work. Copies of applicable standards are not bound with the contract documents.

1. Where copies of standards are needed for proper performance of the work, the Contractor is required to obtain such copies directly from the publication source.
2. Although a certain number of copies of these standards may be required as a part of the submittal, the Architect/Engineer reserves the right to require the Contractor to submit additional copies of these standards as necessary for enforcement of the requirements.

F. Acronyms: Where acronyms are used in the specifications or other contract documents they are defined to mean the industry recognized name of the trade association, standards generating organization, governing authority or other entity applicable to the context of the test provision.

1.7 GOVERNING REGULATIONS/AUTHORITIES

A. General: The procedure followed by Architect/Engineer has been to contact governing authorities where necessary to obtain information needed for the purpose of preparing contract documents; recognizing that such information may or may not be of significance in relation to Contractor's responsibilities for performing the work. Contact governing authorities directly for necessary information and decisions having a bearing on performance of the work.

B. "Regulations" is defined to include laws, statutes, ordinances and lawful orders issued by governing authorities, as well as those rules, conventions and agreements within the construction industry which effectively control the performance of the work regardless of whether they are lawfully imposed by governing authority or not.

1.8 SUBMITTALS

A. Permits, Licenses, and Certificates: For the Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipt for fee payments, judgments, and similar documents, correspondence and records established in conjunction with compliance with standards and regulations bearing upon performance of the work.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Administrative and procedural requirements related to inspections, tests, and related quality control procedures required to be performed by the Contractor and that facilitate the Contactor's compliance with the Contract Documents.

1.2 RELATED REQUIREMENTS

A. Section 01 3300, Submittal Procedures; submission of manufacturers' instructions and certificates.

B. Section 01 4523, Testing and Inspecting Services, and DSA 103; Special Tests and Inspections required by authorities having jurisdiction and are the responsibility of Owner.

C. Section 01 7700, Closeout Procedures.

D. Specific requirements for testing, inspections, mockups, and other quality control requirements as described in the various Sections of the Specifications.

1.3 DEFINITIONS

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

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

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

D. Mockups: Full-size, physical assemblies that are constructed on-site and in-place mockups to demonstrate aesthetic effects and, where indicated, qualities of materials and execution, and to review construction, coordination, interface, testing, and operation of various building components. Mockups are not samples.

E. Tests: Procedures intended to establish the quality, performance, or reliability of a product or system conducted by a qualified Testing Agency.

F. Source Quality-Control Tests: Tests and inspections related to materials manufactured or fabricated away from the jobsite that will be incorporated into the work.

G. Testing Agency: An independent entity engaged to perform specific tests, inspections, or both, is qualified to operate in California, and meets the additional requirements specified.

1. Testing laboratory shall mean the same as Testing Agency.

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

I. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Contractor's quality-control services do not include Contract administration activities performed by Architect.

1.4 REFERENCES AND STANDARD SPECIFICATIONS

A. General:

1. The Contract Documents contain references to various standard specifications, codes, practices, and requirements for materials, work quality, installation, inspections, and tests published and issued by the organizations, societies, and associations.
2. Contractor shall obtain its own copies of required specified referenced publications.
3. The specification or standard referred to shall have full force and effect as though printed in these Specifications.
4. When the effective date of a reference standard is not specified, it shall be understood that the current edition or latest revision thereof and any amendments or supplements thereto in effect on the date of the DSA approval, shall govern the Work.
5. The contractual relationships, duties, and responsibilities of the parties in Contract or those of the Architect shall not be altered from the Contract Documents by mention or inference otherwise in any reference document.

B. Products or workmanship specified by association, trade, or other consensus standards shall comply with requirements of the referenced standard or specification except when more rigid requirements are specified or are required by applicable codes.

C. Conflicting Requirements:

1. If compliance with two or more standards or requirements are specified and the standards or requirements establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement.
2. Refer conflicting requirements that are different, but apparently equal, to Architect for direction before proceeding.

1.5 ADMINISTRATIVE REQUIREMENTS

A. Submittal Procedures:

1. Informational Submittals shall be submitted in accordance with Section 01 3300, Submittal Procedures.
2. Closeout Submittals shall be submitted in accordance with Section 01 7700, Closeout Procedures.

1.6 INFORMATIONAL SUBMITTALS

A. Schedule of Tests and Inspections.

B. Field Superintendent's Quality Control Responsibilities

C. Procedures for inspection prior to subsequent Work or cover up.

D. Qualifications of Contractor's Testing Agencies.

E. Certified copies of Reports and Documents.

1.7 CLOSEOUT SUBMITTALS

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

B. Test and Inspection Log including final record for each test and inspection as specified in Part 3 and in accordance with Section 01 7839, Project Record Documents.

1.8 REPORTS AND DOCUMENTS

A. Test and Inspection Reports: Prepare and submit certified written reports where specified in the Specification Sections. Include the following:

1. Date of issue.
2. Project title and number.
3. Name, address, and telephone number of testing agency.
4. Dates and locations of samples and tests or inspections.
5. Names of individuals making tests and inspections.
6. Description of the Work and test and inspection method.
7. Identification of product and Specification Section.
8. Complete test or inspection data.
9. Test and inspection results and an interpretation of test results.
10. Record of temperature and weather conditions at time of sample taking and testing and inspecting.

11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
12. Name and signature of laboratory inspector.
13. Recommendations on retesting and re-inspecting.

1.9 QUALITY ASSURANCE

A. Minimum Quantity or Quality Levels:

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

B. Use of trade-specific terminology in referring to a trade or entity does not require that certain construction activities be performed by accredited or unionized individuals, or that requirements specified apply exclusively to specific trade(s).

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

D. Correct conditions or workmanship not in conformance with specified standards or quality. Do so immediately after non-conformance item is discovered or within a reasonable time frame agreed upon with Construction Manager.

E. Comply with manufacturers' instructions, including each step in sequence. Should manufacturers' instructions conflict with Contract Documents, request clarification from the Architect before proceeding.

F. 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.

G. Perform Work by persons qualified to produce required and specified quality.

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

I. Upon delivery to the jobsite, materials and products shall be inspected for compliance with the Project Specifications.

1. Nonconforming materials, products, equipment, hardware, tools and/or safety devices shall be removed immediately from the general work area and stored within a secured area approved by the Owner as "NON CONFORMING MATERIALS AREA" to ensure that defective or nonconforming materials are not incorporated into or used on the project
2. Materials or products shall not be removed from the designated area until they are deemed by the Architect to be in compliance, or until they are modified or fixed to

meet the project specifications, or until they are removed from the jobsite for the purposes of disposal or shipment back to the manufacturer.

1.10 CONTRACTORS TESTING AGENCY

A. Qualifications: At Contractor's expense, provide an independent testing laboratory nationally recognized according to 29 CFR 1910.7 and accredited according to NIST's National Voluntary Laboratory Accreditation Program (NVLAP,) or other independent agency with the experience and capability to conduct testing and inspecting indicated, documented according to ASTM E329; with additional qualifications specified in individual Sections; and, where required, that is acceptable to authorities having jurisdiction.

B. Testing Agency shall cooperate with Architect, Owner's Project Inspector, and Contractor in performance of duties.

C. Testing Agency shall provide qualified personnel to perform required tests and inspections.

D. Testing Agency shall not be authorized to release, revoke, alter, or increase the Contract Document requirements, approve or accept any portion of the Work, or perform any duties of Contractor.

1.11 TESTS AND INSPECTIONS

A. Preconstruction Testing: Where preconstruction testing is specified to verify performance requirements, comply with the following as applicable:

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

B. Tests and Inspections indicated in individual Specification Sections shall be conducted by a qualified Testing Agency. The responsibilities of the Testing Agency shall be as follows:

1. Verifying that manufacturer maintains detailed fabrication and quality-control procedures and reviews the completeness and adequacy of those procedures to perform the Work.
2. Notifying Architect, Owner's Project Inspector**,** and Contractor promptly of irregularities and deficiencies observed in the Work during performance of its services.
3. Submit a certified written report of each test, inspection, and similar quality-control service to Architect and Owner's Project Inspector with copy to Contractor and to DSA.
4. Submit a final report of tests and inspections at Substantial Completion which includes a list of unresolved deficiencies.
5. Interpret tests and inspections and stating in each report whether tested and inspected work complies with or deviates from the Contract Documents.
6. Retest and reinspect corrected work.

C. Monitoring and Documentation: Contractor shall maintain testing and inspection reports including log of approved and rejected results as specified in Part 3.

1. Include work Architect has indicated as nonconforming or defective.
2. Indicate corrective actions taken to bring nonconforming work into compliance with requirements.
3. Comply with requirements of the California Division of the State Architect (DSA).

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 NOTIFICATIONS

A. Contractor shall provide the following notifications;

1. Owner's Project Inspector writing:
   a. 24 hours in advance of starting new Work
   b. 24 hours in advance of each test or inspection
2. 48 hours' prior notice, minimum, to the Testing Agency for required tests and inspections.

3.2 TEST AND INSPECTION FIELD BINDER

A. Contractor shall maintain in the Field Office a Test and Inspection Field Binder that includes a hard copy of the following documents:

1. Approved Quality Control Plan.
2. Specification Sections that apply to the respective portions of work.
3. RFI's, CCD's or other approved document that changes the work.

4. Manufacturer’s Installation Instructions (MII).
5. Specific details of the Work as requested by the Inspector.
6. Test and Inspection Log.

3.3 TEST AND INSPECTION LOG

A. Prepare and maintain a record of tests and inspections using an electronic spreadsheet.

B. Include the following information:

1. Date test or inspection was conducted.
2. Description of the Work tested or inspected.
3. List pertinent detail/sheet number.
4. List pertinent Specification Section.
5. Attach manufacturer’s installation inspections if applicable.
6. List and attach RFI’s, ASI’s or CCD’s affecting the Work.
7. Date Inspector verified work is acceptable.

C. Final record for each test and inspection shall be submitted on Contractors letterhead and include the name of the responsible person to verify Work was in accordance with the approved Contract Documents.

3.4 MANUFACTURERS’ FIELD SERVICES

A. When specified in respective Specification Sections, Contractor shall require supplier or manufacturer to provide qualified personnel to observe field conditions, conditions of surfaces and installation, quality of workmanship, start-up of equipment, testing, adjusting and balancing of equipment as applicable, and to make appropriate recommendations. Contractor is responsible for proper notification of manufacturer's representative before installation of applicable work and for obtaining necessary inspection certificate stating that installation was observed and approved.

B. Product Performance Verification: The supplier of products specified based on performance criteria shall, at the request of the Agency, inspect the installed product and certify conformance of the product to specified criteria under the installed conditions.

C. Manufacturer's representative shall submit written report to the Architect listing observations and recommendations.

3.5 TOLERANCES - GENERAL

A. Monitor tolerance control of installed products or portions to produce acceptable Work. Do not permit tolerances to accumulate.

B. Comply with manufacturers’ tolerances. Should manufacturers’ tolerances conflict with Contract Documents, request clarification from Architect before proceeding.

C. Adjust products to appropriate dimensions; position before securing products in place.

3.6 DIMENSIONING AND TOLERANCES FOR ACCESSIBILITY

A. While it is recognized that construction practices generally permit a level of reasonable dimensional tolerance, the installation of items subject to compliance with the Americans with Disabilities Act Accessibility Guidelines and Chapter 11B of the California Building Code, typically does not allow such tolerances. Therefore, these dimensions are to be considered absolute and will be strictly enforced. Items found to be out of tolerance may require modification and/or replacement at Contractor's expense.

3.7 REPAIR AND PROTECTION

A. On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.

1. Provide materials and comply with installation requirements specified in other Specification Sections or matching existing substrates and finishes.
2. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible. Comply with the Contract Document requirements for cutting and patching in Section 01 7329, Cutting and Patching.

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

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

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Requirements for Testing Laboratory.
2. Contractor's responsibilities for facilitation of Testing and Inspections.

1.2 RELATED SECTIONS AND DOCUMENTS

A. Individual Specification Sections: Inspections and tests required, and standards for testing.

1.3 REFERENCES

A. California Administrative Code (CAC), edition as noted on the drawings, as adopted by the California Division of the State Architect (DSA).

B. California Building Code (CBC), edition as noted on the drawings, as adopted by the California Division of the State Architect (DSA).

1.4 SELECTION AND PAYMENT

A. Testing laboratory shall be approved by both the Architect and the Division of the State Architect.

B. Owner will employ and pay for services of an independent testing laboratory to perform specified inspection and testing. Retesting costs for failed tests will be the Contractors responsibility and will be back-charged against the contract.

C. Under provisions for Relocatable Building construction, Owner limits his exposure to in-plant inspection and testing costs. Refer to other Specification Sections related to such specific construction.

D. Employment of testing laboratory shall in no way relieve Contractor of obligation to perform work in accordance with requirements of Contract Documents.

1.5 LABORATORY REPORTS

A. After each inspection and test, promptly submit two copies of laboratory report to Owner, Architect, and Contractor.

B. Include:

1. Date of issue,
2. Project title and number,
3. Name of inspector,
4. Date and time of sampling or inspection,

5. Identification of product and Specification Section,
6. Location in the Project,
7. Type of inspection or test,
8. Date of test,
9. Results of test,
10. Conformance with Contract Documents.

C. When requested by Architect, provide interpretation of test results.

1.6 LIMITS ON TESTING LABORATORY AUTHORITY

A. Laboratory may not release, revoke, alter or enlarge on requirements of Contract Documents.

B. Laboratory may not approve or accept any portion of the work.

C. Laboratory may not assume any duties of Contractor.

D. Laboratory has no authority to stop the work.

1.7 CONTRACTOR RESPONSIBILITIES

A. Deliver to laboratory at designated location, adequate samples of materials proposed to be used which require testing, along with proposed mix designs. Allow reasonable time for review and testing.

B. Arrange for, and coordinate with, laboratory for all required testing and inspection. Provide adequate notice, in advance, for proper scheduling and processing of testing. The Inspector will not be responsible for scheduling or arranging for testing and inspection services.

C. Cooperate with laboratory personnel, and provide access to the work and to manufacturer's facilities.

D. Provide incidental labor and facilities to provide access to work to be tested, to obtain and handle samples at the site or at the source of products to be tested, to facilitate tests and inspections, storage and curing of test samples.

E. Notify Architect, Inspector, Structural Engineer (when applicable) and laboratory 24 hours prior to expected time for operations requiring inspection and testing services.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Included: Except as otherwise specified, temporary facilities and controls required for performance of the Contract including, but not necessarily limited to:

1. Temporary utilities.
2. Sanitary facilities.
3. Construction equipment.
4. Enclosures, fencing and barricades.
5. Temporary signs.
6. Site access and parking.
7. Temporary controls.
8. Fire alarm, intrusion alarm and fire sprinkler systems.
9. Existing conditions.

1.2 RELATED REQUIREMENTS

A. Section 01 7419, Construction Waste Management and Disposal.

B. Section 01 7700, Closeout Procedures; final cleaning.

C. Permanent Utilities: As specified under other Specification Sections.

1.3 REQUIREMENTS OF REGULATORY AGENCIES

A. General:

1. Temporary facilities and controls shall be approved by local, state and federal authorities and regulatory agencies having jurisdiction, including insurance companies, with regard to safety precautions, operation and fire hazard.
2. Contractor shall contact local authorities prior to start of work to coordinate local requirements.

B. Comply with applicable standards referenced in Section 01 4216, Definitions and Standards.

C. Contractor shall:

1. Take suitable steps to ensure that public utilities encountered in connection with the Work will not be damaged.
2. Send notices, make necessary arrangements and provide services required for the care of gas mains, water pipes, sewer pipes, conduits, cables, and other equipment or property.

3. Arrange with utility companies for fees required to move or remove their meters, poles, cables, guy wires, or equipment in or set under the property which will interfere with the construction work or which will not be required in the new construction.

1.4 PRODUCT HANDLING

A. Protection: Use all means necessary to protect and maintain temporary facilities and controls in proper and safe condition throughout progress of work.

B. Replacements: In event of loss or damage, immediately make necessary repairs and replacements; as approved by Architect at no additional cost to Owner.

PART 2 - TEMPORARY FACILITIES AND CONTROLS

2.1 MATERIALS

A. General: Materials may be new or used but shall be adequate in capacity for the required usage, shall not create unsafe conditions, and shall not violate requirements of applicable codes and standards.

B. Tools, extension cords, and electrical equipment shall conform to Underwriters' Laboratory standards and OSHA requirements and shall be in proper working order to preclude hazard to occupants and premises.

2.2 TEMPORARY UTILITIES

A. General: Provide water, electricity, gas, fire protection and other specified utility services required during construction and extend temporary service lines to construction areas to allow use by all trades and subcontractors.

B. Telephone:

1. Contractor and its Superintendent shall have a cell phone for communication with the Architect and Owner when at the Project site.

C. Temporary Water:

1. Owner will provide source and pay for water for construction purposes from existing available source(s) on site. This does not include use of hydrants or off-site sources. If necessary provide and pay for these services.
2. Provide temporary connections to source and sufficient hose or pipe to carry water to every required part of construction.
3. Drinking Water Facilities: Provide clean, sanitary and adequate drinking water.

D. Temporary Electrical Facilities:

1. Electrical Service: Provide such temporary electrical power and facilities as necessary to supply lighting for work operations and power for portable power driven tools and for testing.
2. Owner will provide temporary power free of charge from existing outlets. If existing sources are insufficient, provide and pay for temporary service from off-site.
3. Construction Requirements: Construct and maintain all temporary electrical facilities in accordance with division of Industrial Safety "Electrical Safety Orders" (ESO), Public Utilities Commission "Rules for Overhead Line Construction" (G.O. 95), and requirements of equipment used for these facilities shall be in good and safe condition, but need not be new.

E. Trash Removal:

1. Store trash or rubbish resulting from construction within the Contract work area.
2. Provide the necessary on-site containers for the collection of recycling materials, waste materials and debris.
3. Remove recycling materials, waste materials and debris from the site regularly and dispose of at recycling centers or legal disposal sites.
4. Keep the work area clean at all times. Increase frequency of trash removal when requested by the Owner to conform to this requirement.
5. Waste material and debris shall not be buried or burned at the site.
6. See additional requirement in Section 01 7419, Construction Waste Management and Disposal.

2.3 SANITARY FACILITIES

A. Toilet Facilities: Provide sufficient suitably enclosed chemical toilets with urinal for use workers on project.

1. Toilets shall be in place at the time work starts and maintained until the permanent toilet facilities are in operation if approved for use by the Owner.
2. Temporary toilets shall be of the chemical type.
3. The number and maintenance of temporary toilets shall meet the requirements of State and local health regulations and ordinances.
4. Locate on the site so as not to be visually offensive and in locations acceptable to the Owner.
5. Sanitary waste from the portable toilets shall be collected as required but not more than weekly.

B. Washing Facilities: Provide properly mounted and adequate wash sinks connected to water supply; in location as approved by Architect.

2.4 CONSTRUCTION AIDS

A. General: Erect, equip, operate, and maintain all construction equipment in strict accordance with applicable statutes, laws, ordinances, rules, and regulations of

authorities having jurisdiction; including insurance companies, with regard to safety, operation and fire hazard.

B. Provide and maintain scaffolding, staging, runways and similar equipment, as needed. Coordinate use and furnishing with subcontractors.

C. Provide and maintain hoists and construction elevators, including elevators for hoisting workers; complete with operators, power and signals, as necessary for operation. Comply with the following:

1. California Title 8, State Elevator Safety Order 3041c, and other applicable state and local codes.
2. "American National Standard Safety Code for Elevators, Dumbwaiters, Escalators, and Moving Walks," ANSI A17.1.
3. California Elevator Safety Construction Code.

2.5 ENCLOSURES, FENCING AND BARRICADES

A. General: Provide and maintain barricades, fencing, shoring, pedestrian walkways including attached lights, other lights, and other safety precautions to properly guard against personal injury and property damage as prescribed by authority having jurisdiction; including insurance companies.

B. Attention is directed to Safety Orders issued by State of California, Division of Industrial Safety. Contractor shall obtain copies of such Safety Orders as are applicable to type of work to be performed, shall be governed by requirements thereof in all construction operations, and shall fully inform subcontractors and material suppliers as to the requirements of applicable Safety Orders.

C. Contractor's Corporation Yard: Locate where shown or agreed on with Owner and Architect. Enclose with fence and gates as required for security, and as approved.

D. Provide and maintain 6 foot high temporary fencing around entire work area to keep unauthorized personnel from accessing the area. Protect work in place from damage, including fields, roads, landscaping, and other existing site improvements to remain. No work is allowed outside the designated construction boundary.

E. The Architect, the Owner, and field inspectors are not hired to review or approve safety procedures followed by the Contractor.

2.6 TEMPORARY SIGNS

A. Signs or advertising are not permitted, except Contractor's name may be placed on his field office and equipment, unless otherwise approved by the architect.

2.7 SITE ACCESS AND PARKING

A. Parking: On-site parking after occupancy may be limited or may not be permitted during the school year due to limited existing conditions. Check with District office to ascertain parking availability and do not park on-site if not permitted.

B. Entrance to Work Site: Contractor and his employees shall use certain access roads or entrance ways as indicated on Drawings or as agreed to by Architect and Owner. Access shall not interfere with on-going operations, if any. Maintain these roads in satisfactory condition during the Contract time, and repair damages attributable to work of this project at intervals as needed. At completion of Contract, roads and entrance ways shall be left in condition at least equal to that existing at start of Contract, except as may be otherwise required by Contract Documents.

C. Site Storage and Work Areas: Owner will allocate available on-site storage and work areas to Contractor, subject to change as may be necessary by job progress, such as site development or other intervening work. If necessary, Contractor shall obtain off-site facilities for storage at his expense. No storage will be allowed beyond the designated construction boundary, or within designated Fire Lane.

D. Regulations: Observe and comply with rules and regulations in effect at occupied campuses or other facilities, including, but not restricted to, parking and traffic regulations, security restrictions, and hours of access.

2.8 TEMPORARY CONTROLS

A. Debris Control: Keep work and storage areas clean and free of debris. Dispose of debris off premises, as it accumulates. Pay all fees required for use of public dumps. Burning on premises is prohibited.

B. Dust Controls:

1. Indoor Operations: Control dust resulting from indoor construction operations by localizing it to greatest practicable extent using temporary partitions, curtains, or other means which will prevent spread of dust beyond immediate work area. Duct openings and other openings communicating with other parts of building shall have effective temporary closures.
2. Outdoor Operations: Use water wagons or spray from hoses to control dust created by outdoor work operations. Comply with all local and state dust control ordinances.

C. Security: Contractor is responsible for security of areas of its work during entire time of Contract. Make good all damages to the work and loss of materials due to vandalism or theft, within this responsibility. This includes damages due to construction activities caused to existing facilities.

D. Contractor may wish to provide a security force at its expense. The Owner will not provide any monitoring for security purposes.

E. Use and Storage of Hazardous or Flammable Materials:

1. Use and store hazardous or flammable chemicals, liquids, or gases brought into the Project site in approved containers, conforming to local, state, and national fire codes.
2. Use hazardous materials in a manner that will prevent their accidental release into other areas.

3. Do not discard hazardous materials into the jobsite waste-disposal facilities.
4. Remove empty containers from the premises immediately, and disposed of in a legal manner.

F. Welding: There shall be at the jobsite adequate shields, guards, or covering placed so as to protect adjacent persons or property during the progress of work requiring welding and cutting equipment including heat, flame, or spark-producing devices.

2.9 FIRE ALARM, INTRUSION ALARM AND FIRE SPRINKLER SYSTEMS

A. Existing Systems:

1. Prior to start of demolition, the Contractor shall fully test the fire and intrusion alarms systems in the presence of district personnel to determine the working status of the systems. The test results shall be coordinated with the Owner's Project Inspector, documented and provided to the Owner and Architect.
2. During construction, the Contractor shall protect and maintain the fire and intrusion alarm systems and the fire sprinkler protection systems of the existing and completed buildings. Failure to provide such protection and maintenance shall result in the Contractor assuming full responsibility for all existing and new unprotected buildings and property - whether a part of the Contract or not.

B. Fire Protection During Construction:

1. General: Comply with NFPA 241, "Standard for Safeguarding Construction, Alteration, and Demolition Operations" and any additional temporary fire protection requirements of Owner's Insurance Representative and governing authorities.
2. During demolition and construction phases, the Contractor shall provide fire safety precautions as described in and required by the California Fire Code, Chapter 33 – Fire Safety during Construction and Demolition. Safety measures include but are not limited to maintaining fire department access, cutting and welding precautions and maintaining water supplies for firefighting purposes.
3. In the event the Contractor discovers utilities not identified in the Contract Drawings or specifications, the Contractor shall immediately notify the Architect and the utility owner by the most expeditious means available and later confirm in writing.
4. Existing building utilities shall not be interrupted during normal operating hours.
5. Fire Extinguishers:
    a. During the progress of work, there shall be at the jobsite an adequate number and type of fire extinguishers accessible for use.
    b. Provide Type A extinguishers at locations of low-potential hazard for either electrical or grease-oil-flammable liquids fires; provide Type ABC dry chemical extinguishers at other locations; comply with recommendations of NFPA No. 10.
    c. Post warning and quick-instructions at each extinguisher location, and instruct personnel at Project site, at time of their first arrival, on proper use of extinguishers and other available facilities at Project site.

6. Provide temporary, battery operated, heat detectors until permanent detection and alarm system is activated. Locate based on area layout including separation of spaces.

C. Smoking:

1. Contractor shall prohibit smoking in all areas of the Project and shall use due diligence to see that such prohibition is enforced.
2. No Smoking signs shall be furnished and posted in accordance with governing fire regulations.

2.10 EXISTING CONDITIONS

A. Before commencement of work on the site, take digital photographs of Project site and surrounding properties, including existing items to remain during construction, from different vantage points, as directed by Architect.

B. Show existing conditions of adjoining construction and site improvements, including finish surfaces that might be misconstrued as cracking or other damage caused by site preparation, earthwork, and building construction operations.

C. Submit digital file and prints as specified for periodic construction photographs.

D. Submit before Work begins.

PART 3 - EXECUTION

3.1 USE OF PERMANENT SYSTEMS FOR CONSTRUCTION PURPOSES

A. Obtain Owner's prior written authorization of use of permanent systems. Authorization will indicate:

1. Reason for use.
2. Condition of use.
3. Which parts of system may be used.
4. Disconnection from source, restoration, and cleaning of system.

3.2 MAINTENANCE AND REMOVAL

A. Maintain all temporary facilities and controls as long as needed for safe and proper completion of Work; remove all such temporary facilities and controls as rapidly as progress of Work will permit.

B. Non-compliance with requirements within this Section may result in payment being withheld and/or deductive change orders for lack of proper facilities and controls. If necessary, the Owner will provide such facilities and controls required and back-charge the Contractor.

3.3 ADJUSTING

A. 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.

B. Repair or replace street paving, curbs, and sidewalks at temporary entrances, as required by authorities having jurisdiction.

C. Restore existing facilities used for temporary services to specified or to original condition.

3.4 CLEAN UP

A. Contractor shall be responsible for controlling, containing and cleaning up of all construction debris throughout construction period.

B. Full compensation for cleanup shall be included in the Contract. No separate compensation will be allowed for work pertaining to cleanup or disposal of material.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: VOC restrictions for product categories listed below under Article "DEFINITIONS" and in compliance with the following.

1. California Code of Regulations, Title 24, Part 11 California Green Building Standards Code.

B. Products of each category that are installed in the project must comply; applicable laws and ordinances do not allow for partial compliance.

C. Listing of a product in these Specifications shall not be construed as a solicitation or requirement to use any product or combination of products in violation of the requirements of South Coast Air Quality Management District Rule No.1168, as described in Rule 1168(g).

1. If a listed product does not meet the requirements of this rule, request approval for use of an alternate product by the same or another manufacturer meeting the requirements of this rule.
2. Do not use products which do not meet the requirements of this rule.

1.2 RELATED REQUIREMENTS

A. Divisions 01 through 33 contain related requirements specific to the work of each of these Sections. Requirements may or may not include reference to this Section.

B. Section 01 8113, Sustainable Design Requirements, for CAL-Green general requirements and procedures.

1.3 REFERENCES

A. California Green Building Standards Code (CALGreen), edition as noted on the Drawings, as adopted by the California Division of the State Architect (DSA).

B. SCAQMD 1168 - South Coast Air Quality Management District Rule No.1168; current edition; www.aqmd.gov.

C. SCS (CPD) - SCS Certified Products; Scientific Certification Systems; current listings at www.scscertified.com.

1.4 DEFINITIONS

A. VOC-Restricted Products: Products of each of the following categories when installed or applied on-site:

1. Adhesives, sealants, and sealer coatings, regardless of specification Section or Division.
2. Paints and coatings.

3. Carpet and resilient flooring.
4. Composite wood products; plywood, particleboard, wood fiberboard.

B. Adhesives: Gunnable, trowelable, liquid-applied, and aerosol adhesives, whether specified or not; including flooring adhesives, resilient base adhesives, and pipe jointing adhesives.

C. Sealants: Gunnable, trowelable, and liquid-applied joint sealants and sealant primers, whether specified or not; including firestopping sealants and duct joint sealers.

1.5 SUBMITTAL REQUIREMENTS

A. Product Data: For each VOC-restricted product used in the project, submit product data showing compliance, except when another type of evidence of compliance is required.

B. Verification of Compliance: Submit for each different product in each applicable category.

1. Identify evidence submittals with the words "CALGreen VOC Compliance Report".

C. Installer Certifications for Accessory Materials:

1. Require each installer of any type of product, not just the products for which VOC restrictions are specified, to certify that either 1) no adhesives, joint sealants, paints, coatings, or composite wood or agrifiber products have been used in the installation of their products, or 2) that such products used comply with these requirements.
2. Use the form following at the end of Part 3 in this Section for Installer certifications.

1.6 QUALITY ASSURANCE

A. Manufacturer’s Testing Agency Qualifications: Independent firm specializing in performing testing and inspections of the type specified in this Section.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General:

1. Provide products conforming to local, State and Federal government requirements limiting the amount of volatile organic compounds contained in the product, for its intended application. If specified product exceeds current requirement, provide conforming product at no additional cost.
2. Provide only products having volatile organic compound (VOC) content not greater than required by South Coast Air Quality Management District Rule No.1168 and less where required by code.
3. Products are specified in multiple Sections throughout these Specifications.

B. Composite Wood Products: Comply with CALGreen Section 5.504 and Table 5.504.4.5 formaldehyde limits for hardwood plywood, particleboard, and medium density fiberboard composite wood products used on the interior and exterior of the building.

1. Verification of Compliance: Acceptable types are:
   a. Certification by manufacturer that product complies with requirements.
   b. Published product data showing compliance with requirements.
   c. Chain of custody certifications.
   d. Product labeled and invoiced as meeting the Composite Wood Products regulation (CCR, Title 17, Section 93120, et seq.).
   e. Products marked as meeting the PS-1 or PS-2 standards of the Engineered Wood Association, the Australian AS/NZS 2269, or European 636 3S standards.
   f. Other method acceptable to enforcing agency.

Table 5.504.4.5 FORMALDEHYDE LIMITS	
Maximum Formaldehyde Emissions in Parts per Million	
Product	**Current Limit**
Hardwood plywood veneer core	0.05
Hardwood plywood composite core	0.05
Particleboard	0.09
Medium density fiberboard	0.11
Thin medium density fiberboard[1]	0.13
Note 1: Thin medium density fiberboard has a maximum thickness of 5/16 inch (8 mm).	

C. Insulation: Comply with CALGreen Section 5.504.4.8.2 formaldehyde limits for insulation.

1. Verification of Compliance: Documentation from manufacturer verifying thermal insulation materials meet the pollutant emission limits of one of the following.
   a. The VOC-emission limits defined in 2014 CACHPS criteria and listed on its High Performance Products Database.
   b. California Department of Public Health 2010 Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers, Version 1.1, February 2010 (also known as Specification 01350.)

D. Adhesives, Including Carpet and Cushion Adhesives: Comply with CALGreen Section 5.504 and Table 5.504.4.1.

1. Verification of Compliance: Acceptable types are:
   a. Report of laboratory testing performed in accordance with requirements.
   b. Published product data showing compliance with requirements.
   c. Certification by manufacturer that product complies with requirements.

2. Aerosol Adhesives: Comply with Table 5.504.4.1 of CalGreen Section 5.504, and California Code of Regulations Title 17, Section 94507.
   a. Verification of Compliance: Acceptable types are:
      1) Current GreenSeal Certification.
      2) Report of laboratory testing performed in accordance with GreenSeal GS-36 requirements.
      3) Published product data showing compliance with requirements.

3. Products used shall comply with the following limits.

Table 5.504.4.1 ADHESIVE VOC LIMIT	
Architectural Applications	**Current VOC Limit**
Indoor Carpet Adhesives	50
Carpet Pad Adhesives	50
Outdoor Carpet Adhesives	150
Wood Flooring Adhesive	100
Rubber Floor Adhesives	60
Subfloor Adhesives	50
Ceramic Tile Adhesives	65
VCT and Asphalt Tile Adhesives	50
Dry Wall and Panel Adhesives	50
Cove Base Adhesives	50
Multipurpose Construction Adhesives	70
Structural Glazing Adhesives	100
Single Ply Roof Membrane Adhesives	250
Other adhesives not specifically listed	250
VOC Limits and Effective Dates**	
Specialty Applications	**Current VOC Limit**
PVC Welding	510
CPVC Welding	490
ABS Welding	325
Plastic Cement Welding	250
Adhesive Primer for Plastic	550
Contact Adhesive	80
Special Purpose Contact Adhesive	250
Structural Wood Member Adhesive	140
Top and Trim Adhesive	250
** The specified limits remain in effect unless revised limits are listed in the current governing edition of CalGreen.	
For adhesives, adhesive bonding primers, or any other primer not regulated by the above two Tables and applied to the following substrates, the following limits shall apply:	
Substrate Specific Applications	**Current VOC Limit**
Metal to Metal	30
Plastic Foams	50

Table 5.504.4.1 ADHESIVE VOC LIMIT	
Porous Material (except wood)	50
Wood	30
Fiberglass 80	80
Note: If an adhesive is used to bond dissimilar substrates together the adhesive with the highest VOC content shall be allowed.	

E. Joint Sealants: Comply with CALGreen Section 5.504 and Table 5.504.4.2.

1. Verification of Compliance: Acceptable types are:
    a. Report of laboratory testing performed in accordance with requirements.
    b. Published product data showing compliance with requirements.
    c. Certification by manufacturer that product complies with requirements.

2. Products used shall comply with the following limits.

Table 5.504.4.2 SEALANT VOC LIMIT	
Less Water and Less Exempt Compounds in Grams per Liter	
Sealant	Current VOC Limit
Architectural	250
Marine Deck	760
Non-Membrane Roof	300
Roadway	250
Single-Ply Roof Membrane	450
Other	420
Sealant Primers	Current VOC Limit
Architectural Non-Porous Porous	 250 775
Modified Bituminous	500
Marine Deck	760
Other	750
For low-solid adhesives or sealants the VOC limit is expressed in grams per liter of material; for all other adhesives and sealants, VOC limits are expressed as grams of VOC per liter of adhesive or sealant less water and less exempt compounds.	

F. Paints and Coatings: Comply with CALGreen Section 5.504 and Table 5.504.4.3 based on the California Air Resources Board, Architectural Coatings Suggested Control Measure.

1. Determination of VOC Content: Testing and calculation in accordance with 40 CFR 59, Subpart D (EPA Method 24), exclusive of colorants added to a tint base and water added at Project site; or other method acceptable to authorities having jurisdiction.
    a. Verification of Compliance: Acceptable types are:

1) Report of laboratory testing performed in accordance with requirements.
2) Published product data showing compliance with requirements.
3) Certification by manufacturer that product complies with requirements.

2. Provide coatings that comply with the most stringent requirements specified in the following:
   a. 40 CFR 59, Subpart D--National Volatile Organic Compound Emission Standards for Architectural Coatings.
   b. South Coast Air Quality Management District Rule No.1168.
3. Aerosol Paints and Coatings: Comply with CALGreen 5.504.4.3.1 and, for projects in the jurisdiction of BAAQMD, comply with VOC by weight of product limits of regulation 8, Rule 49.
4. Products used shall comply with the following limits.

Table 5.504.4.3 VOC CONTENT LIMITS FOR ARCHITECTURAL COATINGS (See Notes 2 & 3 below)	
Grams of VOC per Liter of Coating, less water and less exempt compounds	
Coating Category	**Current VOC Limit 1/1/2012**
Flat Coatings	50
Non-Flat Coatings	100
Non-Flat High Gloss Coatings	150
Specialty Coatings	
Aluminum Roof Coatings	400
Basement Specialty Coatings	400
Bituminous Roof Coatings	50
Bituminous Roof Primers	350
Bond Breakers	350
Concrete Curing Compounds	350
Concrete / Masonry Sealers	100
Driveway Sealers	50
Dry Fog Coatings	150
Faux Finishing Coatings	350
Fire Resistive Coatings	350
Floor Coatings	100
Form-Release Compounds	250
Graphic Arts Coatings (Sign Paints)	500
High-Temperature Coatings	420
Industrial Maintenance Coatings	250
Low Solids Coatings (See Note 1 below)	120
Magnesite Cement Coatings	450
Mastic Texture Coatings	100
Metallic Pigmented Coatings	500
Multicolor Coatings	250
Pretreatment Wash Primers	420

Table 5.504.4.3 VOC CONTENT LIMITS FOR ARCHITECTURAL COATINGS (See Notes 2 & 3 below)	
Grams of VOC per Liter of Coating, less water and less exempt compounds	
Coating Category	**Current VOC Limit 1/1/2012**
Primers, Sealers and Undercoaters	100
Reactive Penetrating Sealers	350
Recycled Coatings	250
Roof Coatings	50
Rust Preventative Coatings	250
Shellacs: Clear Opaque	 730 550
Specialty Primers, Sealers and Undercoaters	100
Stains	250
Stone Consolidants	450
Swimming Pool Coatings	340
Traffic Marking Coatings	100
Waterproofing Membranes	250
Wood Coatings	275
Wood Preservatives	350
Zinc Rich Primers	340
Note 1: Grams of VOC per liter of coating including water and including exempt compounds	
Note 2:Not Applicable	
Note 3: Values in this table are derived from those specified by the California Air Resources Board, Architectural Coatings Suggested Control Measure, February 1, 2008. More information is available from the Air Resources Board.	

5. Restricted Components: In addition to the specified VOC limits, paints and coatings shall not contain any of the following:
   a. Acrolein.
   b. Acrylonitrile.
   c. Antimony.
   d. Benzene.
   e. Butyl benzyl phthalate.
   f. Cadmium.
   g. Di (2-ethylhexyl) phthalate.
   h. Di-n-butyl phthalate.
   i. Di-n-octyl phthalate.
   j. 1,2-dichlorobenzene.
   k. Diethyl phthalate.
   l. Dimethyl phthalate.

m. Ethylbenzene.
n. Formaldehyde.
o. Hexavalent chromium.
p. Isophorone.
q. Lead.
r. Mercury.
s. Methyl ethyl ketone.
t. Methyl isobutyl ketone.
u. Methylene chloride.
v. Naphthalene.
w. Toluene (methylbenzene).
x. 1,1,1-trichloroethane.
y. Vinyl chloride.

PART 3 - EXECUTION

3.1 FIELD QUALITY CONTROL

A. Owner 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 Owner.

B. Additional costs to restore indoor air quality, including fines by authorities, due to installation of non-compliant products shall be borne by Contractor.

3.2 CERTIFICATION FORM

A. Use of this Form:

1. Because installers are allowed and directed to choose accessory materials suitable for the applicable installation, there is a possibility that such accessory materials might contain VOC content in excess of that permitted, especially where such materials have not been explicitly specified.
2. Contractor is required to obtain and submit this Form from each installer of work on this project.
3. For each product category listed, circle the correct words in brackets: either [HAS] or [HAS NOT].
4. If these accessory materials have been used, attach to this form product data and MSDS sheet for each such product.

(The Remainder of this Page is Intentionally Left Blank)

ACCESSORY MATERIAL VOC CONTENT CERTIFICATION FORM

IDENTIFICATION:

Project Name: _____

Project No.: _____

Architect: _____

PRODUCT CERTIFICATION: I certify that the installation work of my firm on this project:

1. [HAS] [HAS NOT] required the use of any ADHESIVES.
2. [HAS] [HAS NOT] required the use of any JOINT SEALANTS.
3. [HAS] [HAS NOT] required the use of any PAINTS OR COATINGS.
4. [HAS] [HAS NOT] required the use of any COMPOSITE WOOD or AGRIFIBER PRODUCTS.

Product data and MSDS sheets are attached.

CERTIFIED BY (Installer/Manufacturer/Supplier Firm):

Firm Name: _____

Print Name: _____

Signature: _____

Title: _____ (officer of company)

Date: _____

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Cutting and patching:
   a. For construction that is defective, or as required to install incomplete work shown in the Contract Documents.
   b. To extend work or restore existing construction to its original condition, unless otherwise specified or shown on the drawings.

1.2 RELATED REQUIREMENTS

A. Section 01 6116, Volatile Organic Compound (VOC) Restrictions, for VOC limits pertaining to adhesives, sealants, fillers, primers, and coatings.

B. Section 01 8113, Sustainable Design Requirements, for CAL-Green general requirements and procedures.

1.3 REFERENCES

A. California Building Code (CBC), edition as noted on the drawings, as adopted by the California Division of the State Architect (DSA).

B. California Green Building Standards Code (CALGreen), edition as noted on the Drawings, as adopted by the California Division of the State Architect (DSA).

1.4 ADMINISTRATION REQUIREMENTS

A. Submittal Procedures:

1. Action Submittals and Informational Submittals shall be submitted in accordance with Section 01 3300, Submittal Procedures.
2. Closeout Submittals shall be submitted in accordance with Section 01 7700, Closeout Procedures.
3. Sustainable Design Submittals shall comply with the additional requirements of Section 01 8113, Sustainable Design Requirements.

1.5 ACTION SUBMITTALS

A. Manufacturer's Data: For products not included in the specifications, submit list and complete descriptive data of all products proposed for use. Include manufacturer's specifications, and installation instructions.

B. Samples: As requested by the Architect.

C. Request for Cutting and Patching:

1. Submit a written request to Architect well in advance of executing any cutting or alteration which affects:
    a. Work of the Owner or any separate contractor.
    b. Structural value or integrity of any element of the Project.
    c. Integrity or effectiveness of weather-exposed or moisture-resistant elements or systems.
    d. Efficiency, operational life, maintenance or safety of operational elements.
    e. Visual qualities of sight-exposed elements.
    f. No cutting of structural elements is allowed unless shown on the Division of the State Architect's approved drawings
2. Request shall include:
    a. Project identification.
    b. Description of affected work.
    c. Necessity for cutting, alteration or excavation.
    d. Effect on work of Owner or any separate contractor, or on structural or weatherproof integrity of Project.
    e. Description of proposed work:
        1) Scope of cutting, patching, alteration, or excavation.
        2) Trades who will execute the work.
        3) Products proposed to be used.
        4) Extent of refinishing to be done.
    f. Alternatives to cutting and patching.
    g. Cost proposal, when applicable.
    h. Written permission of any separate contractor whose work will be affected.

D. Should conditions of work or schedule indicate change of products from original installation, Contractor shall submit request for substitution.

E. Submit written notice to Architect designating date and time work will be uncovered.

1.6 INFORMATIONAL SUBMITTALS

A. Sample of manufacturer’s warranty, where applicable.

B. Sustainable Design:

1. General:
    a. Submit information necessary to establish and document compliance with the California Green Building Standards Code.
    b. Sustainable design submittals are in addition to other submittals.
2. The following information shall be provided:
    a. Adhesives and Sealants: Evidence of compliance that products meet maximum VOC content limits specified in Section 01 6116.
    b. Paints and Coatings: Evidence of compliance that products meet maximum VOC content limits specified in Section 01 6116.

1.7 CLOSEOUT SUBMITTALS

A. Warranty/Guarantee: Submit executed warranties and Subcontractors' guarantees for products not included in the specifications.

1.8 QUALITY ASSURANCE

A. Qualifications for Installers:

1. General: As specified in the product specifications.
2. Employ specially qualified installers or fabricators to perform cutting and patching for:
    a. Weather-exposed or moisture-resistant elements.
    b. Sight-exposed finished surfaces.

B. Use only new materials and products, unless existing materials or products are specifically shown otherwise on the Drawings to be salvaged and re-used.

C. Single-Source Responsibility: Use materials and products of one manufacturer whenever possible.

D. All materials, components, assemblies, workmanship and installation are to be observed by the Owner's Project Inspector. Work not so inspected is subject to uncovering and replacement.

1.9 FIELD CONDITIONS

A. Make and be responsible for all field dimensions necessary for proper fitting and completion of work. Report discrepancies to Architect before proceeding.

1.10 WARRANTY

A. Manufacturer: In addition to the Contractor's and Subcontractor's Guarantee, furnish Owner with manufacturers' available fully executed written warranties for products not included in the specifications against defects in materials and workmanship

PART 2 - PRODUCTS

2.1 DESIGN AND PERFORMANCE CRITERIA

A. Sustainable Design:

1. VOC emissions for field-applied adhesives, sealants, and sealant primers must comply with limits specified in Section 01 6116.
2. VOC emissions for field-applied paints and coatings must comply with limits specified in Section 01 6116.

2.2 MATERIALS

A. Comply with these specifications, standards and manufacturer's recommendations for each specific product involved.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Inspect conditions of Project, including elements subject to damage or to movement during cutting and patching.

B. After uncovering work, inspect conditions affecting installation of products, or performance of work.

C. Verify that specified items may be installed in accordance with the approved design.

D. In event of discrepancy, immediately notify Architect. Do not proceed in discrepant areas until discrepancies have been fully resolved.

3.2 PREPARATION

A. Provide adequate temporary support as necessary to assure structural value or integrity of affected portion of work.

B. Provide devices and methods to protect other portions of Project from damage.

C. Provide protection from elements for that portion of Project which may be exposed by cutting and patching work, and maintain excavations free from water.

3.3 INSTALLATION

A. Execute cutting and demolition by methods which will prevent damage to other work and will provide proper surfaces to receive installation of repairs.

1. Removal or cutting of concrete paving shall occur at adjacent expansion joint or control joint.

B. Execute excavating and backfilling by methods which will prevent settlement or damage to other work, and in accordance with Section 31 2333, Trenching and Backfilling.

C. Execute fitting and adjustment of products to provide finished installation to comply with specified products, functions, tolerances and finishes.

D. Restore work which has been cut or removed; install new products to provide completed work in accord with requirements of Contract Documents.

E. Fit work airtight to pipe, sleeves, ducts, conduit and other penetrations through surfaces.

F. Refinish entire surfaces as necessary to provide even finish to match adjacent finishes:

1. For continuous surfaces, refinish to nearest intersection.
2. For an assembly, refinish entire unit.

3.4 CLEANING AND ADJUSTING

A. In the event of damage, make all repairs and replacements necessary to the approval of the Architect at no additional cost to the Owner.

B. Upon completion of installation, thoroughly wash surfaces and remove foreign material. Leave entire work in neat, orderly, clean and acceptable condition.

3.5 PROTECTION

A. Protect work and materials of this Section prior to and during installation, and protect the installed work and materials of other trades.

B. Exposed finishes shall be free from scratches, dents, permanent discolorations and other defects in workmanship or material.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes: Requirements and procedures for ensuring optimal diversion of construction waste materials generated by the Work from landfill disposal within the limits of the Construction Schedule and Contract Sum.

1. The Work of this Contract requires that a minimum of 65% by weight of the construction and demolition materials generated in the Work is diverted from landfill disposal through a combination of re-use and recycling activities.
2. CAL-Green: Alternate waste reduction methods developed in cooperation with local agencies if diversion or recycle facilities capable of compliance with CAL-Green requirements do not exist within the haul boundary of the jobsite (California Code of Regulations, Title 24, Part 11, 5.408).
3. Requirements for submittal of Contractor's Construction Waste and Recycling Plan prior to the commencement of the Work.
4. Contractor's quantitative reports for construction waste materials as a condition of approval of progress payments submitted to the Architect.

1.2 RELATED REQUIREMENTS

A. Section 01 3516, Alteration Project Procedures.

B. Section 01 5000, Temporary Facilities & Controls.

C. Section 01 7329, Cutting and Patching.

D. Section 01 8113, Sustainable Design Requirements, for CAL-Green general requirements and procedures.

1.3 REFERENCES AND STANDARDS

A. California Green Building Standards Code (CALGreen), edition as noted on the drawings, as adopted by the California Division of the State Architect (DSA).

1.4 DEFINITIONS

A. Class III Landfill: A landfill that accepts non-hazardous resources such as household, commercial, and industrial waste, resulting from construction, remodeling, repair, and demolition operations. A Class III landfill must have a solid waste facilities permit from the California Integrated Waste Management Board (CIWMB) and is regulated by the Enforcement Agency (EA).

B. Construction and Demolition Debris: Building materials and solid waste resulting from construction, remodeling, repair, cleanup, or demolition operations that are not hazardous as defined in California Code of Regulations, Title 22, Section 66261.3 et seq. This term includes, but is not limited to, asphalt concrete, Portland cement concrete, brick, lumber, gypsum wallboard, cardboard and other associated packaging, roofing

material, ceramic tile, carpeting, plastic pipe, and steel. The debris may be commingled with rock, soil, tree stumps, and other vegetative matter resulting from land clearing and landscaping for construction or land development projects.

C. C&D Recycling Center: A facility that receives only construction and demolition debris material that has been separated for reuse prior to receipt, in which the residual (disposed) amount of waste in the material is less than 10% of the amount separated for reuse by weight.

D. Disposal: Final deposition of construction and demolition or inert debris into land, including stockpiling onto land of construction and demolition debris that has not been sorted for further processing or resale, if such stockpiling is for a period of time greater than 30 days; and construction and demolition debris that has been sorted for further processing or resale, if such stockpiling is for a period of time greater than one year, or stockpiling onto land of inert debris that is for a period of time greater than one year.

E. Enforcement Agency (EA): Enforcement agency is the authority having jurisdiction within the Project location.

F. Inert Disposal Facility or Inert Waste Landfill: A disposal facility that accepts only inert waste such as soil and rock, fully cured asphalt paving, uncontaminated concrete (including fiberglass or steel reinforcing rods embedded in the concrete), brick, glass, and ceramics, for land disposal.

G. Mixed Debris: Loads that include commingled recyclable and non-recyclable materials generated at the construction site.

H. Mixed Debris Recycling Facility: A processing facility that accepts loads of commingled construction and demolition debris for the purpose of recovering re-usable and recyclable materials and disposing the non-recyclable residual materials.

I. Recycling: The process of sorting, cleansing, treating and reconstituting materials for the purpose of using the altered form in the manufacture of a new product. Recycling does not include burning, incinerating or thermally destroying solid waste.

J. Reuse. The use, in the same or similar form as it was produced, of a material which might otherwise be discarded.

K. Separated for Reuse. Materials, including commingled recyclables, that have been separated or kept separate from the solid waste stream for the purpose of additional sorting or processing those materials for reuse or recycling in order to return them to the economic mainstream in the form of raw material for new, reused, or reconstituted products which meet the quality standards necessary to be used in the marketplace, and includes materials that have been “source separated”.

L. Solid Waste: All putrescible and nonputrescible solid, semisolid, and liquid wastes, including garbage, trash, refuse, paper, rubbish, ashes, industrial wastes, demolition and construction wastes, abandoned vehicles and parts thereof, discarded home and industrial appliances, dewatered, treated, or chemically fixed sewage sludge which is not hazardous waste, manure, vegetable or animal solid and semisolid wastes, and other

discarded solid and semisolid wastes. "Solid waste" does not include hazardous waste, radioactive waste, or medical waste as defined or regulated by State law.

M. Source-Separated: Materials, including commingled recyclables, that have been separated or kept separate from the solid waste stream at the point of generation, for the purpose of additional sorting or processing of those materials for reuse or recycling in order to return them to the economic mainstream in the form of raw materials for new, reused, or reconstituted products which meet the quality standards necessary to be used in the marketplace.

N. Waste Hauler: A company that possesses a valid permit from the local waste management authority having jurisdiction to collect and transport solid wastes from individuals or businesses for the purpose of recycling or disposal.

1.5 ADMINISTRATIVE REQUIREMENTS

A. Submittal Procedures:

1. Action Submittals and Informational Submittals shall be submitted in accordance with Section 01 3300, Submittal Procedures.
2. Closeout Submittals shall be submitted in accordance with Section 01 7700, Closeout Procedures.
3. Sustainable Design Submittals shall comply with the additional requirements of Section 01 8113, Sustainable Design Requirements.

1.6 ACTION SUBMITTALS

A. Contractor’s Construction Waste and Recycling Plan:

1. Review Contract Documents and estimate the types and quantities of materials under the Work that are anticipated to be feasible for on-site processing, source separation for re-use or recycling. Indicate the procedures that will be implemented in this program to effect jobsite source separation, such as, identifying a convenient location where dumpsters would be located, putting signage to identify materials to be placed in dumpsters, etc.
2. Prior to commencing the Work, submit Contractor’s Construction Waste and Recycling Plan. Submit in format provided with this specification section. The Plan must include, but is not limited to the following:
    a. Contractor’s name and project identification information;
    b. Procedures to be used;
    c. Materials to be re-used and recycled;
    d. Estimated quantities of materials;
    e. Names and locations of re-use and recycling facilities/sites;
    f. Tonnage calculations that demonstrate that Contractor will re-use and recycle a minimum of 65% by weight of the construction waste materials generated by the Work.
3. Contractor’s Construction Waste and Recycling Plan must be approved by the Architect prior to the start of Work.

4. Contractor's Construction Waste and Recycling Plan will not otherwise relieve the Contractor of responsibility for adequate and continuing control of pollutants and other environmental protection measures

1.7 INFORMATIONAL SUBMITTALS

A. Contractor's Reuse, Recycling, and Disposal Report:

1. Submit Contractor's Reuse, Recycling, and Disposal Report on the form provided with this specification section with each Application & Certificate for Payment. Failure to submit the form and its supporting documentation will render the Application & Certificate for Payment incomplete and delay progress payments. If applicable, include manifests, weight tickets, receipts, and invoices specifically identifying the Project for re-used and recycled materials:
    a. Reuse of building materials or salvage items on site (i.e. crushed base or red clay brick).
    b. Salvaging building materials or salvage items at an offsite salvage or reuse center (i.e. lighting, fixtures).
    c. Recycling source separated materials on site (i.e. crushing asphalt/concrete for base course, or grinding for mulch).
    d. Recycling source separated material at an offsite recycling center (i.e. scrap metal or green materials).
    e. Use of material as Alternative Daily Cover (ADC) at landfills.
    f. Delivery of soils or mixed inerts to an inert landfill for disposal (inert fill).
    g. Disposal at a landfill or transfer station (where no recycling takes place).
    h. Other (describe).
2. Contractor's Reuse, Recycling, and Disposal Report must quantify all materials generated in the Work, disposed in Class III landfills, or diverted from disposal through recycling. Indicate zero (0) if there is no quantity to report for a type of material. As indicated on the form:
    a. Report disposal or recycling either in tons or in cubic yards. If scales are available at disposal or recycling facility, report in tons; otherwise, report in cubic yards. Report in units for salvage items when no tonnage or cubic yard measurement is feasible.
    b. Indicate locations to which materials are delivered for reuse, salvage, recycling, accepted as daily cover, inert backfill, or disposal in landfills or transfer stations.
    c. Provide legible copies of weight tickets, receipts, or invoices that specifically identify the project generating the material. Said documents must be from recyclers and/or disposal site operators that can legally accept the materials for the purpose of re-use, recycling, or disposal.
        1) Indicate project title, project number, progress payment number, name of the company completing the Contractor's Report and compiling backup documentation, the printed name, signature, and daytime phone number of the person completing the form, the beginning and ending dates of the period covered on the Contractor's Report, and the date that the Contractor's Report is completed.

3. Demonstrate compliance with California Code of Regulations, Title 24, Part 11 California Green Building Standards Code, "CAL-Green" 5.408.2, to the satisfaction of the enforcing agency.
    a. Landfill and Incinerator Disposal Records: Indicate receipt and acceptance of waste by landfills and incinerator facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.
    b. Recycling and Processing Facility Records: Indicate receipt and acceptance of recyclable waste by recycling and processing facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.

PART 2 - PRODUCTS-NOT USED

PART 3 - EXECUTION

3.1 WASTE MANAGEMENT PLAN

A. Implement procedures for disposal of materials, as specified in Contractor's Construction Waste and Recycling Plan, which are not diverted for re-use, salvage or recycling.

1. Identify materials to be diverted from disposal by efficient usage, recycling, reuse on the project, or salvage for future use or sale.
2. Determine if materials will be sorted on-site or mixed.
3. Identify diversion facilities where material collected will be taken.
4. Specify that quantities of diverted material will calculated by weight or volume, but not both.

3.2 SALVAGE, RE-USE, RECYCLING AND PROCEDURES

A. Re-use, Salvage, and Recycling Facilities: As specified in Contractor's Construction Waste and Recycling Plan.

B. Develop and implement procedures to re-use, salvage, and recycle new construction and excavation materials, based on the Contract Documents, the Contractor's Construction Waste and Recycling Plan, estimated quantities of available materials, and availability of recycling facilities. Procedures may include on-site recycling, source separated recycling, and/or mixed debris recycling efforts.

1. Identify materials that are feasible for salvage, determine requirements for site storage, and transportation of materials to a salvage facility.
2. Source separate new construction, excavation and demolition materials including, but not limited to the following types.
    a. Asphalt.
    b. Concrete, concrete block, slump stone (decorative concrete block), and rocks.
    c. Drywall.
    d. Green materials (i.e. tree trimmings and land clearing debris).

e. Metal (ferrous and non-ferrous).
f. Miscellaneous Construction Debris.
g. Paper or cardboard.
h. Red Clay Brick.
i. Reuse or Salvage Materials
j. Soils.
k. Wire and Cable.
l. Wood.
m. Other (describe)

3. Miscellaneous Construction Debris: Develop and implement a program to transport loads of mixed (commingled) new construction materials that cannot be feasibly source separated to a mixed materials recycling facility

3.3 DISPOSAL OPERATIONS AND WASTE HAULING

A. Legally transport and dispose of materials that cannot be delivered to a source separated or mixed recycling facility to a transfer station or disposal facility that can legally accept the materials for the purpose of disposal.

B. Use a permitted waste hauler or Contractor's trucking services and personnel. To confirm valid permitted status of waste haulers, contact the local solid waste authority having jurisdiction.

C. Become familiar with the conditions for acceptance of new construction, excavation and demolition materials at recycling facilities, prior to delivering materials.

D. Deliver to facilities that can legally accept new construction, excavation and demolition materials for purpose of re-use, recycling, composting, or disposal.

E. Do not burn, bury or otherwise dispose of solid waste on the project job-site.

3.4 RE-USE AND DONATION OPTIONS

A. Implement a re-use program to the greatest extent feasible. Options may include:

1. California Materials Exchange (CAL-MAX) Program is sponsored by the California Integrated Waste Management Board. CAL-MAX is a free service provided by the California Integrated Waste Management Board, designed to help businesses find markets for materials that traditionally would be discarded. The premise of the CAL-MAX Program is that material discarded by one business may be a resource for another business. To obtain a current Materials Listings Catalog, call CAL-MAX/California Integrated Waste Management Board at (916) 255-2369 or send a FAX to (916) 255-2200. The CALMAX Catalog is available through the Internet Site at http://www.ciwmb/ca.gov/calmax.

3.5 REVENUE

A. Revenues or other savings obtained from recycled, re-used, or salvaged materials shall accrue to Contractor unless otherwise noted in the Contract Documents

END OF SECTION

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Last Updated: December 16, 2021

SECTION 01 7419A

CONTRACTOR'S CONSTRUCTION WASTE AND RECYCLING PLAN

(Submit After Award of Contract and Prior to Start of Work)

Project Title:		
Contract or Work Order No.:		
Contractor's Name:		
Street Address:		
City:	State:	Zip:
Phone: ( )	Fax: ( )	
E-Mail Address:		
Prepared by: (Print Name)		

Date Submitted:		
Project Period:	From:	TO:

Reuse, Recycling or Disposal Processes To Be Used

Describe the types of recycling processes or disposal activities that will be used for material generated in the project. Indicate the type of process or activity by number, types of materials, and estimated quantities that will be recycled or disposed in the sections below:

01 - Reuse of building materials or salvage items on site (i.e. crushed base or red clay brick)
02 - Salvaging building materials or salvage items at an off site salvage or re-use center (i.e. lighting, fixtures)
03 - Recycling source separated materials on site (i.e. crushing asphalt/concrete for reuse or grinding for mulch)
04 - Recycling source separated materials at an off site recycling center (i.e. scrap metal or green matls)
05 - Recycling commingled loads of C&D matls at an off site mixed debris recycling center or transfer station
06 - Recycling material as Alternative Daily Cover at landfills
07 - Delivery of soils or mixed inerts to an inert landfill for disposal (inert fill).
08 - Disposal at a landfill or transfer station.
09 - Other (please describe) _____

Types of Material To Be Generated

Use these codes to indicate the types of material that will be generated on the project

A = Asphalt	C = Concrete	M = Metals	I = Mixed Inert	G = Green Matls
D = Drywall	P/C=Paper/Cardboard	W/C = Wire/Cable	S= Soils (Non Hazardous)	
M/C = Miscellaneous Construction Debris		R = Reuse/Salvage	W = Wood	O = Other (describe)

Facilities Used: Provide Name of Facility and Location (City)

Total Truck Loads: Provide Number of Trucks Hauled from Site During Reporting Period

Total Quantities: If scales are available at sites, report in tons. If not, quantify by cubic yards. For salvage/reuse items, quantify by estimated weight (or units).

SECTION I - RE-USED/RECYCLED MATERIALS

Include all recycling activities for source separated or mixed material recycling centers where recycling will occur.

Type of Material	Type of Activity	Facility to be Used/Location	Total Truck Loads	Total Quantities Tons	Cubic YD	Other Wt.
(ex.) M	04	ABC Metals, Los Angeles	24	355		
a. Total Diversion			0	0	0	0

SECTION 01 7419A

CONTRACTOR'S CONSTRUCTION WASTE AND RECYCLING PLAN

Continued

SECTION II - DISPOSED MATERIALS								
Include all disposal activities for landfills, transfer stations, or inert landfills where no recycling will occur.								
Type of Material	Type of Activity	Facility to be Used/Location			Total Truck Loads	Total Quantities Tons	Cubic YD	Other Wt.
(ex.) D	08	DEF Landfill, Los Angeles			2	35		
b. Total Disposal						0	0	0

SECTION III - TOTAL MATERIALS GENERATED						
This section calculates the total materials to be generated during the project period (Reuse/Recycle + Disposal = Generation						
				Tons	Cubic YD	Other Wt.
a. Total Reused/Recycled				0	0	0
b. Total Disposed				0	0	0
c. Total Generated				0	0	0

SECTION IV - CONTRACTOR'S LANDFILL DIVERSION RATE CALCULATION					
Add totals from Section I + Section II					
	Tons	Cubic Yards	Other Wt.		
a. Materials Re-Used and Recycled	0				
b. Materials Disposed	0				
c. Total Materials Generated (a. + b. = c.)	0	0	0		
d. Landfill Diversion Rate (Tons Only)*	#DIV/0!				

** Use tons only to calculate recycling percentages: Tons Reused/Recycled/Tons Generated = % Recycled*

Contractor's Comments (Provide any additional information pertinent to planned reuse, recycling, or disposal activities):

Notes:

1. Suggested Conversion Factors: From Cubic Yards to Tons (Use when scales are not available)

Asphalt: .61 (ex. 1000 CY Asphalt = 610 tons. Applies to broken chunks of asphalt)

Concrete: .93 (ex. 1000 CY Concrete = 930 tons. Applies to broken chunks of concrete)

Ferrous Metals: .22 (ex. 1000 CY Ferrous Metal = 220 tons)

Non-Ferrous Metals: .10 (ex. 1000 CY Non-Ferrous Metals = 100 tons)

Drywall Scrap: .20

Wood Scrap: .16

SECTION 01 7419B

CONTRACTOR'S REUSE, RECYCLING, AND DISPOSAL REPORT

(Submit With Each Progress Payment)

Project Title:		
Contract or Work Order No.:		
Contractor's Name:		
Street Address:		
City:	State:	Zip:
Phone: ( )	Fax: ( )	
E-Mail Address:		
Prepared by: (Print Name)		

Date Submitted:		
Period Covered:	From:	To:

Reuse, Recycling or Disposal Processes Used

Describe the types of recycling processes or disposal activities used for material generated in the project. Indicate the type of process or activity by number, types of materials, and quantities that were recycled or disposed in the sections below:

01 - Reuse of building materials or salvage items on site (i.e. crushed base or red clay brick)
02 - Salvaging building materials or salvage items at an off site salvage or re-use center (i.e. lighting, fixtures)
03 - Recycling source separated materials on site (i.e. crushing asphalt/concrete for reuse or grinding for mulch)
04 - Recycling source separated materials at an off site recycling center (i.e. scrap metal or green matls)
05 - Recycling commingled loads of C&D matls at an off site mixed debris recycling center or transfer station
06 - Recycling material as Alternative Daily Cover at landfills
07 - Delivery of soils or mixed inerts to an inert landfill for disposal (inert fill).
08 - Disposal at a landfill or transfer station.
09 - Other (please describe) _____

Types of Material Generated

Use these codes to indicate the types of material that were generated on the project

A = Asphalt	C = Concrete	M = Metals	I = Mixed Inert	G = Green Matls
D = Drywall	P/C=Paper/Cardboard	W/C = Wire/Cable	S= Soils (Non Hazardous)	
M/C = Miscellaneous Construction Debris		R = Reuse/Salvage	W = Wood	O = Other (describe)

Facilities Used: Provide Name of Facility and Location (City)

Total Truck Loads: Provide Number of Trucks Hauled from Site During Reporting Period

Total Quantities: If scales are available at sites, report in tons. If not, quantify by cubic yards. For salvage/reuse items, quantify by estimated weight (or units).

SECTION I - RE-USED/RECYCLED MATERIALS

Include all recycling activities for source separated or mixed material recycling centers where recycling occurred.

Type of Material	Type of Activity	Facilities Used/Location			Total Truck Loads	Total Quantities Tons	Cubic YD	Other Wt.
(ex.) M	04	ABC Metals, Los Angeles			24	355		
a. Total Diversion					0	0	0	0

SECTION 01 7419B

CONTRACTOR'S REUSE, RECYCLING, AND DISPOSAL REPORT

Continued

SECTION II - DISPOSED MATERIALS								
Include all disposal activities for landfills, transfer stations, or inert landfills where no recycling occurred.								
Type of Material	Type of Activity	Facilities Used/Location			Total Truck Loads	Total Quantities Tons	Cubic YD	Other Wt.
(ex.) D	08	DEF Landfill, Los Angeles			2	35		
b. Total Disposal						0	0	0

SECTION III - TOTAL MATERIALS GENERATED						
This section calculates the total materials generated during the project period (Reuse/Recycle + Disposal = Generation						
				Tons	Cubic YD	Other Wt.
a. Total Reused/Recycled				0	0	0
b. Total Disposed				0	0	0
c. Total Generated				0	0	0

SECTION IV - CONTRACTOR'S LANDFILL DIVERSION RATE CALCULATION					
Add totals from Section I + Section II					
	Tons	Cubic Yards	Other Wt.		
a. Materials Re-Used and Recycled	0				
b. Materials Disposed	0				
c. Total Materials Generated (a. + b. = c.)	0	0	0		
d. Landfill Diversion Rate (Tons Only)*	#DIV/0!				

** Use tons only to calculate recycling percentages: Tons Reused/Recycled/Tons Generated = % Recycled*

Contractor's Comments (*Provide any additional information pertinent to planned reuse, recycling, or disposal activities*):

Notes:

1. Suggested Conversion Factors: From Cubic Yards to Tons (Use when scales are not available)

Asphalt: .61 (ex. 1000 CY Asphalt = 610 tons. Applies to broken chunks of asphalt)

Concrete: .93 (ex. 1000 CY Concrete = 930 tons. Applies to broken chunks of concrete)

Ferrous Metals: .22 (ex. 1000 CY Ferrous Metal = 220 tons) Drywall Scrap: .20

Non-Ferrous Metals: .10 (ex. 1000 CY Non-Ferrous Metals = 100 tons) Wood Scrap: .16

1.1 SUMMARY

A. Section Includes: Administrative and procedural requirements for Contract closeout.

B. These requirements supplement those included in the General Conditions and are subject to modification upon mutual agreement between the Architect, Owner, and Contractor.

1.2 FINAL CLEANING

A. Immediately prior to completion and occupancy, remove marks, stains, fingerprints, dust, dirt and paint drippings resulting from work of this project, both interior and exterior including roofs, walls, floors, sidewalks, paving and other finished surfaces.

B. Contractor shall engage the services of an independent, professional cleaning service to perform final cleaning after Contractor's final clean-up is completed.

C. Materials:

1. Use only those cleaning materials that will neither create hazards to health or property, damage surfaces, and are in compliance with Proposition 65.
2. Use only those cleaning materials and methods recommended by manufacturer of the surface material to be cleaned.
3. Use cleaning materials only on surfaces recommended by cleaning material manufacturer.
4. Use only environmentally acceptable "green" cleaning products.

D. Clean and polish hardware and other unpainted metals.

E. Remove temporary labels, tags and paper covering.

1.3 REQUIREMENTS PREPARATORY TO FINAL ACCEPTANCE

A. Temporary facilities shall be removed from site.

B. Plumbing, mechanical and electrical equipment shall operate quietly and free from vibration. Properly adjust, repair, balance, or replace equipment producing objectionable noise or vibration in occupied areas of building. Provide additional brackets, bracing, etc., to prevent objectionable noise or vibration. Systems shall operate without humming, surging, or rapid cycling.

C. Operating instructions for equipment shall be properly mounted and posted.

D. Training: Provide training and orientation of Owner's operating staff in proper care and operation of equipment, systems and controls including:

1. Plumbing equipment.
2. Control systems.

3. Other systems as required in the specifications or needed to properly instruct Owner's representatives.
4. Three copies of certificate, signed by the Owner's representative, attesting to their having been instructed.

E. The following shall be submitted in accordance with Section 01 3300, Submittal Procedures.

1. Completed Record Drawings signed by Contractor and Inspector.
2. Maintenance and Operating instructions and manuals.
3. Certifications completed and signed.
4. Guarantees and warranties as specified and required by the General Conditions.

F. Contractor's Final Verified Report (Form DSA 6-C) and other Reports and Affidavits required by Division of State Architect shall be submitted; originals and one copy.

G. Extra Stock shall be delivered and acknowledged by the Owner in quantities specified.

1.4 PUNCH LIST

A. Prior to Architect's punch list, Contractor shall prepare and address initial deficiencies list for all work. Upon completion, this list shall be sent to the Architect.

B. Contractor shall notify Architect when Contractor, with concurrence of Inspector, feels project is complete enough for preparation of Architect's punch list.

C. Architect will then notify appropriate consultants including civil, mechanical and electrical engineers, landscape architect, food service designer and others as needed, to make their inspections and prepare "punch lists". Consultant "punch lists" will be completed before Architect will make its "punch list".

D. Architect will prepare a "punch list".

E. Punch lists will be published within 14 days of Architect's walk through.

F. Work on the punch list, except minor items as determined by the Architect, shall be completed prior to completion and occupancy.

1.5 FINAL ACCEPTANCE

A. After requirements preparatory to Final Acceptance have been completed as hereinbefore specified, Contractor shall notify Architect to perform acceptance tour. Notice shall be given at least three days in advance of the time the acceptance tour is to be performed.

B. Contractor or its principal superintendents authorized to act in behalf of Contractor, shall accompany Architect and Inspector on acceptance tour, as well as any principal subcontractors that Architect may request to be present.

C. If work has been completed in accordance with Contract Documents, and no further corrective measures are required, Architect will recommend Final Acceptance to the Owner and initiate the filing of the Notice of Completion.

D. If work has been substantially completed in accordance with Contract Documents, and only minor corrective measures are required, Architect will recommend that Owner conditionally accept Project and file Notice of Completion based upon Contractor's assurance that corrective measures will be completed within shortest practicable time period (but absolutely not later than 30 days).

E. If work has not been substantially completed in accordance with Contract Documents, and several or many corrective measures are still required, Architect will recommend one or the other of the following:

1. That Owner accept Project and file Notice of Completion only upon receiving from Contractor a Cashier's Check in amount sufficient to account for corrective measures still required, in the event that Owner had to have others complete the work.
2. That Owner not accept project and not file Notice of Completion. Instead, based on information gathered from acceptance tour, Contractor will be required to complete all corrective measures and then call for another project acceptance tour following procedure outlined above.

F. Should any corrective measures remain incomplete at time final payment is due, Contractor shall provide Owner with Money Order(s) or Cashier's Check in exchange for retention. Money Order(s) or Cashier's Check shall be in an amount one and one-half times the agreed estimated cost as determined by the Architect.

G. Upon Final Acceptance of Project by Owner, Contractor shall submit his request for final payment, less retention. Retention payment will not be made by Owner until 35 days after board acceptance and filing of Notice of Completion with County Recorder, as specified in General Conditions.

H. Retention payment will not be made until Contractor has filed the required Form DSA 6-C with DSA with two original copies to the Architect.

1.6 CLOSEOUT CHECKLIST

A. The following items are to be fully completed and/or submitted as a condition for final acceptance of the project (as applicable)

1. Specifications and Plans Review for Closeout
2. Fire Alarm System Certification
3. Megger Grounding Test Certificate
4. Certificate of Chlorination and Sterilization
5. Certificate of Compliance for Building Materials
6. Contractor’s Reuse, Recycling and Disposal Report
7. Environmental Product Certification as required under Section 01 3543

8. Indoor Air Quality Report (Section 01 3543)
9. Certifications as required under Section 01 3300.
10. Operation & Maintenance Manuals
11. Guarantees/Warranties
12. Training
13. Record Drawings
14. Labels and name plates on all electrical panels
15. Keys (from Contractor - properly labeled)
16. Punch List Items Completed
17. Extra Stock of Specified Items, delivered to Owner (including documents)
18. Back charges Resolved
19. Removal of Stop Notices
20. Contractor's Final Verified Reports (DSA 6-C)

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Requirements for explicit warranties, guarantees, bonds, and service and maintenance contracts specified in the individual Sections and supplementing the requirements included in the General Conditions and Supplementary Conditions.
2. Guarantee and warranty period inspections.
3. Forms for Guarantees/Warranties.

1.2 RELATED REQUIREMENTS

A. Section 01 3300, Submittal Procedures; additional requirements and submittal procedures for guarantees/warranties.

1.3 DEFINITIONS

A. General: The following definitions apply to the language used in these Specifications.

B. Warranty: A representation or affirmative covenant that the work will be performed in accordance with certain standards stated in the Contract, such as in "a good and workmanlike manner," and otherwise be free of defects and in conformity with the Contract Documents for the duration noted or, if a duration is not indicated, the statute of limitations period for contract breaches will constitute the time frame for enforcement.

C. Guarantee: A provision of the warranty which becomes operative after completion of the work under the Contract and requires replacement of defective or non-conforming materials or equipment, or remedy improper workmanship, at the guarantors own cost and expense, for the duration noted under the General Conditions of the Contract or in the Specifications.

D. Standard Product Guarantees/Warranties: Preprinted written documents published by individual manufacturers for particular products and specifically endorsed by the manufacturer to the Owner.

E. Contractor Standard Guarantee: The Contractor’s guarantee for the term included in the General Conditions.

F. Subcontractor Standard Guarantee: A Subcontractor’s guarantee period that coincides with the term of the Contractor’s guarantee included in the General Conditions.

G. Special Guarantees/Warranties: Written guarantees/warranties required by or incorporated in the Contract Documents to be provided by the Contractor or its Subcontractors to either extend time limits of the Standard Guarantees/Warranties included in the General Conditions or to provide greater rights for the Owner.

1.4 GENERAL REQUIREMENTS

A. Guarantees/warranties between Contractor and manufacturers and between Contractor and suppliers shall not affect those issued to the Owner.

B. Contractor shall not be held responsible for defects due to misuse, negligence, willful damage, improper maintenance, or accident caused by others nor shall it be responsible for damaged parts whose replacement is necessitated by failure of Owner's maintenance forces to properly clean and service them, provided that Contractor has furnished complete operating and maintenance instructions to Owner.

C. By terms of each guarantee/warranty, unless otherwise specified or stipulated, also agree to remove and replace other work, as required, that has been connected to or superimposed on substrate material to be replaced.

D. In addition to other requirements specified:

1. Compile specified service and maintenance contracts.
2. Coexecute submittals when specified.
3. Review submittals to verify compliance with Contract Documents.
4. Submit to Architect for review and transmittal to Owner.

E. In case of items remaining incomplete after date of filing of the Notice of Completion, the guarantee/warranty period shall run from the date of acceptance of such items.

F. Special guarantees/warranties applicable to definite parts of the Work and as specifically stipulated in the respective Sections of the Specifications or other Contract Documents shall be subject to the terms of this Section.

G. If repairs or changes are required in connection with the work within a guarantee/warranty period, the Contractor shall, promptly upon receipt of notice from the Owner and without expense to the Owner, comply with the following:

1. Correct defects and place in satisfactory condition the work covered by the respective guarantee/warranty.
2. Repair, to the satisfaction of the Owner, damage to the Buildings and/or site that is the result of the cause for said repairs and changes.
3. Repairs and corrective work shall be made to the satisfaction of the Owner including the equipment and contents of the Buildings and/or site disturbed during performance of the guarantee/warranty work.

H. The Owner may, at its sole discretion, proceed with the correction work at Contractor’s expense if Contractor does not proceed with the corrective work within a reasonable time fixed by a written notice from the Owner.

1. As part of the corrective work, the Owner reserves the right to remove and store or dispose of defective equipment or material at Contractor’s expense.
2. If Contractor does not pay the costs of such removal and storage within ten days thereafter, the Owner may, upon ten additional days’ written notice, sell such

defective items and shall account for the net proceeds after deducting all the costs that should have been borne by the Contractor, including compensation for the Architect's additional services.

3. If the proceeds from the sale are insufficient to cover all amounts chargeable to Contractor, Contractor shall pay the difference to the Owner.

I. If repairs or changes are required in connection with guarantee/warranty work and notice is given within the guarantee/warranty period, the warranty shall continue until the corrective work has been completed, regardless of the termination of the specified guarantee/warranty period.

J. In case of work performed by subcontractors and where a special guarantee/warranty is required, guarantees/warranties addressed to and in favor of the Owner shall be secured from said subcontractors.

K. No provision in the Contract Documents or in any special or general guarantee/warranty shall be held to limit, as to time or scope of liability, the Contractor's liability for defects or the liability of its sureties to less than the legal limit of liability under laws having jurisdiction.

L. The delivery of any guarantees/warranties shall not relieve the Contractor from any obligation assumed under any other provision of the Contract Documents.

M. The obligation of the Contractor under this Section shall survive the termination of the Contract.

1.5 SUBMITTAL REQUIREMENTS

A. Assemble guarantees/warranties, bonds, and service and maintenance contracts executed by each of the respective manufacturers, suppliers, and subcontractors.

B. Format:

1. Size: 8-1/2-inch-by 11-inch sheets, punched for three-ring binder. Fold larger sheets to fit into binders.
2. Binders: Commercial quality, three-ring, "View" type, with durable and cleanable plastic covers.
3. Cover: Identify each packet with typed or printed title, "GUARANTEES/WARRANTIES," and list the title of Project and name of Contractor.

C. Contents:

1. Neatly typed, in orderly sequence.
2. Provide complete information for each item including:
    a. Product or work item.
    b. Firm name with name of principal, address, and telephone number.
    c. Beginning date and duration of warranty, bond, or service and maintenance contract.

3. Provide the following information for Owner's personnel:
   a. Proper procedure in case of failure.
   b. Circumstances that might affect the validity of guarantee/warranty or bond.
4. Contractor's name, name of responsible principal, address, and telephone number.

D. Refer to Section 01 3300, Submittal Procedures, for additional requirements.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 TIME OF SUBMITTALS

A. Typical: Within 30 days after filing date of Notice of Completion.

B. Equipment or component parts of equipment put into service during progress of construction; submit documents within 10 days after inspection and acceptance.

C. Items of work, where acceptance is delayed materially beyond date of filing date of Notice of Completion; provide updated submittal within 14 days after acceptance, listing date of acceptance as start of guarantee/warranty period.

3.2 GUARANTEE PERIOD INSPECTIONS

A. Contractor and subcontractors performing the construction work are required to guarantee workmanship and materials for the period noted in the Contract. Within a month of the end of such guarantee period, Contractor's agent shall prepare an inspection report indicating the condition of the Owner's facility and related common facility, itemizing the work to be completed, performed and/or corrected. Such guarantee period shall be continued in effect and extended until such time as Owner submits to Contractor written confirmation of the satisfactory completion of the itemized work, which confirmation shall be submitted within a reasonable period of time.

3.3 GUARANTEE/WARRANTY FORMS

A. Contractor Standard Guarantee: Submit the following written Standard Guarantee/Warranty form for the overall Work against defects in materials and workmanship for the period of guarantee/warranty required under the Contract after the filing of the Notice of Completion (included with this section).

B. Subcontractor Standard Guarantee: Submit the following written Standard Guarantee/Warranty form for Subcontracted Work against defects in materials and workmanship for the period of guarantee/warranty required under the Contract after the filing of the Notice of Completion (included with this section).

C. Subcontractor Special or Extended Guarantee/Warranty: Contractor shall have its Subcontractor submit the following Special Extended Written Guarantee/Warranty, typed

on Subcontractor's letterhead, when required by a Specification Section for a period in excess of 2 years (included with this section).

END OF SECTION

(Letterhead of Contractor)

STANDARD GUARANTEE / WARRANTY

for

_____

Project Name

_____

Contract No.

We hereby warrant that the Work we have provided under the above reference Contract has been completed in accordance with the Drawings, Specifications, and other Contract Documents.

Under the terms of this warranty, we agree to repair or replace any or all of our work, together with any other adjacent work which may be displaced or damaged by so doing, which may prove to be either patently defective in its workmanship or latently defective in its workmanship or materials within the period of 24 months from the date of filing of the Notice of Completion of the above named Project by the Board of Trustees of the School District, and we also agree to repair any and all damages resulting from such defects, without any expense whatsoever to said Board of Trustees, ordinary wear and tear and unusual abuse or neglect excepted.

In the event of our failure to comply with above-mentioned guarantee conditions within ten (10) day after being notified in writing by the Owner, we collectively and separately do hereby authorize the Owner to have said defective work and damages repaired or replaced and made good at our expense and will honor and pay the costs and charges therefore upon demand.

SIGNED (Contractor) _____

_____

(Address)

_____ _____

(Printed Name of Authorized Representative) Signature

_____ _____

(License Number) (Date of Signing)

COUNTERSIGNED (Owner) _____

_____ _____

(Printed Name of Authorized Representative) Signature

Date of Filing or Notice of Completion:_____

(Letterhead of Company)

SUBCONTRACTOR STANDARD GUARANTEE / WARRANTY

We hereby warrant that

_____

which we have provided in _____
Name of Project

for _____
District

has been completed in accordance with Specification Section _____ and requirements of the Contract Documents.

Under the terms of this warranty, we agree to repair or replace any or all of our work, together with any other adjacent work which may be displaced or damaged by so doing, which may prove to be either patently defective in its workmanship or latently defective in its workmanship or materials within a period of 24 months from date of filing the Notice of Completion of the above-named Project by the Board of Trustees of the School District without any expense whatsoever to said Board of Trustees, ordinary wear and tear and unusual abuse or neglect excepted.

In the event of our failure to comply with above-mentioned guarantee conditions within ten (10) day after being notified in writing by the Owner, we collectively and separately do hereby authorize the Owner to have said defective work and damages repaired or replaced and made good at our expense and will honor and pay the costs and charges therefore upon demand.

SIGNED (Subcontractor)

_____
(Signature)

_____
(Company Name)

_____
(Address)

_____ _____
(License Number) (Date of Signing)

COUNTERSIGNED (General Contractor)

_____
(Signature)

_____
(Company Name)

_____
(Address)

_____ _____
(License Number) (Date of Signing)

(Letterhead of Company)

SPECIAL EXTENDED WRITTEN GUARANTEE / WARRANTY

We hereby warrant that

_____

which we have provided in _____
Name of Project

for _____
District

has been completed in accordance with Specification Section _____ and requirements of the Contract Documents.

Under the terms of this warranty, we agree to repair or replace any or all of our work, together with any other adjacent work which may be displaced or damaged by so doing, which may prove to be either patently defective in its workmanship or latently defective in its workmanship or materials within a period of _____ year(s) from date of filing the Notice of Completion of the above-named Project by the Board of Trustees of the School District without any expense whatsoever to said Board of Trustees, ordinary wear and tear and unusual abuse or neglect excepted. We also agree to repair any and all damages resulting from such defects.

In the event of our failure to comply with above-mentioned conditions within a reasonable time but in no case longer than ten (10) calendar days after being notified in writing by the Owner, we collectively and separately do hereby authorize the Owner to have said defective work and damages repaired or replaced and made good at our expense and will honor and pay the costs and charges therefore upon demand.

SIGNED (Subcontractor)

_____
(Name)

_____
(Address)

_____

_____ _____
(License Number) (Date of Signing)

COUNTERSIGNED (General Contractor)

_____
(Name)

_____
(Address)

_____

_____ _____
(License Number) (Date of Signing)

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes general requirements and procedures for compliance with California Code of Regulations, Title 24, Part 11 California Green Building Standards Code, "CAL-Green".

1. Chapter 5- Non-Residential Mandatory Measures.

1.2 RELATED REQUIREMENTS

A. Section 01 3543, Environmental Procedures.

B. Section 01 6116, Volatile Organic Compound (VOC) Restrictions.

C. Section 01 7419, Construction Waste Management and Disposal.

D. Section 01 7700, Closeout Procedures.

1.3 DEFINITIONS

A. CAL-Green Definitions: Certain terms are defined by CAL-Green in Chapter 5 of the code. Words and terms used in this section shall have the meanings shown therein.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Respond to questions and requests from Architect and the jurisdiction having authority regarding CAL-Green credits that are the responsibility of the Contractor, that depend on product selection or product qualities, or that depend on Contractor's procedures. Document responses as informational submittals.

1.5 SUBMITTALS

A. CAL-GREEN Submittals: Submit CAL-GREEN submittals required by code and in other Specification Sections.

1. CAL-GREEN submittals are in addition to other submittals. If submitted item is identical to that submitted to comply with other requirements, submit duplicate copies as a separate submittal to verify compliance with indicated CAL-GREEN requirements.
2. Acceptable verification submittals are specified in the related sections.

PART 2 - PRODUCTS

2.1 REQUIREMENTS - GENERAL

A. Provide products and procedures necessary to confirm CAL-GREEN compliance required in this Section. Although other Sections may specify some CAL-GREEN requirements, the Contractor shall determine additional materials, techniques, means, methods and procedures necessary to comply with CAL-GREEN requirements.

2.2 STORM WATER POLLUTION PREVENTION PLAN

A. Section 5.106.1: Comply with requirements of this code section, local ordinances, General Conditions, Special Provisions, and related sections specifying erosion control.

2.3 OUTDOOR WATER USE

A. Section 5.304.3.1: Irrigation Controllers: Comply with requirements of this code section, local ordinances and Section 32 8000.

2.4 CONSTRUCTION WASTE REDUCTION

A. Section 5.408 Construction Waste Management, Diversion and Recycling: Comply with requirements of this code section, local ordinances and Section 01 7419.

2.5 BUILDING MAINTENANCE AND OPERATION

A. Section 5.410.2.3, 4. Commissioning and Functional Performance Testing: Participate in Commissioning and provide functional performance testing as required by these code sections and as specified in Section 01 9113.

B. Section 5.410.2.5. Documentation and Training: Provide Operations Training as required by these code sections and as specified in Section 01 7700 and Systems Manual as specified in Section 01 7700.

PART 3 - EXECUTION

3.1 GENERAL

A. Comply with Section 01 7419, Construction Waste Management and Disposal.

B. Comply with execution requirements of related sections and applicable local codes and ordinances.

END OF SECTION

SECTION 22 00 50

BASIC PLUMBING MATERIALS AND METHODS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Valve boxes.
   2. Access Doors.
   3. Expansion loops.
   4. Flexible joints.
   5. Insulation.

1.2 RELATED REQUIREMENTS

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.

1.3 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.

C. Plumbing work done under this contract shall not adversely affect the operation of the existing plumbing systems.

1.4 REFERENCES AND 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.

B. Requirements of Regulatory Agencies:

1. The publications listed below form part of this specification; comply with provisions of these publications except as otherwise shown or specified.
   a. California Building Code, 2022.
   b. California Electrical Code, 2022.
   c. California Energy Code, 2022.
   d. California Fire Code, 2022.
   e. California Green Building Standards Code, 2022.
   f. California Mechanical Code, 2022.
   g. California Plumbing Code, 2022.
   h. California Code of Regulations, Title 24.
   i. California Health and Safety Code.
   j. CAL-OSHA.
   k. California State Fire Marshal, Title 19 CCR.
   l. National Fire Protection Association.
   m. Occupational Safety and Health Administration.
   n. Other applicable state laws.

2. 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.

1.5 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 acces-

sories 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.

1.6 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.

1. 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.

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. Coordination:

1. General:

a. Coordinate plumbing Work with trades covered in other Specifications Sections to provide a complete, operable and sanitary installation of the highest quality workmanship.

2. Electrical Coordination:

a. 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:

1) Review the Electrical Drawings and Division 26 Specifications to verify that electrical services provided are adequate and compatible with equipment requirements.
2) 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.
3) Prior to proceeding with installation of additional electrical work, submit detailed drawings indicating exact scope of additional electrical work.

3. Mechanical Coordination:

a. Arrange for pipe spaces, chases, slots and openings in building structure during progress of construction, to accommodate mechanical system installation.
b. Coordinate installation of supporting devices. Set sleeves in poured-in-place concrete and other structural components during progress of construction.
c. 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.”
d. Coordinate with other trades 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 other trades as required for a completely coordinated project.

1.7 SUBMITTALS - GENERAL

A. Refer to Division 01 Submittals Section(s) for additional requirements.

B. 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.

C. 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.

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.

D. 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.

E. 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.

F. Furnish to the Project Inspector complete installation instructions on material and equipment before starting installation.

1.8 ACTION SUBMITTALS

A. Product Data: Submit manufacturer's technical product data and installation instructions for plumbing systems materials and products.

B. Shop Drawings.

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 116875. Provide submittal information for products third-party certified by an approved laboratory as complying with California Health and Safety Code Section 116875.

D. Delegated-Design Submittals: For seismic supports, anchorages, restraints, and vibration isolators 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. Include design calculations and details for selecting vibration isolators and vibration isolation bases complying with performance requirements, design criteria, and analysis data signed and sealed by the California registered structural engineer responsible for their preparation.
3. Supports, anchorages and restraints for piping, ductwork, and equipment shall be an OSHPD pre-approved system such as TOLCO, ISAT, 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. Gas pipe bracing shall be designed in accordance with California Building Code Section 1615A.1.22 and ASCE 7-10 Section 13.6. Coefficient I_p = 1.5 shall be used for gas piping bracing calculations.
    b. 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 2022 California Building Code
4. Additional Requirements: In addition to the above, conform to all state and local requirements.

1.9 INFORMATIONAL SUBMITTALS

A. Provide layouts for plumbing systems, for inclusion in coordinated layout specified in Section 23 80 00. Comply with requirements for layouts specified in Section 23 80 00.

1.10 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data:

1. Refer to Division 01 for complete instructions.
2. 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. Begin compiling data upon approval of submittals.

    a. Sets shall incorporate the following:

        1) Product Data.
        2) Shop Drawings.
        3) Record Drawings.
        4) Service telephone number, address and contact person for each category of equipment or system.
        5) Complete operating and maintenance instructions for each item of plumbing equipment and systems.
        6) Copies of guarantees/warrantees for each item of equipment and systems.
        7) Test data and system balancing reports.
        8) Typewritten maintenance instructions for each item of equipment listing lubricants to be used, frequency of lubrication, inspections required, adjustment, etc.
        9) Manufacturers' bulletins with parts numbers, instructions, etc., for each item of equipment.
        10) Control diagrams and literature.
        11) 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.
        12) Check test and start reports for each piece of plumbing equipment provided as part of the Work.
        13) 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.

B. Record Drawings:

1. Refer to Division 01, Record Documents, for requirements governing Work specified herein.
2. Upon completion of the work, deliver to Architect the following:

    a. Originals of drawings showing the Work exactly as installed.

b. One complete set of reproducible drawings showing the Work exactly as installed.
c. One compact disc with complete set of drawings in PDF format showing the Work exactly as installed.
d. Provide Contractor's signature, verifying accuracy of record drawings.
e. Obtain the signature of the Project Inspector for all record drawings.

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 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of plumbing 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 plumbing systems work similar to that required for this Project.

C. 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 116875.

D. Comply with applicable portions of California Plumbing Code pertaining to selection and installation of plumbing materials and products.

E. All materials and products shall be new and shall match existing.

1.13 DELIVERY, STORAGE, AND HANDLING

A. Protect equipment and piping delivered to Project site from weather, humidity and temperature variations, dirt, dust and other contaminants.

1.14 FIELD CONDITIONS

A. Contractor shall visit Project site and examine existing conditions in order to become familiar with Project scope. Verify dimensions shown on Drawings at Project site. Bring discrepancies to the attention of Architect. Failure to examine Project site shall not constitute basis for claims for additional work because of lack of knowledge or location of hidden conditions that affect Project scope.

B. 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.

1.15 WARRANTY

A. Refer to Division 01 for warranty requirements, and duration and effective date of Contractor’s Standard Guarantee.

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 warranty requirements within a reasonable length of time after notification is given, the Architect/Owner shall have the repairs made at the Contractor's expense.

PART 2 - PRODUCTS

2.1 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.

2.2 MATERIALS AND PRODUCTS

A. No material installed as part of this Work shall contain asbestos.

B. 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).

2.3 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.

2.4 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.

2.5 THERMAL AND SEISMIC 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. Return bend section shall have support lug and plugged FPT drain. Flexible hose shall consist of corrugated metal inner hose and braided metal outer sheath. Assemblies shall be constructed from materials compatible with the fluid or gas being conveyed and shall be suitable for the system operating pressure and temperature. Provide assembly selected for 4 inches of movement.

B. Provide CSA certified expansion loops 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. Basis-of-Design Product: Subject to compliance with requirements, provide Metraflex Inc., Metraloop series, or comparable product by one of the following, or equal:

1. Flexicraft Industries.

2.6 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.

2.7 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.

2.8 EQUIPMENT IDENTIFICATION

A. Identify each piece of equipment with a permanently attached engraved bakelite plate, 1/2 inch high white letters on black background.

2.9 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. For insulating domestic hot water pumps, refer to Section 225000, Plumbing Equipment,
2. 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).
3. Adhesives and sealants shall comply with testing and product requirements of South Coast Air Quality Management District, Rule 1168.
4. The term "piping" used herein includes pipe, valves, strainers and fittings.
5. 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.
6. Provide pre-formed PVC valve and fitting covers.

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 or ASTM E84.
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 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.
2.

PART 3 - EXECUTION

3.1 EXISTING MATERIALS

A. Remove existing equipment, piping, wiring, construction, etc., which interferes with Work of this Contract. Promptly return to service upon completion of work in the area. Replace items damaged by Contractor with new material to match existing.

B. Removed materials which will not be re-installed and which are not claimed by Owner shall become property of Contractor and shall be removed from Project site. Consult Owner before removing any material from Project site. Carefully remove materials claimed by Owner to prevent damage and deliver to Owner-designated storage location.

C. Existing piping and wiring not reused and are concealed in building construction may be abandoned in place and all ends shall be capped or plugged. Remove unused piping and wiring exposed in Equipment Rooms or occupied spaces. Material shall be removed from Project premises. Disconnect power, water, gas, pump or any other active energy source from piping or electrical service prior to abandoning in place.

D. Existing piping, ductwork, and equipment modified or altered as part of this Work shall comply with the most recent applicable code requirements.

3.2 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.

C. Cutting, patching, and repairing of existing construction to permit installation of equipment, and materials is the responsibility of Contractor. Repair or replace damage to existing work with skilled mechanics for each trade.

D. Cut existing concrete construction with a concrete saw. Do not utilize pneumatic devices.

E. Core openings through existing construction for passage of new piping and conduits. Cut holes of minimum diameter to suit size of pipe and associated insulation installed. Coordinate with building structure, and obtain Structural Engineer's approval prior to coring through existing construction.

3.3 PLUMBING DEMOLITION

A. Refer to Division 01 Sections “Cutting and Patching” and “Selective Demolition” for general demolition requirements and procedures.

B. Disconnect, dismantle and remove mechanical systems, equipment, and components indicated to be removed. Coordinate with all other trades.

1. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
2. Piping to Be Abandoned in Place: Drain piping and cap or plug piping to remain with same or compatible piping material. Refrigerant system must be evacuated per EPA requirements.
3. Equipment to Be Removed: Drain down and cap remaining services and remove equipment.
4. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
5. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.

C. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

3.4 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.

3.5 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.

3.6 PRIMING AND PAINTING

A. Perform priming and painting on the equipment and materials as specified herein.

B. See Division 09 Painting Section(s) for detailed requirements.

C. Priming and Painting:

1. Exposed ferrous metals, including piping, which are not galvanized or factory-finished shall be primed and painted.

    a. Black Steel Piping:

        1) Primer: One coat gray Sherwin-Williams Pro Industrial Pro-Cryl Universal Primer, comparable products by Rust-Oleum, Kelly Moore, or equal.
        2) Topcoat: Two coats gray Sherwin-Williams Pro Industrial Waterbased Alkyd Urethane Enamel, comparable products by Rust-Oleum, Kelly Moore, or equal.

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 shall be masked off prior to painting. When painting is completed, remove masking material.

3.7 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 100 percent of the material 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.

3.8 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.

3.9 PIPING SYSTEMS INSTALLATION

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. 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 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.
13. 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.
14. 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.

15. 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. 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.
c. Trapeze Supporting Rods: Shall have a safety factor of five; securely anchor to building structure.
d. 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.
e. 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.
f. Steel Connectors: Beam clamps with retainers.

6. Support to Structure:

a. Wood Structure: Provide and install wood blocking as required to suit structure. Provide lag screws or through bolts with length to suit requirements, and with size (diameter) to match the size of hanger rods required.

1) Do not install Lag screws in tension without written review and acceptance by Structural Engineer.

Side Beam Angle Clip	B-Line B3062---MSS Type 34
Side Beam Angle Clip	B-Line B3060
Ceiling Flange	B-Line B3199

2) Blocking for support of piping shall be not less than 2 inch thick for piping up to 2 inch size. Provide 3 inch blocking for piping up through 5 inch size, and 4 inch blocking for larger piping. Provide support for blocking in accordance with Structural Engineers requirements.
3) Where lag screws are used, length of screw shall be 1/2 inch less than the wood blocking. Pre-drill starter holes for each lag screw.

b. 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 support for piping through roof, arranged to anchor piping solidly in place at the roof penetration.
9. 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.
10. Insulate copper tubing from ferrous materials and hangers with two thicknesses of 3 inch wide, 10 mil polyvinyl tape wrapped around pipe.
11. 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.
12. Suspend rods from concrete inserts with removable nuts where suspended from concrete decks. Power actuated inserts will not be allowed.

3.10 UNION AND FLANGE INSTALLATION

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 116875.

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 116875.

C. Locate the unions for easy removal of the equipment, tank, or valve.

3.11 ACCESS DOOR INSTALLATION

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.

3.12 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.

3.13 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 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.

F. 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.

3.14 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.

3.15 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.

3.16 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.
6. Make connections to existing systems with flanged connection. During testing of new work, provide a slip-in plate to restrict test pressure to new systems. Remove plate and make final connection to existing system at completion of testing.

    a. Authority having jurisdiction shall witness final connection to system.

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.

3.17 TRACER WIRES

A. Provide tracer wire for non-metallic gas and water pipe in ground outside of buildings. Use AWG #14 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.

3.18 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.

3.19 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.

3.20 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.

3.21 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.

3.22 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

1.1 SUMMARY

A. Section Includes:

1. Pipe and fittings.
2. Valves.
3. Gas piping specialties.

1.2 RELATED REQUIREMENTS

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.

1.3 ACTION SUBMITTALS

A. For additional requirements, refer to Section 22 00 50, Basic Plumbing Materials and Methods.

B. Product Data: Submit manufacturer's technical product data and installation instructions for plumbing piping systems materials and products.

1.4 INFORMATIONAL SUBMITTALS

A. For additional requirements, refer to Section 22 00 50, Basic Plumbing Materials and Methods.

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.

1.5 CLOSEOUT SUBMITTALS

A. For additional requirements, refer to Section 22 00 50, Basic Plumbing Materials and Methods.

B. Maintenance Data: Submit maintenance data and parts lists for plumbing piping systems materials and products. Include this data in Operation and Maintenance Manual.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish to Owner, with receipt, one valve key for each key operated hydrant, bibb, or faucet installed.

1.7 QUALITY ASSURANCE

A. For additional requirements, refer to Section 22 00 50, Basic Plumbing Materials and Methods.

B. Gas Pipe Installer Qualifications: Individuals performing tasks requiring qualifications under Federal and State regulations shall be qualified by the gas utility supplying Project site. The qualifications shall be current at the time of performing the Work.

C. NFPA/ANSI Compliance: Fabricate and install natural gas systems in accordance with latest edition of NFPA 54/ANSI Z223.1 "National Fuel Gas Code."

D. Pipe Welding: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

E. Fabricate and install natural gas systems in accordance with California Plumbing Code.

F. Utility Compliance: Fabricate and install natural gas systems in accordance with local gas utility company requirements.

PART 2 - PRODUCTS

2.1 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.

B. Potable-water piping and components shall comply with NSF 14, NSF 61, and NSF 372. Plastic piping components shall be marked with "NSF-pw."

2.2 PIPE AND FITTINGS ATTACHED TO AND BELOW BUILDINGS INCLUDING 5 FEET FROM BUILDINGS

A. Piping and fittings attached to covered walkways and corridors shall comply with the requirements of this article.

B. Gas Pipe: Schedule 40 black steel conforming to ASTM A53, with malleable iron threaded 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 Flexible Connectors for Indoor Equipment Without External Spring Isolation:

a. Contractor may choose one of the following:

1) Direct gas pipe connection.
2) Appliance flexible connector:

a) Comply with ANSI Z21.24.

b) Polymer or hot-dipped PVC coated corrugated 304 stainless steel.
c) Operating-Pressure Rating: 0.5 psig.
d) End Fittings: Zinc-coated steel.
e) Maximum Length: 30 inches.
f) Manufacturers: Dormont, Series 30C, 31, 40C, 41, and 51, Brasscraft model ProCoat, or equal.

b. Provide with end connections compatible with equipment and piping system.
c. Equipment located in spaces normally accessible to building occupants, other than maintenance personnel, shall utilize direct gas pipe connection.
d. Provide anti-microbial PVC coating for use with appliances located in kitchen areas.

2. Flexible Gas Connector for Outdoor Equipment Without External Spring Isolation:

a. Contractor may choose one of the following:

1) Direct gas pipe connection.
2) Corrugated stainless steel hose with 304 stainless steel braid covering, CSA certified. Metraflex model GASCT, Unisource Manufacturing series 400, or equal. Provide with end connections compatible with equipment and piping system.

3. Flexible Gas Connector for Equipment with External Spring Isolation, Indoors and Outdoors:

a. 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 certified for 4 inches of movement in all directions.

4. Flexible Gas Connection System for Movable Gas-Fired Cooking Equipment:

a. System shall include flexible PVC coated braided stainless steel hose, quick disconnect fitting, full port CSA certified ball valve, 2 swivel elbows, coiled steel restraining cable and mounting hardware. Assembly shall be certified per ANSI Z21.69/CSA 6.16, “Connectors for Movable Gas Appliances.” Size as required for appliance connection, 48” minimum hose length. Install per manufacturer’s instructions. Connectors shall be Dormont Safety System, T&S Safe-T-Link, or equal.

2.3 SITE PIPING AND FITTINGS TO 5 FEET FROM BUILDINGS

A. 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.

B. 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.

2.4

2.5 PIPE JOINING MATERIALS

A. Refer to piping Articles in this Section 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. Welding Filler Metals: Comply with ASME B31.1 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

2.6 VALVES AND FITTINGS FOR NON-POTABLE WATER, COMPRESSED AIR, AND GAS SYSTEMS

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: 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.

B. Building Gas Shut-Off Valves:

1. 2 inches and smaller: Provide 175 psi SWP ball valve, CSA listed, full port, lock-wing 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.

C. 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.

D. 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 valves: 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.

E. Seismic Gas Shut-Off Valves: 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.

2.7 GAS PIPING SPECIALTIES

A. Gas Pressure Regulating Valves:

1. 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.
2. 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	Maxitrol, Pietro Fiorentini
3/4 thru 1-1/4inches	Maxitrol, Pietro Fiorentini
1-1/2 thru 2 inches	Maxitrol, Pietro Fiorentini

B. Gas and Air Outlets:

PART 3 - EXECUTION

3.1 EXAMINATION

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.

3.2 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.
2. Where gas supply is connected to equipment with flexible connectors, install drip-leg in piping on downstream side of flexible connector, and install shut off valve on piping on upstream side of flexible connector.

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. For additional requirements, refer to Section 22 00 50, Basic Plumbing Materials and Methods, article, Painting.

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. Provide watertight Schedule 40 PVC conduit to protect gas piping installed below covered walk, covered driveways, and where noted on Drawings. Extend sleeve at least 12 inches beyond any area where it is required to be installed, and terminate with valve box extended to grade, and marked “GAS”.

N. Maintain minimum of 12 inch clearance between gas piping and steam piping above 200 degrees F.

3.3 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. Welded Pipe:

1. Make up with oxyacetylene or electric arc process.
2. All line welds shall be of the single "V" butt type. Welds for flanges shall be of the fillet type.

3. 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.

E. Polyethylene and Polypropylene Pipe: Assemble with fusion joints in strict accordance with manufacturer's instructions.

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, 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.

3.4 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. Gas Shut-Off Valves:

1. Provide line size ball valve in gas line to each appliance.

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.

3.5 INSTALLATION OF 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.

3.6 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. Route gas vent and gas relief to outside.
2. 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.

3.7 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.

3.8 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.

3.9 OPERATIONAL TESTS

A. Test each piece of equipment to show that it will operate in accordance with indicated requirements.

3.10 TESTING AND BALANCING

A. See Section 23 05 93 of Specifications for testing and balancing 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 26 00 00

ELECTRICAL GENERAL REQUIREMENTS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Furnish and install all necessary labor, materials, tools and equipment to perform and completely finish the work according to the intent of this specification, and the accompanying drawings.

B. Furnish and install any incidental work which can reasonably be inferred as required and necessary to provide complete and workable systems.

C. Provide connections of all equipment specified under these sections and other Divisions including Divisions 22 (Plumbing) and 23 (HVAC) including installation and connection of all motors, relays, remote starters, etc.

D. The requirements of the General and Supplemental Conditions, and Division 01 apply to Divisions 26, 27 and 28, and these specifications. All sections in Divisions 26, 27, and 28 are interrelated. Work specified in other sections, as applicable, shall apply to all work hereunder.

1.2 LOCAL 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 proposal. No allowance will be made for extra expenses because of omission on Contractor's part to include cost of work under prevailing conditions.

B. Information shown relative to services is based upon available records and data shall be regarded as approximate only. Minor deviations found necessary to conform with actual locations and conditions shall be made without extra cost.

C. Extreme care shall be exercised in excavating near existing utilities to avoid any damage thereto. It shall be the contractor's responsibility to verify existing underground utilities prior to digging anywhere. Information provided on these plans indicating existing conditions shall only be used as reference, and shall not be deemed considered accurate. Any damage to existing utilities done by the contractor shall be repaired and/or replaced by the contractor at their expense to its pre-damage condition.

1.3 PERMITS AND INSPECTIONS

A. Obtain and pay for all permits and service charges required in installation of the work. Arrange for required inspections and secure approvals from authorities having jurisdiction.

B. During its progress, work shall be subject to inspection by Project Inspector.

1.4 CODES AND STANDARDS

A. Work and materials shall be in full accordance with California Occupational Safety Health Act (CAL-OSHA), California Electrical Code (CEC), State Fire Marshal, Electrical Safety Orders (Title 8, Subchapter 5), the National Fire Protection Association, California Building Code (CBC); California Code of Regulations - Title 24 and other applicable State or local laws or regulations. Nothing in the Drawings or Specifications shall be construed to permit work not conforming to these codes.

B. Electrical materials shall bear the label of, or be listed by, the Underwriter's Laboratories (UL) unless of a type for which label or listing service is not provided.

C. Materials and components shall conform to Industry Standards, including:
1. NEMA - National Electrical Manufacturer's Association
2. ANSI - American National Standards Institute
3. ASTM - American Society for Testing Material Association
4. IPCEA - Insulated Power Cable Engineer's Association
5. CBM - Certified Ballast Manufacturers

D. When Contract Documents differ from governing codes, furnish and install larger size or higher standards called for without extra charge.

1.5 REVIEW OF MATERIALS

A. Prior to commencement of Work and within 35 days after award of contract, submit for approval in accordance with General Conditions all equipment and materials to be furnished.
1. Equipment/Product submittals shall be bound and indexed and shall include a table of contents listing all equipment submitted. The table of contents shall include: Project designation, submittal number, submittal name including specification section, date, and include manufacturer, model number, reference specification paragraph or sheet detail number, description, and page location. Where a group or series of products are submitted, each item does not have to be listed; only the series need to be identified. Example:

Project:

Submittal No.

Submittal Name:

Date:

Spec para.,

Page(s)	Manufacturer	Model No.	Detail No.	Description
1-12	XYZ Corp	123ABC	2.5	Control panel
13,14	XYZ Corp	456DEF	2.6-A	Power supply

15	ABC Corp	789GHK		A/E9.5	Rack
16,17	Cantex	PVC-40		2.1	PVC conduit
18	Steel City	XYZ series	2.2		Steel fittings

2. Shop drawings submittals shall be neat and professionally done using CAD (computer aided drafting), hand-drawn submittals will not be accepted. Shop drawings shall have sufficient information to clearly indicate work to be performed and be complete including device/equipment locations, wire sizes, wire types and number of wires, symbol list or legend, point-to-point connections, wiring diagrams, and equipment anchorage detail where needed. Shop drawings shall utilize the same size paper as the Bid set of plans.

B. Substitutions:
1. Only one request for substitution will be considered on each item of material or equipment. No substitutions will be considered thereafter. Substitutions will be interpreted to be all manufacturers other than those specifically listed by model or catalog number. Should the original submittal of a proposed substitution be rejected, the specified item shall be furnished.
2. Submit complete information or catalog data to show equality of equipment or material offered to that specified. Identify which product is being substituted in the specifications and/or the plans and provide analysis as indicating either it "Complies" or that it "Does Not Comply" and providing a reason. Each Specification paragraph shall be provided with this analysis. No substitutions will be allowed unless requested and approved in writing. Materials of equal merit and appearance, in the opinion of the Engineer, will be approved for use. Engineer reserves the right to require originally specified item.
3. Acceptance of a substitute is not to be considered a release from the Specifications. Any deficiencies in an item, even though approved, shall be corrected by the Contractor at his expense.
4. Responsibility for installation of approved substitution is included herein. Any changes required for installation of approved substituted equipment shall be made without additional cost to Owner.

C. Where it is in the best interest of the Owner, Engineer may give written consent to a submittal received after expiration of designated time limits, or for an additional resubmittal.

D. Submit for approval in ample time to avoid delay of construction, shop drawings or submittals on all items of equipment and materials covered in list mentioned above. Submit in accordance with General Conditions in a complete package; partial submittals will not be considered.

E. Failure to comply with any of the preceding requirements will necessitate that the specified materials be submitted and supplied.

1.6 RECORD DRAWINGS

A. Upon completion of Work, furnish Engineer with AutoCAD file, PDF file, and one printed full size hardcopy upon which shall be shown all Work installed under contract

including any Work which are not in accordance with Original Contract Drawings. AutoCAD files shall be 2004 or later version, with external references bound to its parent drawing. Provide a separate PDF file for each sheet, do not combine all sheets into a single file. Furnish digital files on a USB flash drive or CD.

1. The above shall also include shop drawings.

B. All symbols and designations used in preparing Record Drawing shall match those used in Contract Drawings.

C. Show all buried and concealed conduit, stub-outs, etc. Locate all buried conduit and stub-outs by dimensions from permanent, easily located and identifiable portions of structure; also, dimension ends of stub-outs, etc. Note depth of buried items below grade.

1.7 ADDENDA AND CHANGE ORDERS

A. Changes in the plans and specifications shall be made by Addenda or Change Orders signed by the Engineer.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Materials mentioned herein or on drawings require that each item listed be provided and of quality noted, or an approved equal. All material shall be new, full weight and standard in all respects and in first-class conditions. Where possible, all materials used shall be of the same brand or manufacturer throughout for each class of material or equipment.

B. Grade or quality of materials desired is indicated by trade names or catalog numbers stated herein. Dimensions, sizes and capacities shown are a minimum and shall not be changed without permission of Engineer.

PART 3 - EXECUTION

3.1 DRAWINGS AND COORDINATION

A. Examine Drawings and Site; be familiar with types of construction where electrical installation is involved. Work shall be neatly installed in a workmanlike manner in accordance with NECA Standard of Installation. Work shall be coordinated with other trades to avoid conflicts. Clarifications will be made by Engineer and minor adjustments shall be made without additional cost to Owner. Obtain ruling from Engineer concerning any obvious discrepancies or omissions in work before bidding. All work involved in correcting obvious errors or omissions after award of Contract shall be performed as directed by Engineer without additional cost to Owner.

B. Layouts of equipment, accessories and wiring systems are diagrammatic (not pictorial), but shall be followed as closely as possible. Drawings and Specifications are for assistance and guidance, and exact locations, distances, levels, etc., will be governed by Site.

C. All equipment (devices, conduits, boxes, etc.) shall be flush or semi-flush mounted unless otherwise noted. Where conditions do not allow flush mounting and where acceptable to the Architect, equipment may be surface mounted.

3.2 WORKING SPACE

A. Provide adequate working space around electrical equipment in compliance with Article 4 of Electrical Safety Orders. In general, provide 36 inches minimum clear work space in front of panelboards and controls of 120/208 volt systems and 42 inches minimum for 277/480 volt systems.

3.3 CARE AND CLEANING

A. All broken, damaged or otherwise defective parts shall be repaired or replaced without additional cost to Owner. Work shall be left in a condition satisfactory to Engineer. At completion, carefully clean and adjust all equipment, fixtures and trim installed as part of this work. Systems and equipment shall be left in a satisfactory operating condition.

B. All surplus materials and debris resulting from this work shall be cleaned out and removed from site; this includes surplus excavated material.

3.4 EXCAVATING AND BACKFILLING

A. Excavate and backfill as required for installation of electrical work. Restore all surfaces, roadways, sod, walks, curbs, walls, existing underground installation, etc., cut by installations to original condition in an acceptable manner. Maintain all warning signs, barricades, flares and lanterns as required by the Safety Orders and local ordinances.

B. Excavation: Dig trenches straight and true to line and grade, with bottom clear of any rock points. Minimum conduit depth of pipe crown shall be 24 inches below finished grade.

C. Backfill: Support conduits with 2" sand bedding at bottom of trench. Provide sand backfill from bottom to 12" below finished grade. The top 12" to be local fine earth material free of rubble, rubbish or vegetation. Trenches shall be backfilled and compacted to 90% (per ASTM D1557) of maximum dry density at optimum moisture content in layers not to exceed 6" when compacted.

3.5 PROTECTION

A. In performance of work, protect work from damage. Protect electrical equipment, stored and installed, from dust, water or other damage.

3.6 EQUIPMENT IDENTIFICATION

A. Panelboards, remote control switches, terminal boxes, etc., shall be properly identified with a descriptive nameplate. Nameplate shall be made of 3/32 inch laminated plastic with black background and white letters. Size of letters shall be 1/4 inch high for equipment in device box or boxes 12" or smaller, and 1/2 inch high for panelboard, terminal can, or larger items. Letters shall be machine engraved. Punched strip type nameplates and cardholders in any form are not acceptable. Nameplates shall be attached with oval head machine screws tapped into front panel.

B. Indicate type of equipment and equipment designation, ex. "PANEL-XXX", "MAIN SWITCHBOARD-XXX", "TRANSFORMER-XXX", "SIGNAL-XXX", "TV-XXX", "EF-1", "AC-1", etc.

3.7 RUST INHIBITOR

A. Channels, joiners, hangers, straps, clamps, brackets, caps, nuts and bolts and associated parts shall be plated electrolytically with zinc followed immediately thereafter by treating 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 shall be hot dipped galvanized.

3.8 EQUIPMENT PADS

A. Concrete reinforced pads for mounting of equipment (i.e. switchboard, transformers, freestanding panels, etc.) shall be minimum 3000psi, 6" thick with #4 rebars at 12" on center each way. Rebars shall be centered in pad. Pad shall extend 2" beyond equipment and 1.5" above surrounding area. Backfill and compact to 95% maximum dry density at optimum moisture content in layers not to exceed 6" when compacted.

3.9 EQUIPMENT ANCHORAGE

A. Seismic Anchorage of Electrical equipment shall conform to the regulations of CBC-2019 and ASCE 7-16, Chapters 13 and 29. All equipment shall be braced or anchored to resist a horizontal force acting in any direction using the following criteria:
   1. The total design lateral seismic force shall be determined from section 1613A California Building Code (CBC) 2019 and 13.3 ASCE 7-16. Forces shall be applied in the horizontal directions, which results in the most critical loadings for design.
   2. The value of Ap (component amplification factor) and Rp (component response modification factor) of section 13 .3 .1 ASCE 7-16 shall be selected from section 13.6-1 ASCE 7-16. The value of Ip (seismic importance factor) shall be selected from 13.1.3 ASCE 7-16.

B. Where anchorage details are not shown on the drawings, the field installation shall be subject to the approval of the structural engineer and the District Engineer of the Division of The State Architect.

3.10 ARC FLASH

A. Electrical equipment such as switchboards, panelboards, load centers, motor control centers, industrial control panels, meter centers shall be field marked to warn persons of potential electric arc flash hazards per CEC 110.16 and NFPA 70E Standard for Electrical Safety in the Workplace. Minimum label wording shall be as follows:

   DANGER

   Arc Flash and Shock Hazard.

   Appropriate PPE Required.

   Do not operate controls or open doors without appropriate

   personal protection equipment.

   Failure to comply may result in injury or death.

3.11 TEST

A. Test all wiring and connections for continuity and grounds; where such test indicate faulty insulation or other defects, locate, repair and retest. Balance loads at panelboards. Furnish all testing equipment.

3.12 CLOSING OF AN UNINSPECTED WORK

A. Do not allow or cause any of work installed hereunder to be covered up or enclosed before it has been inspected and approved.

B. 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 conditions in which it was found at time of cutting, all without additional cost to Owner.

3.13 WARRANTY

A. All materials and installation shall be provided with a one (1) year warranty which shall include replacement parts, labor, retesting, and travel to and from the job site. The warranty period shall begin after final acceptance of the project. The warranty shall cover but is not limited to the following:
   1. Defective workmanship and installation.
   2. All System components, devices, conduit, wires, etc.
   3. Manufactured items such as light fixtures, receptacles, switchboard, panelboard, transformer, switches, etc.
   4. Basic materials such as conduit, wires, boxes, cabinets, etc.

B. Certain manufactured items will have longer warranty periods. Refer to specific item and specification section for warranty information and terms.

END OF SECTION

SECTION 26 05 00

BASIC MATERIALS AND METHODS

PART 1 - GENERAL

1.1 SCOPE

A. The work of this Section consists of basic materials and methods for all work included under Divisions 26, 27, and 28. Additional specifications requirements for electrical work are specified under other sections of Divisions 26, 27 and 28 and where those requirements differ from the requirements of this Section, they shall govern.

1.2 SUBMITTALS

A. Submit product data per Section 26 00 00.

PART 2 - PRODUCTS

2.1 CONDUIT

A. Rigid Steel Conduit: Standard weight, mild steel pipe, zinc coated on both inside and outside by a hot dipping or sherardizing process. Inside and outside of conduit shall be finished with a protective coating. All threads galvanized after cutting. Meets UL 6, UL Card #DYIX, and ANSI C80.1.

B. Intermediate Metallic Conduit (IMC): Intermediate weight, mild steel pipe, meeting same requirements for finish and material as rigid steel conduit. Meets UL 1242, UL Card #DYIX, and ANSI C80.6.

C. Electrical Metallic Tubing (EMT): Cold rolled steel tubing, hot-dipped galvanized, with zinc coating on outside and protective lubricating coating on inside. Fittings shall meet same requirements for finish and material as EMT. Meets UL 797 and ANSI C80.3.

D. Flexible Conduit: UL Listed. Flexible steel, zinc coated on both inside and outside by hot dipping or sherardizing process. Liquid-tight conduit shall be galvanized with extruded polyvinyl covering and with watertight connectors, sunlight resistant, direct burial rated. Flexible steel conduit less than 1/2" shall not be used except that 3/8" shall be permitted in lengths not in excess of 6 feet as part of a listed assembly or for tap connections to lighting fixtures as required in CEC Section 410-67(c). Flexible conduit to be one continuous length, no couplings. AFC Liquid-Tuff Type-LFMC and AFC Reduced Wall Flexible Steel Conduit, or equal.

E. Raceway Fittings:

1. Rigid Steel Conduit: Fittings, such as couplings, connectors, condulets, elbows, bends, etc., shall be subject to same requirements as for rigid steel conduit. Couplings and unions shall be threaded type, assembled with anti-corrosion, conductive anti-seize compound at joints made absolutely tight to exclude water. Connectors shall be threaded hubs with bonding insulated metallic bushings. Unions shall be equal to Crouse Hinds UNY or UNF.
2. IMC: Fittings shall be as specified for rigid steel conduit.
3. EMT: Fittings shall be steel, box connectors shall have insulated throat. Connectors and couplings to be compression type.
4. Flexible Metallic Conduit: Connectors to be insulated. Metallic connectors (except for liquid-tight) shall be steel "squeeze" type via a screw, Steel City XC-90X and XC-49X series. Liquid-tight metallic connectors shall be watertight approved for such use.
5. Bushings: Metallic insulated type. Weatherproof or dust-tight installations; liquid-tight with sealing ring and insulated throat, OZ/Gedney type "KR".
6. Expansion and Deflection Fittings: OZ/Gedney, Type "DX" or accepted equal.
7. All box connectors to be insulated throat type.
8. Conduit Straps: Galvanized steel, 2-hole straps. 1-hole straps may be used for conduit sizes 1" and smaller concealed in wall or above ceiling.

F. Metallic conduits, raceways, and fittings shall be listed and approved as a grounding means.

2.2 BOXES

A. Galvanized one-piece or welded pressed steel type. Boxes for fixture shall not be less than 4" square and shall be equipped with fixture stud. Boxes shall be at least 1-1/2" deep, 4" square for 1 or 2 gang devices, with plaster rings and gang box with gang cover. Boxes mounted in wall or ceiling finished with gypsum board shall be furnished with 3/4" deep plaster rings. Use screws and not nails to support/secure outlet boxes. Provide blank cover plates for all boxes without devices.
1. 1-gang and 2-gang outlet and junction boxes installed exposed outdoors shall be weatherproof type FS, FD, WS, WD die cast metal or aluminum boxes, Appleton or equal. Plug all unused hubs.
2. Provide an equipment grounding pigtail at all receptacle, switch, and device outlet boxes. Ground conductor size to match circuit overcurrent protection complying with CEC.
3. Outlet boxes for data, telecommunications, video, and TV outlets shall be 4 11/16" square x 2.125" deep.
4. Outlet boxes containing #8, #6, or #4 AWG wires shall be a minimum 2.125" deep per CEC.

B. Junction boxes located outdoors, or in wet or damp locations shall be rated NEMA-3R, with hinged door and pad-locking tabs.

C. Equipment furnished by other trade but require electrical connection shall be provided with appropriate backbox.

2.3 WIRES

A. Wire shall be copper only, manufactured by General Cable Co., Rome, General Electric Co., or Anaconda. Wire shall be rated 90 degrees C for both dry and wet locations, THWN-2, XHHW-2, or RHW-2 insulation. 90 degrees C THHN may be used in dry and damp locations. Wire installed in high temperature areas, including branch circuits in or above roof insulation or in fluorescent ballast channel, shall have type RHW-2 or XHHW-2 90° insulation.

1. Feeders sized #2 and larger routed below grade, extending beyond or outside the building foundation line shall use types XHHW-2, THW-2, or RHW-2 insulation, 90 degrees C dry and wet rated.

B. Wire shall be Code type copper wire of not less than 98% conductivity. Wires #8 gauge and larger, shall be stranded. Wires shall bear the Underwriters' label, be color coded and be marked with gauge, type and manufacturer's name on 24" centers. Wires smaller than #8 may be solid or stranded. Where stranded wire is used, provide solid pigtail for connection to screw terminals of receptacles, switches, etc.

C. Color Coding to be as follows:

	208/120 Volts	480/277 Volts
Phase A	Black	Brown
Phase B	Red	Orange
Phase C	Blue	Yellow
Neutral	White	Natural Grey
Ground	Green	Green

1. Switch legs shall use the same branch circuit phase color coding which they are connected to. IG ground wire shall be green with yellow tracer.

D. Bring wire to job in original unbroken packages. Obtain approval of inspector or Engineer before installation of wires.

2.4 CONVENIENCE OUTLETS

A. Shall be "Specification" grade rated 15 amperes at 125 volts, duplex, composition base with slots to accommodate parallel plug caps with grounding peg. Contact shall grip both sides of plug prongs. Where only one receptacle is connected to a 20 ampere circuit, a 20 ampere receptacle shall be used. Outlet shall be UL listed. Receptacles to be Hubbell or equal.

1. 15 Amp: Hubbell 5262 series Heavy Duty Industrial Grade, 8200 series for Hospital Grade.
2. 20 Amp: Hubbell 5362 series Heavy Duty Industrial Grade, 8300 series for Hospital Grade.
3. Other designations as noted below:
   a. Ground Fault: GFR
   b. Tamper Resistant: TR
   c. Weather Resistant: WR
   d. Isolated Ground: IG

4. Leviton 5252, 5352, 8200, and 8300 series can be considered equal.
5. Pass & Seymour 5252, 5352, 8200, 8300 series can be considered equal.

B. Provide devices with matching plates. Isolated ground (IG) receptacles shall be orange with matching color plate. Hospital grade receptacles shall have a distinctive "green" dot. GFI receptacles shall have a visible (light) indicator.

C. All 15 and 20 Amp, 125V and 250V non-locking receptacles (NEMA 5-15, 5-20, 6-15, 6-20) located outdoors and/or in damp or wet locations shall be listed weather-resistant type. Weather resistant receptacles shall be the same grade or class as 15A and 20A receptacles specified above.

D. Weatherproof covers for receptacles in wet locations shall be rated as weatherproof whether or not a plug is inserted (NEMA-3R), minimum 3.25" clearance from front of receptacle, metallic cast type with hinged lid and padlocking hasp, Leviton or equal. Weatherproof covers for receptacles in damp locations shall be rated as weatherproof when attachment plug is removed, with metallic cast cover and flip lids with padlocking hasp.

E. Provide a separate GFI duplex receptacle at each location identified on the drawings and as specified. Through wiring is not acceptable. Receptacles located at the following locations shall be GFI type, whether indicated in the plans or not.
1. In elevator control rooms.
2. In elevator pits/shafts.
3. In bathrooms or restrooms.
4. Outdoors, on the exterior of the building, and on/above the roof.
5. In commercial and institutional kitchens, unless dedicated to specific equipment.
6. Within 72" from any sink or basin such as in a small kitchen, lunch/break room, and the like.

F. Provide an equipment grounding jumper (pigtail) connecting the grounding terminal of the receptacle to the grounded box.

2.5 SAFETY/DISCONNECT SWITCHES

A. Type "HD" Heavy Duty safety switches with externally operated handle. Switches shall be manufactured by Westinghouse, General Electric, Square D, or approved equal. Switches shall be rated 250 and 600 volts, A.C., of size and poles as shown on Drawings and as required. Disconnects used outdoor shall be in NEMA-3R. Provide fused switches with proper sized fuses where required by equipment manufacturer. All switches shall have pad-locking cover with interlocking cover. Switches shall be capable of be pad-lockable in the ON or OFF position. Label switch with circuit identification per section 26 00 00, example "AC-1, HD1-24".

2.6 INDIVIDUAL CIRCUIT BREAKERS

A. Circuit breakers shall be molded case thermal magnetic type with trip rating as scheduled on drawings.

1. Circuit breaker trip settings 300 amps and higher shall have Long-Time setting, STPU, STD, GFPU, Inst. PU settings. Breaker shall be solid state with field adjustable and replaceable trip rating plugs, or of the electronic type.
2. Circuit breakers with trip settings 1200 amps and higher shall be solid state electronic type with full function trip units including: LTPU, LTD, STPU, STD, Inst PU, Inst OFF, GFPU, GFD.

B. Circuit breakers shall be quick-make, quick-break, trip free operation. The trip-free mechanism shall be independent of manual handle control. All circuit breakers shall be fully rated to withstand the available short circuit current as designated on the drawings. Series rated equipment will not be acceptable.

C. Breakers to be in NEMA-1 (indoor) or NEMA-3R (damp, wet, and outdoor) enclosures. NEMA-3R enclosures shall have the handle concealed behind the cover, and the hinged cover shall be provided with padlocking tabs. Each circuit breaker shall be identified with an engraved, laminated phenolic plate showing the load served or the function of the circuit breaker and trip rating. The nameplate shall be attached with oval head machine screws tapped into the front of the board. Equip breaker handles with padlocking "lock-off" devices.

2.7 PULL LINE

A. Furnish and install pull line in all unused (empty) raceways. Pull lines shall not rot or mildew.
1. Conduits up to 1.5": 1/8" diameter braided line of polypropylene with 200 lbs. tensile strength, IDEAL, Jet-Line #232, or equal.
2. Conduits 2" or Larger: 3/16" polypropolene pull rope with 800 lbs. tensile strength, IDEAL Pro-Pull or equal.

B. Provide pull line in conduits for utility company systems, size and type per their requirements.

2.8 ACCESS DOORS

A. Milcor, Newman or equal with concealed hinges, screwdriver locks, prime coated with rust inhibitive paint, and style of door to suit ceiling or wall construction, including fire rating. Access doors in acoustical tile ceilings shall be Hi-Hatch with tile recess. Doors shall be 14 gage C.R. steel and shall be 22" x 30"; 24" x 24" in tile ceilings, unless otherwise noted or required.

2.9 SURFACE METALLIC AND NONMETALLIC RACEWAYS

A. The surface raceway system for branch circuit wiring and/or data network, voice, video and other low-voltage wiring shall be manufactured by the Wiremold Company, or equal. Raceway series as indicated on the plans. The raceway and all system components must be UL listed and exhibit non-flammable self-extinguishing

characteristics. The raceway shall be a two-piece design with a base and a snap-on cover.

1. The nonmetallic raceway base and cover shall be manufactured of rigid PVC compound, available in ivory color. Exposed cuts shall be covered with cover clips.
2. The metal raceway base and cover shall be manufactured of galvanized steel, ivory finish and suitable for field painting.

B. A full complement of fittings must be available including, but not limited to flat, internal and external elbows, tees, entrance fittings, boxes, covers, adapters, cover clips, and end caps. The fittings shall match the base and cover, and be of matching colors. All fittings shall be supplied with a base where applicable to eliminate mitering. A transition fitting shall be available to adapt to other Wiremold series raceways. Field cuts shall be clean, straight, and true with no rough edges.

C. For multicompartment raceways, device brackets shall be available for mounting standard devices in-line or offset from the raceway. A device bracket shall be available for mounting up to four devices at one location. Faceplates shall match and fit flush in the device plate and shall overlay the cover and base to hide uneven cuts. They shall match the raceway base and cover. The raceway manufacturer will provide a complete line of connectivity outlets and modular inserts for UTP (i.e. data jacks), STP (150 ohm), Fiber Optic, Coaxial and other cabling types with face plates and bezels to facilitate mounting.

D. Work shall include furnishing all raceway and appropriate fittings and device plates to install a nonmetallic surface raceway system. Installer shall comply with detailed manufacturer's instruction sheets, which accompany system components as well as system instruction sheets.

E. Non-metallic raceway systems shall not be used in Assembly areas and other areas where the system is not rated for the installation. Assembly areas include but not limited to; gymnasiums, multipurpose rooms, auditoriums, conference rooms, etc.

2.10 COVER PLATES

A. Switch and receptacle cover plates shall be smooth nylon type. Cover plates for other devices/outlets such as data, telephone, television, etc. shall be nylon. Cover plate color shall be ivory, matching all systems.

B. For multi-purpose rooms, gymnasiums, kitchens, locker rooms, toilet/restrooms, and walls such as CMU, brick, concrete block, and concrete walls, device plates shall be smooth stainless steel with beveled edges.

C. Each receptacle shall have its circuit identification on the cover plate (i.e., "LA1-12"). Use typewritten "clear tape". Use black letters/numbers for light colored (white, almond, tan, beige, etc.) cover plates. For darker colored cover plates (black, brown, gray, red, etc.), tape to be white with black letters/numbers. Tape shall be located at the lower portion of the cover plate. Clean surface before adhesive tape is applied, and wrap tape (approx. 1") at each end around back side of each cover plate.

1. For floor boxes, plates shall be engraved with circuit identification.
2. For light switches, use same circuit identification method as for receptacles.

PART 3 - EXECUTION

3.1 CONDUITS & CIRCUITS

A. All conduits shall be rigid steel or IMC except EMT may be used at following locations:
   1. In dry locations in concealed furred spaces.
   2. In partitions other than concrete, concrete block, or solid masonry.
   3. For exposed work indoors and outdoors above 10 ft except:
      a. In special locations prohibited by Code, such as hazardous locations, rigid steel shall be used.
      b. Conduits exposed on/above the roof shall be rigid steel up to 10 ft above roof surface.
      c. Conduits exposed in Gymnasiums and Multi-Purpose Rooms shall be rigid steel up to 25 ft.
   4. Concealed above suspended ceilings or ceilings directly attached to structure above.

B. Flexible Conduit: Shall be used to provide flexible connections of short length (3 ft or less) to equipment subject to vibration or movement and to all motors. Up to 6 ft is allowed where additional flexibility is needed. Provide a separate bonding conductor in all flexible connections/conduit. Flexible conduit shall be one continuous length without couplings.
   1. Secure flex conduit within 12" of each box, cabinet, conduit body, or other termination, and maximum 4.5 ft on center. Refer to the CEC for other secure lengths where flexibility is required or in other specific instances.

C. Run conduit concealed in areas having finished ceilings and in walls. Run all cross conduits and vertical risers or drops concealed in wall and/or partitions. Should it be necessary to notch any framing members, make such notching only at locations and in a manner as approved by the Architects. Where concealing conduit is not possible or practical, conduit may be run exposed in areas only where so permitted by the Architect. Install exposed conduit run neatly, parallel to or at right angles to structural members. Maintain a minimum of 6" clearance from steam or hot water pipes.

D. Support conduit with straps and secure to wood structure by means of bolts or lag screws, to concrete by means of insert or expansion bolts, to brickwork by means of expansion bolts, and to hollow masonry by means of toggle bolts. Expanders and shields shall be steel or malleable iron.

E. Do not install in concrete slabs.

F. Support individual conduits with 2-hole steel straps. 1-hole steel straps may be used for conduits 1" and smaller concealed in wall or above ceilings.

G. Galvanized iron hanger rods sizes 1/4" diameter and larger with spring steel fasteners, clips or clamps specifically designed for purpose for conduits up to 1" size may be used.

H. Individual conduits 3/4" and smaller run above wire suspended ceilings may be supported from independent hanger wires with approved spring steel clips. Wire ties will not be acceptable. Wire shall be taut and secured to ceiling and structure above.

I. Support multi-parallel horizontal conduit runs with trapeze type hangers consisting of two or more steel hanger rods, cross channels, J-bolts, clamps, etc.

J. Sizes of rods and cross channels shall be designed to support four times actual load. Hanger rods shall have safety factor of 5 based on ultimate strength of material used.

K. Conduits for data, telecommunications, signal, video, TV, and/or containing fiber optic, coaxial, or OSP (outside plant) multi-pair cables shall have a minimum inside bend radius per CEC Table 346-10 (do not use exception); except that conduits 2" to 4" shall be minimum 24" radius bends.

L. After installation of conductors, all conduits routed below grade shall be sealed at each opening, including risers and in pull boxes, to prevent the entrance of water and debris.

M. Conduits not terminated into a box or cabinet, such as stubbed to a backboard, shall be terminated with an insulated bushing. Bushings for metallic conduits shall be metallic type secured by set screw, compression, or threaded type. Bushings for PVC conduits shall be glued in place.

N. Although circuiting is shown as diagrammatic, their point-to-point destinations and their indication of above/below ground route shall be followed as much as possible. Where site conditions dictate that an alternate means of routing will alleviate conflicts, the alternate means will be considered with prior approval by the Engineer.

O. Where cinder fill is encountered in Block walls, conduit shall be PVC-40 where in contact with cinder fill. Boxes shall be PVC type where in contact with cinder fill.

P. EMT conduit circuits installed on the roof, if allowed by the Engineer, shall have a ground conductor routed with the circuit conductors sized per the circuit protective device.

Q. Horizontal runs of conduit above suspended wire lay-in ceilings shall not be less than 12" above the ceiling.

R. Maintain 12 inch separation between power circuits (>120V) and all signal circuits (data, telephone, speaker, clock, etc.) to prevent interference.

S. Feeder conduits connected to panels/switchboard shall have ground lug bushing connected to equipment ground buss with ground wire same size as largest ground wire in the panel/switchboard.

T. Conduits penetrating through the roof shall be secured within 12" below roof and supported within 12" of the penetration on the roof.

U. Where conduits cross building expansion/seismic joints provide a short length of flexible conduit (do not exceed 6 ft.) and fittings listed as a grounding means, or in locations where flex conduit cannot be used provide UL listed expansion/seismic fittings.

V. Conduits concealed in any masonry shall be routed in a conduit sleeve. Such sleeves shall not be placed closer than 3 diameters, center to center.

W. Conduits to air conditioning (AC) equipment, fans, or other roof mounted equipment shall rise up from the ceiling below through the equipment curb or conduit window within the equipment, if allowed by equipment manufacturer, to prevent additional roof penetrations.

X. Where conduit passes through finished walls or ceilings, provide steel escutcheon plates, chrome or painted as directed. Conduit which penetrate floor slabs, concrete or masonry walls shall be grouted and sealed watertight at penetrations.

Y. For 20-amp 120 or 277 Volt Circuits using 90-deg C Wires:
   1. Do not install more than three(3) circuits in any conduit.
   2. Do not install more than six(6) current carrying conductors in any conduit.
   3. Where using #10 AWG wires to allow for conductor derating:
      a. Do not install more than six(6) circuits in any conduit.
      b. Do not install more than twelve(12) current carrying conductors in any conduit.

Z. Cables and Raceways installed under metal-corrugated sheet roof decking shall maintain a minimum 1.5" from the nearest surface of the roof decking per CEC. This shall not apply to RMC or IMC.

AA. Where switches control lighting loads supplied by a grounded branch circuit, the grounded conductor for the controlled lighting circuit shall be provided at the switch location. The grounded circuit conductor can be omitted where exceptions 1 & 2 apply. (CEC 404.2(C))

3.2 CAPPING

A. Cap conduits during construction with manufactured seals. Swab out conduits before wires are pulled in.

B. Cap all empty conduits below grade and in pull boxes with manufacturer's caps to prevent entrance of water and debris, attach pull string to cap.

3.3 FLASHING

A. Make conduit projecting through roof watertight by proper flashing. Secure a sheet lead cap with a tightening bend to conduit. Use two collars for tar or asphalt composition roofings. Set one collar directly on roof deck and second collar set over on top of roofing felts. Lead sheet flashing shall be made of 4 lb. sheet lead. Use Stoneman #1100-4 series for individual conduits and #910/915 multi-flash for more than on conduit penetration, or equal.

3.4 PENETRATIONS OF FIRE RESISTIVE WALLS AND PARTITIONS

A. Penetrations of protected openings (fire rated walls, ceilings, floor-ceilings, roofs, etc.) shall be protected in accordance with the California Building Code, Part 2, Chapter 7, Title 24. Penetrations shall apply to conduits (raceways), cable trays, boxes, cabinets, panels, cables, etc.

B. Fire stopping shall be provided at penetrations of fire resistive walls, floors, ceilings, floor-ceiling assemblies, and roofs. Fire-stopping shall have a "F" and/or "T" rating as determined by tests conducted in accordance with ASTM E 814 or UL-1479. Fire stopping system/materials shall be UL Listed.

3.5 ACCESS DOORS

A. Furnish and install access doors wherever required whether shown or not for easy maintenance of electrical systems; for example, inaccessible areas and attics containing heat detectors, junction boxes, etc. Access doors shall provide for complete removal and replacement of equipment. Provide fire rated access doors where located in fire rated partitions.

3.6 BOXES

A. Nails shall not be used to support outlet boxes. Boxes must be accurately placed for finish, independently and securely supported by adequate wood backing or by manufactured adjustable channel type heavy-duty box hangers. For metal stud construction, use metal box hangers only. Box hangers shall be securely tied or welded (where permitted) or screwed to metal studs. Paint weld with rust inhibitor. Boxes installed in masonry tile or concrete block construction shall be secured with auxiliary plates, bars or clips and be grouted in place.
   1. Outlet Boxes with Receptacles or Switches: Provide a solid pigtail (green) ground wire grounded to the metallic outlet box. Pigtail shall also ground device and separate ground conductor if available. Size of ground wire to match overcurrent protection.

B. Locate outlets at the following heights above floor to the center of the device or handle unless otherwise noted on Drawings or in Specifications.
   1. The top of the outlet box shall not be higher than 48" above finished floor, and the bottom of the outlet box shall not be less than 15" above finished floor. For

forward or side approach over counter, maximum 44” and 46” respectively to top of box.
2. Convenience Outlets: 18" (4" above counter or splash).
3. Local Switches: 45".
4. Telephone Outlets: 18" (45" for wall phone).
5. Data, TV Outlets: 18".
6. Where devices are shown at counter locations, they shall be located approximately 4" above counter, clearing back-splash where applicable.
7. Refer to elevations and details on Architectural Drawings for exact heights and locations of all electrical outlets for switches, receptacles, special equipment, etc. Where above heights do not suit building construction or finish, consult Architect.

C. Install pull boxes or junction boxes as required in accessible spaces but do not install in finished areas unless approved by Architect.

D. Where fire rated construction is required (refer to Architectural Drawings), do not locate electrical outlet boxes back-to-back. Provide a minimum of 24" horizontal separation between outlet boxes on opposite side of the same wall. Where such restrictions cannot be met, provide fire-stopping around box such as 3M Moldable Putty Pads or equal.

E. Boxes up to 100 cubic inches located in suspended wire ceilings may be supported through an independent hanger wire with approved tension clips. Wire shall be taut. Secure wire to the structure above and the ceiling below.

3.7 CONDUCTORS

A. Splices and joints for #10 AWG or smaller wiring shall be twisted together electrically and mechanically strong and insulated with approved type insulated electrical spring connectors, Scotchlok or Ideal. Joints and connections for #8 AWG or larger shall be made with Burndy, T & B, or approved equal, solderless tool applied pressure lugs and connectors. Uninsulated lugs and wire ends shall be insulated with layers of plastic tape equal to insulation of wire and with all irregular surfaces properly padded with "Scotchfil" putty prior to application of tape. Tape shall be equal to Scotch #33, General Electric #AW-1, or approved equal. Feeder splicing is not permitted.
1. In special instances where feeder splicing is allowed by the Engineer, it shall be made with high compression sleeve type connector followed by manufactured splicing kit utilizing as insulators, resins poured into a ready-to-use plastic mold to provide a uniform, moisture-proof tough, impact-resistant insulation.
2. Conductor splices below grade shall meet ANSI C119.1-1986 and UL 486D Standards. Raychem WCSM or FCSM heavy wall heat shrink tubing; or RVS or RVC series if use of flame heat is prohibited. Conductors to be joined with compression sleeve connectors.

B. Use only UL approved wire pulling compound as lubricant.

C. Lace conductors together with waxed linen lacing cord, T & B "Ty-Rap", Holub "Quik-Wrap" or equal, in a neat and workmanlike manner in panelboards, wireways, raceways, pull boxes and similar locations.

D. #12 AWG wire shall be minimum size wire used for lighting and power circuits. Motor control circuits may be #14 except as marked on Drawings, unless shown.

E. Provide cable supports in risers by means of a clamping device with insulated wedges or "Kellem" grips.

F. All conductors shall be in conduit unless otherwise indicated.

G. Conduit sizes shall be based on code fill table for THW insulated wires to accommodate the number, size, and type of wires shown or specified.

H. Wiring installed in pull boxes or junction boxes, where wire is pulled through without terminations (except splices), shall have a service loop around the interior of the box for 360 degrees utilizing the largest circumference.

I. Use #10 AWG conductor for 20 Amp 120 Volt circuit home runs longer than 75 feet, and for 20 Amp 277 Volt circuit homeruns longer than 200 feet.

J. Where conductors are increased in size and number (such as for voltage drop reasons), such that conductors will not fit the standard breaker or panel lugs, terminate conductors in one of the following means:
   1. Provide larger breaker frame or panelboard.
   2. Provide oversized lugs.
   3. Last Option only with Approval from Engineer: Terminate wires in multiport connector and provide pigtail. Splice to be made in panel or switchboard if space is available, or in separate splice box. This option will not be normally granted.

3.8 PANELS AND CABINETS

A. Recessed enclosures (panelboards, terminal cabinets, cabinets, control cabinets, etc.) shall be provided with a minimum of three 3/4" empty conduits stubbed into accessible space above the ceiling. Drawings may require additional conduits.

3.9 GROUNDING

A. Grounding and ground bonding of the electrical installation shall be in accordance with CEC Article 250, and any applicable codes. Ground fittings shall be approved manufactured type, installed and connected to conform with Code requirements.

B. Neutral conductors and noncurrent-carrying parts of equipment at each installation shall be grounded in accordance with applicable code. Ground conductor shall be copper having a current capacity sized in accordance with CEC.

C. All equipment cases, motor frames, etc., shall be completely grounded to satisfy requirements of CEC. Install bond wire in flexible conduit. Install copper bond wire, sized in accordance with CEC, in all nonmetallic raceways and bond to all metallic parts using approved fittings.

D. Service ground conductor shall be connected to a "Ufer" encased ground and bonded to the metallic cold water pipe system and to the metallic natural gas line.

E. Interior metallic cold water pipe system and other interior metallic piping systems shall be ground bonded to the building grounding system.

F. Each building shall be provided with a grounding electrode connected to the metallic enclosure of the building disconnecting means. Grounding electrode conductor shall be sized per CEC table 250-66.

G. Total ground resistance shall not exceed 25 ohms.

H. All connections shall be made with solderless connectors or molded fusion-welding process.

I. Equipment grounding conductors shall be insulated with a continuous green outer finish along its entire length. Conductors size #4 AWG and larger may be identified (with green electrical tape applied half-lapped) at each end and at every point where the conductor is accessible. Tape shall be applied from its point of entry to point of exit or termination.

J. Insulated grounded (neutral) conductors shall be identified with a continuous white outer finish along its entire length. Neutral conductors #4 AWG or larger can be identified by a distinctive white marking (applied half-lapped with white electrical tape) for the last 12 inches at each end.

3.10 FIELD TESTS

A. General: Perform field test in the presence of the Owner's Representative except as otherwise specified. Provide required labor, materials, equipment and connections to perform tests. Document results and submit them to the Owner's Representative. Repair or replace all defective work.

3.11 GROUND FAULT PROTECTION AND TESTING

A. Where indicated on the plans, provide circuit breaker with ground fault protection. The ground fault system shall include a memory circuit for positive tripping action despite intermittent arcing ground faults.

B. Provide an integral means of testing the ground fault system to meet the on-site requirements of CEC Articles 230 and 517.

C. Provide acceptance testing per InterNational Electrical Testing Association Inc. (NETA) specifications and standards. Submit test results.

3.12 CLEANING

A. Brush and clean work prior to concealing, painting and acceptance. Performed in stages if directed.

B. Clean and repair soiled or damaged painted exposed work and match adjoining work before final acceptance.

C. Remove debris from inside and outside of material, equipment and structures.

3.13 WARRANTY

A. All materials and installation shall be provided with a one (1) year warranty which shall include replacement parts, labor, retesting, and travel to and from the job site. The warranty period shall begin after final acceptance of the project.

END OF SECTION

SECTION 26 05 11

REQUIREMENTS FOR ELECTRICAL INSTALLATIONS

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section applies to all sections of Division 26.

B. Furnish and install electrical systems, materials, equipment, and accessories in accordance with the specifications and drawings. Capacities and ratings of motors, transformers, conductors and cable, switchboards, switchgear, panelboards, motor control centers, generators, automatic transfer switches, and other items and arrangements for the specified items are shown on the drawings.

C. Electrical service entrance equipment and arrangements for temporary and permanent connections to the electric utility company’s system shall conform to the electric utility company's requirements. Coordinate fuses, circuit breakers and relays with the electric utility company’s system, and obtain electric utility company approval for sizes and settings of these devices.

D. Conductor ampacities specified or shown on the drawings are based on copper conductors, with the conduit and raceways sized per NEC. Aluminum conductors are prohibited.

1.2 MINIMUM REQUIREMENTS

A. The latest California Building Code (CBC), Underwriters Laboratories, Inc. (UL), Institute of Electrical and Electronics Engineers (IEEE), and National Fire Protection Association (NFPA) codes and standards are the minimum requirements for materials and installation.

B. The drawings and specifications shall govern in those instances where requirements are greater than those stated in the above codes and standards.

1.3 TEST STANDARDS

A. All materials and equipment shall be listed, labeled, or certified by a Nationally Recognized Testing Laboratory (NRTL) to meet Underwriters Laboratories, Inc. (UL), standards where test standards have been established. Materials and equipment which are not covered by UL standards will be accepted, providing that materials and equipment are listed, labeled, certified or otherwise determined to meet the safety requirements of a NRTL. Materials and equipment which no NRTL accepts, certifies, lists, labels, or determines to be safe, will be considered if inspected or tested in

accordance with national industrial standards, such as ANSI, NEMA, and NETA. Evidence of compliance shall include certified test reports and definitive shop drawings.

B. Definitions:
   1. Listed: Materials and equipment included in a list published by an organization that is acceptable to the Authority Having Jurisdiction and concerned with evaluation of products or services, that maintains periodic inspection of production or listed materials and equipment or periodic evaluation of services, and whose listing states that the materials and equipment either meets appropriate designated standards or has been tested and found suitable for a specified purpose.
   2. Labeled: Materials and equipment to which has been attached a label, symbol, or other identifying mark of an organization that is acceptable to the Authority Having Jurisdiction and concerned with product evaluation, that maintains periodic inspection of production of labeled materials and equipment, and by whose labeling the manufacturer indicates compliance with appropriate standards or performance in a specified manner.
   3. Certified: Materials and equipment which:
      a. Have been tested and found by a NRTL to meet nationally recognized standards or to be safe for use in a specified manner.
      b. Are periodically inspected by a NRTL.
      c. Bear a label, tag, or other record of certification.
   4. Nationally Recognized Testing Laboratory: Testing laboratory which is recognized and approved by the Secretary of Labor in accordance with OSHA regulations.

1.4 QUALIFICATIONS (PRODUCTS AND SERVICES)

A. Manufacturer’s Qualifications: The manufacturer shall regularly and currently produce, as one of the manufacturer's principal products, the materials and equipment specified for this project, and shall have manufactured the materials and equipment for at least three years.

B. Product Qualification:
   1. Manufacturer's materials and equipment shall have been in satisfactory operation, on three installations of similar size and type as this project, for at least three years.
   2. The District reserves the right to require the Contractor to submit a list of installations where the materials and equipment have been in operation before approval.

C. Service Qualifications: There shall be a permanent service organization maintained or trained by the manufacturer which will render satisfactory service to this installation within eight hours of receipt of notification that service is needed. Submit name and address of service organizations.

1.5 APPLICABLE PUBLICATIONS

A. Applicable publications listed in all Sections of Division 26 shall be the latest issue, unless otherwise noted.

B. Products specified in all sections of Division 26 shall comply with the applicable publications listed in each section.

1.6 MANUFACTURED PRODUCTS

A. Materials and equipment furnished shall be of current production by manufacturers regularly engaged in the manufacture of such items, and for which replacement parts shall be available. Materials and equipment furnished shall be new, and shall have superior quality and freshness.

B. When more than one unit of the same class or type of materials and equipment is required, such units shall be the product of a single manufacturer.

C. Equipment Assemblies and Components:
   1. Components of an assembled unit need not be products of the same manufacturer.
   2. Manufacturers of equipment assemblies, which include components made by others, shall assume complete responsibility for the final assembled unit.
   3. Components shall be compatible with each other and with the total assembly for the intended service.
   4. Constituent parts which are similar shall be the product of a single manufacturer.

D. Factory wiring and terminals shall be identified on the equipment being furnished and on all wiring diagrams.

E. When Factory Tests are specified, Factory Tests shall be performed in the factory by the equipment manufacturer. In addition, the following requirements shall be complied with:
   1. When factory tests are successful, contractor shall furnish four (4) copies of the equipment manufacturer's certified test reports to EOR fourteen (14) days prior to shipment of the equipment, and not more than ninety (90) days after completion of the factory tests.
   2. When factory tests are not successful, factory tests shall be repeated in the factory by the equipment manufacturer. The Contractor shall be liable for all additional expenses for the EOR to witness factory re-testing.

1.7 MATERIALS AND EQUIPMENT PROTECTION

A. Materials and equipment shall be protected during shipment and storage against physical damage, vermin, dirt, corrosive substances, fumes, moisture, cold and rain.
   1. Store materials and equipment indoors in clean dry space with uniform temperature to prevent condensation.

2. During installation, equipment shall be protected against entry of foreign matter, and be vacuum-cleaned both inside and outside before testing and operating. Compressed air shall not be used to clean equipment. Remove loose packing and flammable materials from inside equipment.
3. Damaged equipment shall be repaired or replaced, as determined by the IOR.
4. Painted surfaces shall be protected with factory installed removable heavy kraft paper, sheet vinyl or equal.
5. Damaged paint on equipment shall be refinished with the same quality of paint and workmanship as used by the manufacturer so repaired areas are not obvious.

1.8 WORK PERFORMANCE

A. All electrical work shall comply with requirements of the latest NFPA 70 (NEC and CEC), NFPA 70B, NFPA 70E, NFPA 99, NFPA 110, OSHA Part 1910 subpart J – General Environmental Controls, OSHA Part 1910 subpart K – Medical and First Aid, and OSHA Part 1910 subpart S – Electrical, in addition to other references required by contract.

B. Job site safety and worker safety is the responsibility of the Contractor.

C. Electrical work shall be accomplished with all affected circuits or equipment de-energized. However, energized electrical work may be performed only for the non-destructive and non-invasive diagnostic testing(s), or when scheduled outage poses an imminent hazard to patient care, safety, or physical security. In such case, all aspects of energized electrical work, such as the availability of appropriate/correct personal protective equipment (PPE) and the use of PPE, shall comply with the latest NFPA 70E, as well as the following requirements:
   1. Only Qualified Person(s) shall perform energized electrical work. Supervisor of Qualified Person(s) shall witness the work of its entirety to ensure compliance with safety requirements and approved work plan.
   2. At least two weeks before initiating any energized electrical work, the Contractor and the Qualified Person(s) who is designated to perform the work shall visually inspect, verify and confirm that the work area and electrical equipment can safely accommodate the work involved.
   3. At least two weeks before initiating any energized electrical work, the Contractor shall develop and submit a job specific work plan, and energized electrical work request to EOR and IOR. At the minimum, the work plan must include relevant information such as proposed work schedule, area of work, description of work, name(s) of Supervisor and Qualified Person(s) performing the work, equipment to be used, procedures to be used on and near the live electrical equipment, barriers to be installed, safety equipment to be used, and exit pathways.
   4. Energized electrical work shall begin only after the Contractor has obtained written approval of the work plan, and the energized electrical work request from IOR and utility inspector. The Contractor shall make these approved documents present and available at the time and place of energized electrical work.
   5. Energized electrical work shall begin only after the Contractor has invited and received acknowledgment from IOR and utility inspector to witness the work.

D. For work that affects existing electrical systems, arrange, phase and perform work to assure minimal interference with normal functioning of the facility. Refer to Article OPERATIONS AND STORAGE AREAS under Section 01 00 00, GENERAL REQUIREMENTS.

E. New work shall be installed and connected to existing work neatly, safely and professionally. Disturbed or damaged work shall be replaced or repaired to its prior conditions, as required by Section 01 00 00, GENERAL REQUIREMENTS.

F. Coordinate location of equipment and conduit with other trades to minimize interference.

1.9 EQUIPMENT INSTALLATION AND REQUIREMENTS

A. Equipment location shall be as close as practical to locations shown on the drawings.

B. Working clearances shall not be less than specified in the CEC.

C. Inaccessible Equipment:
1. Where the Government determines that the Contractor has installed equipment not readily accessible for operation and maintenance, the equipment shall be removed and reinstalled as directed at no additional cost to the Government.
2. "Readily accessible" is defined as being capable of being reached quickly for operation, maintenance, or inspections without the use of ladders, or without climbing or crawling under or over obstacles such as, but not limited to, motors, pumps, belt guards, transformers, piping, ductwork, conduit and raceways.

D. Electrical service entrance equipment and arrangements for temporary and permanent connections to the electric utility company's system shall conform to the electric utility company's requirements. Coordinate fuses, circuit breakers and relays with the electric utility company's system, and obtain electric utility company approval for sizes and settings of these devices.

1.10 EQUIPMENT IDENTIFICATION

A. In addition to the requirements of the CEC, install an identification sign which clearly indicates information required for use and maintenance of items such as switchboards and switchgear, panelboards, cabinets, motor controllers, fused and non-fused safety switches, generators, automatic transfer switches, separately enclosed circuit breakers, individual breakers and controllers in switchboards, switchgear and motor control assemblies, control devices and other significant equipment.

B. Identification signs for Normal Power System equipment shall be laminated black phenolic resin with a white core with engraved lettering. Identification signs for Essential Electrical System (EES) equipment, as defined in the NEC, shall be laminated red phenolic resin with a white core with engraved lettering. Lettering shall be a minimum of 12 mm (1/2 inch) high. Identification signs shall indicate equipment

designation, rated bus amperage, voltage, number of phases, number of wires, and type of EES power branch as applicable. Secure nameplates with screws.

C. Install adhesive arc flash warning labels on all equipment as required by the latest NFPA 70E. Label shall show specific and correct information for specific equipment based on its arc flash calculations. Label shall show the followings:
   1. Nominal system voltage.
   2. Equipment/bus name, date prepared, and manufacturer name and address.
   3. Arc flash boundary.
   4. Available arc flash incident energy and the corresponding working distance.
   5. Minimum arc rating of clothing.
   6. Site-specific level of PPE.

1.11 SUBMITTALS

A. Submit to EOR in accordance with Section 01 33 00, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.

B. The EOR's approval shall be obtained for all materials and equipment before delivery to the job site. Delivery, storage or installation of materials and equipment which has not had prior approval will not be permitted.

C. All submittals shall include six copies of adequate descriptive literature, catalog cuts, shop drawings, test reports, certifications, samples, and other data necessary for the EOR to ascertain that the proposed materials and equipment comply with drawing and specification requirements. Catalog cuts submitted for approval shall be legible and clearly identify specific materials and equipment being submitted.

D. Submittals for individual systems and equipment assemblies which consist of more than one item or component shall be made for the system or assembly as a whole. Partial submittals will not be considered for approval.
   1. Mark the submittals per spec section 01 33 00.
   2. Submittals shall be marked to show specification reference including the section and paragraph numbers.
   3. Submit each section separately.

E. The submittals shall include the following:
   1. Information that confirms compliance with contract requirements. Include the manufacturer's name, model or catalog numbers, catalog information, technical data sheets, shop drawings, manuals, pictures, nameplate data, and test reports as required.
   2. Submittals are required for all equipment anchors and supports. Submittals shall include weights, dimensions, center of gravity, standard connections, manufacturer's recommendations and behavior problems (e.g., vibration, thermal expansion, etc.) associated with equipment or piping so that the proposed installation can be properly reviewed. Include sufficient fabrication information so that appropriate mounting and securing provisions may be designed and attached to the equipment.

3. Elementary and interconnection wiring diagrams for communication and signal systems, control systems, and equipment assemblies. All terminal points and wiring shall be identified on wiring diagrams.
4. Parts list which shall include information for replacement parts and ordering instructions, as recommended by the equipment manufacturer.

F. Maintenance and Operation Manuals:
1. Submit as required for systems and equipment specified in the technical sections. Furnish in hardcover binders or an approved equivalent.
2. Inscribe the following identification on the cover: the words "MAINTENANCE AND OPERATION MANUAL," the name and location of the system, material, equipment, building, name of Contractor, and contract name and number. Include in the manual the names, addresses, and telephone numbers of each subcontractor installing the system or equipment and the local representatives for the material or equipment.
3. Provide a table of contents and assemble the manual to conform to the table of contents, with tab sheets placed before instructions covering the subject. The instructions shall be legible and easily read, with large sheets of drawings folded in.
4. The manuals shall include:
   a. Internal and interconnecting wiring and control diagrams with data to explain detailed operation and control of the equipment.
   b. A control sequence describing start-up, operation, and shutdown.
   c. Description of the function of each principal item of equipment.
   d. Installation instructions.
   e. Safety precautions for operation and maintenance.
   f. Diagrams and illustrations.
   g. Periodic maintenance and testing procedures and frequencies, including replacement parts numbers.
   h. Performance data.
   i. Pictorial "exploded" parts list with part numbers. Emphasis shall be placed on the use of special tools and instruments. The list shall indicate sources of supply, recommended spare and replacement parts, and name of servicing organization.
   j. List of factory approved or qualified permanent servicing organizations for equipment repair and periodic testing and maintenance, including addresses and factory certification qualifications.

G. Approvals will be based on complete submission of shop drawings, manuals, test reports, certifications, and samples as applicable.

H. After approval and prior to installation, furnish the //Resident Engineer// //COR// with one sample of each of the following:
1. A minimum 300 mm (12 inches) length of each type and size of wire and cable along with the tag from the coils or reels from which the sample was taken. The length of the sample shall be sufficient to show all markings provided by the manufacturer.
2. Each type of conduit coupling, bushing, and termination fitting.
3. Conduit hangers, clamps, and supports.
4. Duct sealing compound.

5. Each type of receptacle, toggle switch, lighting control sensor, outlet box, manual motor starter, device wall plate, engraved nameplate, wire and cable splicing and terminating material, and branch circuit single pole molded case circuit breaker.

1.12 SINGULAR NUMBER

A. Where any device or part of equipment is referred to in these specifications in the singular number (e.g., "the switch"), this reference shall be deemed to apply to as many such devices as are required to complete the installation as shown on the drawings.

1.13 ACCEPTANCE CHECKS AND TESTS

A. The Contractor shall furnish the instruments, materials, and labor for tests.

B. Where systems are comprised of components specified in more than one section of Division 26, the Contractor shall coordinate the installation, testing, and adjustment of all components between various manufacturer’s representatives and technicians so that a complete, functional, and operational system is delivered to the District.

C. When test results indicate any defects, the Contractor shall repair or replace the defective materials or equipment, and repeat the tests for the equipment. Repair, replacement, and re-testing shall be accomplished at no additional cost to the District.

1.14 WARRANTY

A. All work performed and all equipment and material furnished under this Division shall be free from defects and shall remain so for a period of one year from the date of acceptance of the entire installation by the Contracting Officer for the District.

1.15 INSTRUCTION

A. Instruction to designated Government personnel shall be provided for the particular equipment or system as required in each associated technical specification section.

B. Furnish the services of competent and factory-trained instructors to give full instruction in the adjustment, operation, and maintenance of the specified equipment and system, including pertinent safety requirements. Instructors shall be thoroughly familiar with all aspects of the installation, and shall be factory-trained in operating theory as well as practical operation and maintenance procedures.

C. A training schedule shall be developed and submitted by the Contractor and approved by the District at least 30 days prior to the planned training.

END OF SECTION

SECTION 26 05 19

LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLE

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes building wires and cables and associated connectors, splices, and terminations for wiring systems rated 600 V and less.

1.2 SUBMITTALS

A. Section 01 33 00 – Submittal Procedures.

B. Field quality-control test reports.

1.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in CEC, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with CEC.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:
   1. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.2 CONDUCTORS AND CABLES

A. Manufacturers:
   1. American Insulated Wire Corp.; a Leviton Company.
   2. General Cable Corporation.
   3. Southwire Company.

B. Refer to Part 3 "Conductor and Insulation Applications" Article for insulation type, cable construction and ratings.

C. Conductor Material: Copper complying with NEMA WC 5 or 7; solid conductor for No. 10 AWG and smaller, stranded for No. 8 AWG and larger.

D. Conductor Insulation Types: Type THW, THHN-THWN2 or XHHW2 complying with NEMA WC 5 or 7.

E. Multiconductor Cable: Metal-clad cable, Type MC with ground wire. MC shall not be used unless approved prior to installation by the school district.

2.3 CONNECTORS AND SPLICES

A. Manufacturers:
1. AFC Cable Systems, Inc.
2. AMP Incorporated/Tyco International.
3. Hubbell/Anderson.
4. O-Z/Gedney; EGS Electrical Group LLC.
5. 3M Company; Electrical Products Division.

B. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

PART 3 - EXECUTION

3.1 CONDUCTOR AND INSULATION APPLICATIONS

A. Service Entrance: Type XHHW-2, single conductors in raceway.

B. Exposed Feeders: Type THWN-2, single conductors in raceway.

C. Feeders Concealed in Ceilings, Walls, and Partitions: Type THHN-THWN2, single conductors in raceway.

D. Feeders Concealed in Concrete, below Slabs-on-Grade, and in Crawlspaces: Type XHHW-2, single conductors in raceway.

E. Exposed Branch Circuits, including in Crawlspaces: Type THHN-THWN 2, single conductors in raceway.

F. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN-THWN, single conductors in raceway. Metal-clad cable, Type MC shall not be used without notice of approval from the school district.

G. Branch Circuits Concealed in Concrete and below Slabs-on-Grade: Type THHN-THWN2, single conductors in raceway.

H. Cord Drops and Portable Appliance Connections: Type SO, hard service cord.

I. Class 1 Control Circuits: Type THHN-THWN, in raceway.

J. Class 2 Control Circuits: Type THHN-THWN, in raceway.

3.2 INSTALLATION

A. Conceal cables in finished walls, ceilings, and floors, unless otherwise indicated.

B. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

C. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips that will not damage cables or raceway.

D. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.

E. Support cables according to Section 26 05 00 "Common Work Results for Electrical."

F. Seal around cables penetrating fire-rated elements according to Section 07 84 13 “Penetration Firestopping.”

G. Identify and color-code conductors and cables according to Section 26 05 00 “Common Work Results for Electrical."

H. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.

I. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches of slack.

3.3 FIELD QUALITY CONTROL

A. Testing: Perform each electrical test and visual and mechanical inspection stated in NETA ATS, Section 7.3.1. Certify compliance with test parameters.

B. Test Reports: Prepare a written report to record the following:
   1. Test procedures used.
   2. Test results that comply with requirements.
   3. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.

END OF SECTION

SECTION 26 05 26

GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes grounding of electrical systems and equipment. Requirements specified in this Section may be supplemented by requirements of other Sections.

1.2 SUBMITTALS

A. Section 01 33 00 – Submittal Procedures.

B. Product Data: For ground rods.
   1. Field quality-control test reports.

1.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled under UL 467 as defined in CEC, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.4 GROUNDING ELECTRODE SYSTEM

A. Metal underground water pipe.

B. Metal frame of the building.

C. Concrete-encased electrode.

D. Rod electrode.

1.5 PERFORAMNCE REQUIREMENTS

A. Grounding System Resistance: 5 ohms.

1.6 SUBMITTALS

A. Section 01 33 00 – Submittal Procedures.

B. Product Data: Provide data for grounding electrodes and connections.

C. Test Reports: Indicate all resistance to ground and resistance of each electrode.

D. Manufacturer's Instructions: Include all instructions for storage, handling, protection, examination, preparation and installation of exothermic connectors.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Cadweld.
2. Thermoweld.
3. Copperweld Corp.
4. Dossert Corp.
5. Erico Inc.; Electrical Products Group.
6. Galvan Industries, Inc.
7. Harger Lightning Protection, Inc.
8. Hastings Fiber Glass Products, Inc.
9. ILSCO.
10. Kearney/Cooper Power Systems.
11. Korns, C. C. Co.; Division of Robroy Industries.
12. Lyncole XIT Grounding.
13. O-Z/Gedney Co.; a business of the EGS Electrical Group.
14. Burndy "Hyground" compression system
15. Thomas & Betts, compression system

2.2 GROUNDING CONDUCTORS

A. For insulated conductors, comply with Section 26 05 19 "Low-Voltage Power Conductors and Cables."

B. Equipment Grounding Conductors: Insulated with green-colored insulation.

C. Isolated Ground Conductors: Insulated with green-colored insulation with yellow stripe. On feeders with isolated ground, use colored tape, alternating bands of green and yellow tape to provide a minimum of three bands of green and two bands of yellow.

D. Grounding Electrode Conductors: Stranded cable.

E. Underground Conductors: Bare, tinned, stranded, unless otherwise indicated.

F. Bare, Solid-Copper Conductors: ASTM B 3.

G. Assembly of Bare, Stranded-Copper Conductors: ASTM B 8.

H. Bare, Tinned-Copper Conductors: ASTM B 33.

I. Copper Bonding Conductor: No. 4 or No. 6 AWG, stranded copper conductor.

J. Copper Bonding Jumper: Bare copper tape, braided bare copper conductors, terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.

K. Tinned-Copper Bonding Jumper: Tinned-copper tape, braided copper conductors, terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.

L. Grounding Bus: Bare, annealed copper bars of rectangular cross section, with insulated spacer.

M. Connectors: Comply with IEEE 837 and UL 467; listed for use for specific types, sizes, and combinations of conductors and connected items. Exothermic-welded type, in kit form, selected per manufacturer's written instructions.

N. Foundation Electrode: 4/0 AWG.

2.3 ROD ELECTRODES

A. Ground Rods: Copper-clad steel.
   1. Size: 3/4 inch diameter by 120 inches.
   2. Manufacturer: Blackburn; Eritech; Or equal.

2.4 GROUNDING WELL COMPONENTS

A. Well Pipe: 12 inch diameter by 24 inches long concrete pipe with belled end.

B. Well Cover: Cast iron with legend 'GROUND" embossed cover.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Use only copper conductors for both insulated and bare grounding conductors in direct contact with earth, concrete, masonry, crushed stone and similar materials.

B. In raceways, use insulated equipment grounding conductors.

C. Exothermic-Welded Connections: Use for connections to structural steel and for underground connections.

D. Grounding Bus: Install in electrical and telephone equipment rooms, in rooms housing service equipment, and elsewhere as indicated.
   1. Use insulated spacer; space 1 inch from wall and support from wall 6 inches above finished floor, unless otherwise indicated.

E. Equipment Grounding Conductors: Comply with CEC, Article 250, for types, sizes, and quantities of equipment grounding conductors, unless specific types, larger sizes, or more conductors than required by CEC are indicated.
   1. Install insulated equipment grounding conductors in feeders.
   2. Isolated Grounding Receptacle Circuits: Install an insulated equipment grounding conductor connected to the receptacle grounding terminal. Isolate grounding conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service, unless otherwise indicated.
   3. Nonmetallic Raceways: Install an equipment grounding conductor in nonmetallic raceways unless they are designated for telephone or data cables.
   4. Signal and Communication Systems: For telephone, alarm, voice and data, and other communication systems, provide No. 4 AWG minimum insulated grounding conductor in raceway from grounding electrode system to each service location, terminal cabinet, wiring closet, and central equipment location.
      a. Service and Central Equipment Locations and Wiring Closets: Terminate grounding conductor on a 1/4-by-2-by-12-inch grounding bus.
      b. Terminal Cabinets: Terminate grounding conductor on cabinet grounding terminal.

F. Ground Rods: Install at least three rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes.
   1. Drive ground rods until tops are 2 inches below finished floor or final grade, unless otherwise indicated.
   2. Interconnect ground rods with grounding electrode conductors. Use exothermic welds, except as otherwise indicated. Make connections without exposing steel or damaging copper coating.

G. Grounding Conductors: Route along shortest and straightest paths possible, unless otherwise indicated. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

H. Bonding Straps and Jumpers: Install so vibration by equipment mounted on vibration isolation hangers or supports is not transmitted to rigidly mounted equipment. Use exothermic-welded connectors for outdoor locations, unless a disconnect-type connection is required; then, use a bolted clamp. Bond straps directly to the basic structure taking care not to penetrate any adjacent parts. Install straps only in locations accessible for maintenance.

I. Connections: Make connections so galvanic action or electrolysis possibility is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact will be galvanically compatible.
   1. Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer to order of galvanic series.
   2. Make connections with clean, bare metal at points of contact.
   3. Make aluminum-to-steel connections with stainless-steel separators and mechanical clamps.
   4. Make aluminum-to-galvanized steel connections with tin-plated copper jumpers and mechanical clamps.

5. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.
6. Exothermic-Welded Connections: Comply with manufacturer's written instructions. Welds that are puffed up or that show convex surfaces indicating improper cleaning are not acceptable.
7. Equipment Grounding Conductor Terminations: For No. 8 AWG and larger, use pressure-type grounding lugs. No. 10 AWG and smaller grounding conductors may be terminated with winged pressure-type connectors.
8. Noncontact Metal Raceway Terminations: If metallic raceways terminate at metal housings without mechanical and electrical connection to housing, terminate each conduit with a grounding bushing. Connect grounding bushings with a bare grounding conductor to grounding bus or terminal in housing. Bond electrically noncontinuous conduits at entrances and exits with grounding bushings and bare grounding conductors, unless otherwise indicated.
9. Tighten screws and bolts for grounding and bonding connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A.
10. Compression-Type Connections: Use hydraulic compression tools to provide correct circumferential pressure for compression connectors. Use tools and dies recommended by connector manufacturer. Provide embossing die code or other standard method to make a visible indication that a connector has been adequately compressed on grounding conductor.
11. Moisture Protection: If insulated grounding conductors are connected to ground rods or grounding buses, insulate entire area of connection and seal against moisture penetration of insulation and cable.

J. Manholes and Handholes: Install a driven ground rod close to wall and set rod depth so 4 inches will extend above finished floor. If necessary, install ground rod before manhole is placed and provide a No. 1/0 AWG bare, tinned-copper conductor from ground rod into manhole through a waterproof sleeve in manhole wall. Protect ground rods passing through concrete floor with a double wrapping of pressure-sensitive tape or heat-shrunk insulating sleeve from 2 inches above to 6 inches below concrete. Seal floor opening with waterproof, nonshrink grout.

K. Connections to Manhole Components: Connect exposed-metal parts, such as inserts, cable racks, pulling irons, ladders, and cable shields within each manhole or handhole, to ground rod or grounding conductor. Make connections with No. 4 AWG minimum, stranded, hard-drawn copper conductor. Train conductors level or plumb around corners and fasten to manhole walls. Connect to cable armor and cable shields as recommended by manufacturer of splicing and termination kits.

3.2 FIELD QUALITY CONTROL

A. Testing: Perform the following field quality-control testing:
1. After installing grounding system but before permanent electrical circuitry has been energized, test for compliance with requirements.
2. Test completed grounding system at each location where a maximum ground-resistance level is indicated and at service disconnect enclosure grounding terminal. Measure ground resistance not less than two full days after the last

trace of precipitation, and without the soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance. Perform tests, by the fall-of-potential method according to IEEE 81.

3. Provide drawings locating each ground rod, ground rod assembly, and other grounding electrodes. Identify each by letter in alphabetical order, and key to the record of tests and observations. Include the number of rods driven and their depth at each location and include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results. Nominal maximum values are as follows:
   a. Equipment Rated 500 kVA and Less: 10 ohms.
   b. Equipment Rated 500 to 1000 kVA: 5 ohms.
   c. Equipment Rated More Than 1000 kVA: 3 ohms.
   d. Manhole Grounds: 10 ohms.

END OF SECTION

SECTION 26 05 29

HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
1. Steel slotted support systems.
2. Aluminum slotted support systems.
3. Nonmetallic slotted support systems.
4. Conduit and cable support devices.
5. Support for conductors in vertical conduit.
6. Structural steel for fabricated supports and restraints.
7. Mounting, anchoring, and attachment components, including powder-actuated fasteners, mechanical expansion anchors, concrete inserts, clamps, through bolts, toggle bolts, and hanger rods.
8. Fabricated metal equipment support assemblies.

B. Related Requirements:
1. Section 26 05 48.16 "Seismic Controls for Electrical Systems" for products and installation requirements necessary for compliance with seismic criteria.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.
1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for the following:
a. Slotted support systems, hardware, and accessories.
b. Clamps.
c. Hangers.
d. Sockets.
e. Eye nuts.
f. Fasteners.
g. Anchors.
h. Saddles.
i. Brackets.
2. Include rated capacities and furnished specialties and accessories.

B. Shop Drawings: For fabrication and installation details for electrical hangers and support systems.
   1. Hangers. Include product data for components.
   2. Slotted support systems.
   3. Equipment supports.
   4. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.

C. Delegated-Design Submittal: For hangers and supports for electrical systems.
   1. Include design calculations and details of hangers.
   2. Include design calculations for seismic restraints.

1.4 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. Suspended ceiling components.
   2. Ductwork, piping, fittings, and supports.
   3. Structural members to which hangers and supports will be attached.
   4. Size and location of initial access modules for acoustical tile.
   5. Items penetrating finished ceiling, including the following:
      a. Luminaires.
      b. Air outlets and inlets.
      c. Speakers.
      d. Sprinklers.
      e. Access panels.
      f. Projectors.

B. Seismic Qualification Data: Certificates, for hangers and supports for electrical equipment and systems, accessories, and components, from manufacturer.
   1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
   2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
   3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

C. Welding certificates.

1.5 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M.

B. Welding Qualifications: Qualify procedures and personnel according to the following:
   1. AWS D1.1/D1.1M.

2. AWS D1.2/D1.2M.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 40 00 "Quality Requirements," to design hanger and support system.

B. Seismic Performance: Hangers and supports shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
1. The term "withstand" means "the supported equipment and systems will remain in place without separation of any parts when subjected to the seismic forces specified and the supported equipment and systems will be fully operational after the seismic event."
2. Component Importance Factor: 1.5 or 1.0.

C. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
1. Flame Rating: Class 1.
2. Self-extinguishing according to ASTM D 635.

2.2 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

A. Steel Slotted Support Systems: Preformed steel channels and angles with minimum 13/32-inch-diameter holes at a maximum of 8 inches o.c. in at least one surface.
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. Allied Tube & Conduit; a part of Atkore International.
b. B-line, an Eaton business.
c. ERICO International Corporation.
d. Flex-Strut Inc.
e. GS Metals Corp.
f. G-Strut.
g. Haydon Corporation.
h. Metal Ties Innovation.
i. Thomas & Betts Corporation; A Member of the ABB Group.
j. Unistrut; Part of Atkore International.
k. Wesanco, Inc.
2. Standard: Comply with MFMA-4 factory-fabricated components for field assembly.
3. Material for Channel, Fittings, and Accessories: Galvanized steel.
1. Channel Width: Selected for applicable load criteria 1-5/8 inches, 1-1/4 inches, 13/16 inches.
2. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.

3. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-4.
4. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
5. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Aluminum Slotted Support Systems: Extruded-aluminum channels and angles with minimum 13/32-inch-diameter holes at a maximum of 8 inches o.c. in at least one surface.
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. Cooper Industries, Inc.
   b. Flex-Strut Inc.
   c. Haydon Corporation.
   d. MKT Metal Manufacturing.
   e. Thomas & Betts Corporation; A Member of the ABB Group.
   f. Unistrut; Part of Atkore International.
2. Standard: Comply with MFMA-4 factory-fabricated components for field assembly.
3. Channel Material: 6063-T5 aluminum alloy.
4. Fittings and Accessories Material: 5052-H32 aluminum alloy.
5. Channel Width: Selected for applicable load criteria 1-5/8 inches, 1-1/4 inches, 13/16 inches.
6. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-4.
7. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
8. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Nonmetallic Slotted Support Systems: Structural-grade, factory-formed, glass-fiber-resin channels and angles with minimum 13/32-inch-diameter holes at a maximum of 8 inches o.c., in at least one surface.
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. Allied Tube & Conduit; a part of Atkore International.
   b. B-line, an Eaton business.
   c. Fabco Plastics Wholesale Limited.
   d. G-Strut.
   e. Haydon Corporation.
   f. Seasafe, Inc.; AMICO, a Gibraltar Industries Company.
2. Standard: Comply with MFMA-4 factory-fabricated components for field assembly.
3. Channel Width: Selected for applicable load criteria 1-5/8 inches, 1-1/4 inches or 13/16 inches.
4. Fittings and Accessories: Products provided by channel and angle manufacturer and designed for use with those items.

5. Fitting and Accessory Materials: Same as those for channels and angles, except metal items may be stainless steel.
6. Rated Strength: Selected to suit applicable load criteria.
7. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

D. Conduit and Cable Support Devices: Steel and malleable-iron hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.

E. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for nonarmored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be made of malleable iron.

F. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M steel plates, shapes, and bars; black and galvanized.

G. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:
1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
    a. 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) Hilti, Inc.
        2) ITW Ramset/Red Head; Illinois Tool Works, Inc.
        3) MKT Fastening, LLC.
        4) Simpson Strong-Tie Co., Inc.
2. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel, for use in hardened portland cement concrete, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
    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) B-line, an Eaton business.
        2) Empire Tool and Manufacturing Co., Inc.
        3) Hilti, Inc.
        4) ITW Ramset/Red Head; Illinois Tool Works, Inc.
        5) MKT Fastening, LLC.
3. Concrete Inserts: Steel or malleable-iron, slotted support system units are similar to MSS Type 18 units and comply with MFMA-4 or MSS SP-58.
4. Clamps for Attachment to Steel Structural Elements: MSS SP-58 units are suitable for attached structural element.
5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
6. Toggle Bolts: All Stainless - steel springhead type.
7. Hanger Rods: Threaded steel.

2.3 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

A. Description: Welded or bolted structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.

B. Materials: Comply with requirements in Section 05 50 00 "Metal Fabrications" for steel shapes and plates.

PART 3 - EXECUTION

3.1 APPLICATION

A. Comply with the following standards for application and installation requirements of hangers and supports, except where requirements on Drawings or in this Section are stricter:
   1. NECA 1.
   2. NECA 101
   3. NECA 102.
   4. NECA 105.
   5. NECA 111.

B. Comply with requirements in Section 07 84 13 "Penetration Firestopping" for firestopping materials and installation for penetrations through fire-rated walls, ceilings, and assemblies.

C. Comply with requirements for raceways and boxes specified in Section 26 05 33 "Raceways and Boxes for Electrical Systems."

D. Maximum Support Spacing and Minimum Hanger Rod Size for Raceways: Space supports for EMT, IMC, and RMC as required by scheduled in NECA 1, where its Table 1 lists maximum spacings that are less than those stated in NFPA 70. Minimum rod size shall be 1/4 inch in diameter.

E. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted or other support system, sized so capacity can be increased by at least **25** percent in future without exceeding specified design load limits.
   1. Secure raceways and cables to these supports with two-bolt conduit clamps or single-bolt conduit clamps

F. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch and smaller raceways serving branch circuits and communication systems above suspended ceilings, and for fastening raceways to trapeze supports.

3.2 SUPPORT INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this article.

B. Raceway Support Methods: In addition to methods described in NECA 1, EMT, IMC and RMC may be supported by openings through structure members, according to NFPA 70.

C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.

D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:
   1. To Wood: Fasten with lag screws or through bolts.
   2. To New Concrete: Bolt to concrete inserts.
   3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
   4. To Existing Concrete: Expansion anchor fasteners.
   5. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches thick.
   6. To Steel: Welded threaded studs complying with AWS D1.1/D1.1M, with lock washers and nuts, Beam clamps (MSS SP-58, Type 19, 21, 23, 25, or 27), complying with MSS SP-69.
   7. To Light Steel: Sheet metal screws.
   8. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate by means that comply with seismic-restraint strength and anchorage requirements.

E. Drill holes for expansion anchors in concrete at locations and to depths that avoid the need for reinforcing bars.

3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

A. Comply with installation requirements in Section 05 50 00 "Metal Fabrications" for site-fabricated metal supports.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.

C. Field Welding: Comply with AWS D1.1/D1.1M.

3.4 CONCRETE BASES

A. Construct concrete bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base.

B. Use 3000-psi, 28-day compressive-strength concrete. Concrete materials, reinforcement, and placement requirements are specified in Section 03 30 00 "Cast-in-Place Concrete."

C. Anchor equipment to concrete base as follows:
   1. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
   2. Install anchor bolts to elevations required for proper attachment to supported equipment.
   3. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

3.5 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
   1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.

B. Touchup: Comply with requirements in Section 09 91 13 "Exterior Painting"/Section 09 91 23 "Interior Painting" and Section 09 96 00 "High-Performance Coatings" for cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.

C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION

SECTION 26 05 33

RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.

1.2 SUBMITTALS

A. Section 01 33 00 – Submittal Procedures.

B. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets indicated.

1.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in CEC, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with CEC.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:
   1. Manufacturers: Subject to compliance with requirements, provide products by the manufacturer’s specified.

2.2 METAL CONDUIT AND TUBING

A. Manufacturers:
   1. AFC Cable Systems, Inc.
   2. Alflex Inc.
   3. Anamet Electrical, Inc.; Anaconda Metal Hose.
   4. Electri-Flex Co.
   5. Grinnell Co./Tyco International; Allied Tube and Conduit Div.

6. LTV Steel Tubular Products Company.
7. Manhattan/CDT/Cole-Flex.
8. O-Z Gedney; Unit of General Signal.
9. Wheatland Tube Co.

B. Rigid Steel Conduit: ANSI C80.1.

C. Aluminum Rigid Conduit: ANSI C80.5.

D. IMC: ANSI C80.6.

E. EMT and Fittings: ANSI C80.3.
1. Fittings: Compression type.

F. FMC: Aluminum.

G. LFMC: Flexible steel conduit with PVC jacket.

H. Fittings: NEMA FB 1; compatible with conduit and tubing materials.

2.3 NONMETALLIC CONDUIT AND TUBING

A. Manufacturers:
1. American International.
2. Anamet Electrical, Inc.; Anaconda Metal Hose.
3. Arnco Corp.
4. Cantex Inc.
5. Certainteed Corp.; Pipe & Plastics Group.
6. Condux International.
7. ElecSYS, Inc.
8. Electri-Flex Co.
9. Lamson & Sessions; Carlon Electrical Products.
10. Manhattan/CDT/Cole-Flex.
11. RACO; Division of Hubbell, Inc.
12. Spiralduct, Inc./AFC Cable Systems, Inc.
13. Thomas & Betts Corporation.

B. RNC: NEMA TC 2, Schedule 40 and Schedule 80 PVC.

C. RNC Fittings: NEMA TC 3; match to conduit or tubing type and material.

2.4 SURFACE RACEWAYS

A. Surface Metal Raceways: Galvanized steel with snap-on covers. Finish with manufacturer's standard prime coating.
1. Manufacturers:

a. Airey-Thompson Sentinel Lighting; Wiremold Company (The).

b. Thomas & Betts Corporation.
c. Walker Systems, Inc.; Wiremold Company (The).
d. Wiremold Company (The); Electrical Sales Division.

B. Types, sizes, and channels as indicated and required for each application, with fittings that match and mate with raceways.

2.5 BOXES, ENCLOSURES, AND CABINETS

A. Manufacturers:
1. Cooper Crouse-Hinds; Div. of Cooper Industries, Inc.
2. Emerson/General Signal; Appleton Electric Company.
3. Erickson Electrical Equipment Co.
4. Hoffman.
5. Hubbell, Inc.; Killark Electric Manufacturing Co.
6. O-Z/Gedney; Unit of General Signal.
7. RACO; Division of Hubbell, Inc.
8. Robroy Industries, Inc.; Enclosure Division.

B. Sheet Metal Outlet and Device Boxes: NEMA OS 1.

C. Cast-Metal Outlet and Device Boxes: NEMA FB 1, Type FD, with gasketed cover.

D. Nonmetallic Outlet and Device Boxes: NEMA OS 2.

E. Floor Boxes: Cast metal, fully adjustable, rectangular.

F. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

G. Cast-Metal Pull and Junction Boxes: NEMA FB 1, cast aluminum with gasketed cover.

H. Hinged-Cover Enclosures: NEMA 250, Type 1, with continuous hinge cover and flush latch.
1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.

I. Cabinets: NEMA 250, Type 1, galvanized steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel. Hinged door in front cover with flush latch and concealed hinge. Key latch to match panelboards. Include metal barriers to separate wiring of different systems and voltage and include accessory feet where required for freestanding equipment.

2.6 FACTORY FINISHES

A. Finish: For raceway, enclosures, or cabinet components, provide manufacturer's standard prime-coat finish ready for field painting.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

A. Outdoors:
   1. Exposed: Rigid steel or IMC.
   2. Concealed: Rigid steel or IMC.
   3. Underground, Single Run: RNC.
   4. Underground, Grouped: RNC.
   5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
   6. Boxes and Enclosures: NEMA 250, Type 3R.

B. Indoors:
   1. Exposed: EMT.
   2. Concealed: EMT.
   3. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC; except use LFMC in damp or wet locations.
   4. Damp or Wet Locations: Rigid steel conduit.
   5. Boxes and Enclosures: NEMA 250, Type 1, except as follows:

      a. Damp or Wet Locations: NEMA 250, Type 4, stainless steel.

C. Minimum Raceway Size: 1/2-inch trade size.

D. Raceway Fittings: Compatible with raceways and suitable for use and location.
   1. Intermediate Steel Conduit: Use threaded rigid steel conduit fittings, unless otherwise indicated.
   2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings approved for use with that material. Patch all nicks and scrapes in PVC coating after installing conduits.

E. Do not install aluminum conduits embedded in or in contact with concrete.

3.2 INSTALLATION

A. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.

B. Complete raceway installation before starting conductor installation.

C. Support raceways as specified in Section 26 05 00 "Common Work Results For Electrical."

D. Install temporary closures to prevent foreign matter from entering raceways.

E. Protect stub-ups from damage where conduits rise through floor slabs. Arrange so curved portions of bends are not visible above finished slab.

F. Make bends and offsets so ID is not reduced. Keep legs of bends in same plane and keep straight legs of offsets parallel, unless otherwise indicated.

G. Conceal conduit and EMT within finished walls, ceilings, and floors, unless otherwise indicated.
   1. Install concealed raceways with a minimum of bends in shortest practical distance, considering type of building construction and obstructions, unless otherwise indicated.

H. Raceways Embedded in Slabs: Install in middle 1/3 of slab thickness where practical and leave at least 2 inches of concrete cover.
   1. Secure raceways to reinforcing rods to prevent sagging or shifting during concrete placement.
   2. Space raceways laterally to prevent voids in concrete.
   3. Run conduit larger than 1-inch trade size parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support.
   4. Change from nonmetallic tubing to Schedule 80 nonmetallic conduit, rigid steel conduit, or IMC before rising above floor.

I. Install exposed raceways parallel or at right angles to nearby surfaces or structural members and follow surface contours as much as possible.
   1. Run parallel or banked raceways together on common supports.
   2. Make parallel bends in parallel or banked runs. Use factory elbows only where elbows can be installed parallel; otherwise, provide field bends for parallel raceways.

J. Join raceways with fittings designed and approved for that purpose and make joints tight.
   1. Use insulating bushings to protect conductors on all raceways 2” and larger.

K. Tighten set screws of threadless fittings with suitable tools.

L. Terminations:
   1. Where raceways are terminated with locknuts and bushings, align raceways to enter squarely and install locknuts with dished part against box. Use two locknuts, one inside and one outside box.
   2. Where raceways are terminated with threaded hubs, screw raceways or fittings tightly into hub so end bears against wire protection shoulder. Where chase nipples are used, align raceways so coupling is square to box; tighten chase nipple so no threads are exposed.

M. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire.

N. Telephone and Signal System Raceways, 2-Inch Trade Size and Smaller: In addition to above requirements, install raceways in maximum lengths of 150 feet and with a maximum of two 90-degree bends or equivalent. Separate lengths with pull or junction boxes where necessary to comply with these requirements.

O. Install raceway sealing fittings at suitable, approved, and accessible locations and fill them with UL-listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings at the following points:
   1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
   2. Where otherwise required by CEC.

P. Stub-up Connections: Extend conduits through concrete floor for connection to freestanding equipment. Install with an adjustable top or coupling threaded inside for plugs set flush with finished floor. Extend conductors to equipment with rigid steel conduit; FMC may be used 6 inches above the floor. Install screwdriver-operated, threaded plugs flush with floor for future equipment connections.

Q. Flexible Connections: Use maximum of 72 inches of flexible conduit for recessed and semi recessed lighting fixtures; for equipment subject to vibration, noise transmission, or movement; and for all motors. Use LFMC in damp or wet locations. Install separate ground conductor across flexible connections.

R. Surface Raceways: Install a separate, green, ground conductor in raceways from junction box supplying raceways to receptacle or fixture ground terminals.

S. Set floor boxes level and flush with finished floor surface.

T. Install hinged-cover enclosures and cabinets plumb. Support at each corner.

3.3 PROTECTION

A. Provide final protection and maintain conditions that ensure coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.
   1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
   2. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION

SECTION 26 22 13

LOW-VOLTAGE DISTRIBUTION TRANSFORMERS

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 distribution, dry-type transformers with a nominal primary and secondary rating of 600 V and less, with capacities up to 1500 kVA.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type and size of transformer.
2. Include rated nameplate data, capacities, weights, dimensions, minimum clearances, installed devices and features, and performance for each type and size of transformer.

B. Shop Drawings:

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. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment.
3. Include diagrams for power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing agency.

B. Seismic Qualification Data: Certificates, for transformers, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
4. Certification: Indicate that equipment meets Project seismic requirements.

C. Source quality-control reports.

D. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For transformers to include in emergency, operation, and maintenance manuals.

1.6 QUALITY ASSURANCE

A. Testing Agency Qualifications: Accredited by NETA.

1. Testing Agency's Field Supervisor: Certified by NETA to supervise on-site testing.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Inspection: On receipt, inspect for and note any shipping damage to packaging and transformer.

1. If manufacturer packaging is removed for inspection, and transformer will be stored after inspection, re-package transformer using original or new packaging materials that provide protection equivalent to manufacturer's packaging.

B. Storage: Store in a warm, dry, and temperature-stable location in original shipping packaging.

C. Temporary Heating: Apply temporary heat according to manufacturer's written instructions within the enclosure of each ventilated-type unit, throughout periods during which equipment is not energized and when transformer is not in a space that is continuously under normal control of temperature and humidity.

D. Handling: Follow manufacturer's instructions for lifting and transporting transformers.

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. Acme Electric Corporation.
2. Eaton.
3. Federal Pacific.
4. General Electric Company.
5. SIEMENS Industry, Inc.; Energy Management Division.
6. Square D; by Schneider Electric.

B. Source Limitations: Obtain each transformer type from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Transformers shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1. The term "withstand" means "the transformer will remain in place without separation of any parts when subjected to the seismic forces specified."

2.3 GENERAL TRANSFORMER REQUIREMENTS

A. Description: Factory-assembled and -tested, air-cooled units for 60-Hz service.

B. Comply with NFPA 70.

1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.

C. Transformers Rated 15 kVA and Larger:

1. Comply with 10 CFR 431 (DOE 2016) efficiency levels.
2. Marked as compliant with DOE 2016 efficiency levels by an NRTL.

D. Shipping Restraints: Paint or otherwise color-code bolts, wedges, blocks, and other restraints that are to be removed after installation and before energizing. Use fluorescent colors that are easily identifiable inside the transformer enclosure.

2.4 DISTRIBUTION TRANSFORMERS

A. Comply with NFPA 70.

B. Provide transformers that are constructed to withstand seismic forces specified in Section 260548.16 "Seismic Controls for Electrical Systems."

C. Cores: Electrical grade, non-aging silicon steel with high permeability and low hysteresis losses.

1. One leg per phase.
2. Core volume shall allow efficient transformer operation at 10 percent above the nominal tap voltage.
3. Grounded to enclosure.

D. Coils: Continuous windings except for taps.

1. Coil Material: Copper.
2. Internal Coil Connections: Brazed or pressure type.
3. Terminal Connections: Welded.

E. Encapsulation: Transformers smaller than 30 kVA shall have core and coils completely resin encapsulated.

F. Enclosure: Ventilated.

1. NEMA 250, Type 2 : Core and coil shall be encapsulated within resin compound to seal out moisture and air.
2. KVA Ratings: Based on convection cooling only and not relying on auxiliary fans.
3. Wiring Compartment: Sized for conduit entry and wiring installation.

4. Finish: Comply with NEMA 250.

    a. Finish Color: Gray weather-resistant enamel.

G. Enclosure: Ventilated.

1. NEMA 250, Type 4X, Stainless Steel: Core and coil shall be encapsulated within resin compound to seal out moisture and air.
2. KVA Ratings: Based on convection cooling only and not relying on auxiliary fans.
3. Wiring Compartment: Sized for conduit entry and wiring installation.

H. Enclosure: Ventilated.

1. NEMA 250, Type 3R: Core and coil shall be encapsulated within resin compound, sealing out moisture and air.
2. Wiring Compartment: Sized for conduit entry and wiring installation.

I. Enclosure: Ventilated.

1. NEMA 250, Type 4X, Stainless Steel: Core and coil shall be encapsulated within resin compound, sealing out moisture and air.
2. Wiring Compartment: Sized for conduit entry and wiring installation.

J. Taps for Transformers 3 kVA and Smaller: None.

K. Taps for Transformers 7.5 to 24 kVA: One 5 percent tap above and one 5 percent tap below normal full capacity.

L. Taps for Transformers 25 kVA and Larger: Two 2.5 percent taps above and two 2.5 percent taps below normal full capacity.

M. Insulation Class, Smaller Than 30 kVA: 180 deg C, UL-component-recognized insulation system with a maximum of 115 deg C rise above 40 deg C ambient temperature.

N. Insulation Class, 30 kVA and Larger: 220 deg C, UL-component-recognized insulation system with a maximum of 150 deg C rise above 40 deg C ambient temperature.

O. Grounding: Provide ground-bar kit or a ground bar installed on the inside of the transformer enclosure.

P. K-Factor Rating: Transformers indicated to be K-factor rated shall comply with UL 1561 requirements for nonsinusoidal load current-handling capability to the degree defined by designated K-factor.

1. Unit shall not overheat when carrying full-load current with harmonic distortion corresponding to designated K-factor, without exceeding the indicated insulation class in a 40 deg C maximum ambient and a 24-hour average ambient of 30 deg C.
2. Indicate value of K-factor on transformer nameplate.

3. Unit shall comply with requirements of DOE 2016 efficiency levels when tested according to NEMA TP 2 with a K-factor equal to one.

Q. Neutral: Rated 200 percent of full load current for K-factor-rated transformers.

R. Wall Brackets: Manufacturer's standard brackets.

S. Low-Sound-Level Requirements: Maximum sound levels when factory tested according to IEEE C57.12.91, as follows:

1. 9.00 kVA and Less: 40 dBA.
2. 9.01 to 30.00 kVA: 45 dBA.
3. 30.01 to 50.00 kVA: 45 dBA for K-factors of 1, 4, and 9.
4. 50.01 to 150.00 kVA: 50 dBA for K-factors of 1, 4, and 9.
5. 150.01 to 300.00 kVA: 55 dBA for K-factors of 1, 4, and 9.
6. 300.01 to 500.00 kVA: 60 dBA for K-factors of 1, 4, and 9.
7. 500.01 to 700.00: 62 dBA for K-factors of 1, 4, and 9.
8. 700.01 to 1000.00: 64 dBA for K-factors of 1, 4, and 9.

2.5 IDENTIFICATION

A. Nameplates: Engraved, laminated-acrylic or melamine plastic signs for each distribution transformer, mounted with corrosion-resistant screws. Nameplates and label products are specified in Section 260553 "Identification for Electrical Systems."

2.6 SOURCE QUALITY CONTROL

A. Test and inspect transformers according to IEEE C57.12.01 and IEEE C57.12.91.

1. Resistance measurements of all windings at rated voltage connections and at all tap connections.
2. Ratio tests at rated voltage connections and at all tap connections.
3. Phase relation and polarity tests at rated voltage connections.
4. No load losses, and excitation current and rated voltage at rated voltage connections.
5. Impedance and load losses at rated current and rated frequency at rated voltage connections.
6. Applied and induced tensile tests.
7. Regulation and efficiency at rated load and voltage.
8. Insulation-Resistance Tests:

    a. High-voltage to ground.
    b. Low-voltage to ground.
    c. High-voltage to low-voltage.

9. Temperature tests.

B. Factory Sound-Level Tests: Conduct sound-level tests on equipment for this Project.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions for compliance with enclosure- and ambient-temperature requirements for each transformer.

B. Verify that field measurements are as needed to maintain working clearances required by NFPA 70 and manufacturer's written instructions.

C. Examine walls, floors, roofs, and concrete bases for suitable mounting conditions where transformers will be installed.

D. Verify that ground connections are in place and requirements in Section 260526 "Grounding and Bonding for Electrical Systems" have been met. Maximum ground resistance shall be 5 ohms at location of transformer.

E. Environment: Enclosures shall be rated for the environment in which they are located. Covers for NEMA 250, Type 4X enclosures shall not cause accessibility problems.

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

3.2 INSTALLATION

A. Install wall-mounted transformers level and plumb with wall brackets fabricated by transformer manufacturer.

1. Coordinate installation of wall-mounted and structure-hanging supports with actual transformer provided.
2. Brace wall-mounted transformers as specified in Section 260548.16 "Seismic Controls for Electrical Systems."

B. Install transformers level and plumb on a concrete base with vibration-dampening supports. Locate transformers away from corners and not parallel to adjacent wall surface.

C. Construct concrete bases according to Section 033000 "Cast-in-Place Concrete" and anchor floor-mounted transformers according to manufacturer's written instructions and requirements in Section 260529 "Hangers and Supports for Electrical Systems."

1. Coordinate size and location of concrete bases with actual transformer provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified with concrete.

D. Secure transformer to concrete base according to manufacturer's written instructions.

E. Secure covers to enclosure and tighten all bolts to manufacturer-recommended torques to reduce noise generation.

F. Remove shipping bolts, blocking, and wedges.

3.3 CONNECTIONS

A. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."

B. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

C. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.

D. Provide flexible connections at all conduit and conductor terminations and supports to eliminate sound and vibration transmission to the building structure.

3.4 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Small (Up to 167-kVA Single-Phase or 500-kVA Three-Phase) Dry-Type Transformer Field Tests:

1. Visual and Mechanical Inspection.

a. Inspect physical and mechanical condition.
b. Inspect anchorage, alignment, and grounding.
c. Verify that resilient mounts are free and that any shipping brackets have been removed.
d. Verify the unit is clean.
e. Perform specific inspections and mechanical tests recommended by manufacturer.
f. Verify that as-left tap connections are as specified.
g. Verify the presence of surge arresters and that their ratings are as specified.

2. Electrical Tests:

a. Measure resistance at each winding, tap, and bolted connection.
b. Perform insulation-resistance tests winding-to-winding and each winding-to-ground. Apply voltage according to manufacturer's published data. In the absence of manufacturer's published data, comply with NETA ATS, Table 100.5. Calculate polarization index: the value of the index shall not be less than 1.0.
c. Perform turns-ratio tests at all tap positions. Test results shall not deviate by more than one-half percent from either the adjacent coils or the calculated ratio. If test fails, replace the transformer.
d. Verify correct secondary voltage, phase-to-phase and phase-to-neutral, after energization and prior to loading.

C. Large (Larger Than 167-kVA Single Phase or 500-kVA Three Phase) Dry-Type Transformer Field Tests:

1. Visual and Mechanical Inspection:

a. Inspect physical and mechanical condition.
b. Inspect anchorage, alignment, and grounding.

c. Verify that resilient mounts are free and that any shipping brackets have been removed.
d. Verify the unit is clean.
e. Perform specific inspections and mechanical tests recommended by manufacturer.
f. Verify that as-left tap connections are as specified.
g. Verify the presence of surge arresters and that their ratings are as specified.

2. Electrical Tests:

a. Measure resistance at each winding, tap, and bolted connection.
b. Perform insulation-resistance tests winding-to-winding and each winding-to-ground. Apply voltage according to manufacturer's published data. In the absence of manufacturer's published data, comply with NETA ATS, Table 100.5. Calculate polarization index: the value of the index shall not be less than 1.0.
c. Perform power-factor or dissipation-factor tests on all windings.
d. Perform turns-ratio tests at all tap positions. Test results shall not deviate by more than one-half percent from either the adjacent coils or the calculated ratio. If test fails, replace the transformer.
e. Perform an excitation-current test on each phase.
f. Perform an applied voltage test on all high- and low-voltage windings to ground. See IEEE C57.12.91, Sections 10.2 and 10.9.
g. Verify correct secondary voltage, phase-to-phase and phase-to-neutral, after energization and prior to loading.

D. Remove and replace units that do not pass tests or inspections and retest as specified above.

E. Infrared Scanning: Two months after Substantial Completion, perform an infrared scan of transformer connections.

1. Use an infrared-scanning device designed to measure temperature or detect significant deviations from normal values. Provide documentation of device calibration.
2. Perform two follow-up infrared scans of transformers, one at four months and the other at 11 months after Substantial Completion.
3. Prepare a certified report identifying transformer checked and describing results of scanning. Include notation of deficiencies detected, remedial action taken, and scanning observations after remedial action.

F. Test Labeling: On completion of satisfactory testing of each unit, attach a dated and signed "Satisfactory Test" label to tested component.

3.5 ADJUSTING

A. Record transformer secondary voltage at each unit for at least 48 hours of typical occupancy period. Adjust transformer taps to provide optimum voltage conditions at secondary terminals. Optimum is defined as not exceeding nameplate voltage plus 5 per-

cent and not being lower than nameplate voltage minus 3 percent at maximum load conditions. Submit recording and tap settings as test results.

B. Output Settings Report: Prepare a written report recording output voltages and tap settings.

3.6 CLEANING

A. Vacuum dirt and debris; do not use compressed air to assist in cleaning.

END OF SECTION

SECTION 26 27 26

WIRING DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
1. Straight-blade convenience, hospital-grade, isolated-ground, and tamper-resistant receptacles.
2. USB charger devices.
3. GFCI receptacles.
4. Twist-locking receptacles.
5. Pendant cord-connector devices.
6. Cord and plug sets.
7. Toggle switches.
8. Decorator-style convenience.
9. Wall switch sensor light switches with ultrasonic sensors.
10. Digital timer light switches.
11. Wall-box dimmers.
12. Wall plates.
13. Floor service outlets.
14. Poke-through assemblies.
15. Prefabricated multioutlet assemblies.
16. Service poles.

1.3 DEFINITIONS

A. Abbreviations of Manufacturers' Names:
1. Cooper: Cooper Wiring Devices; Division of Cooper Industries, Inc.
2. Hubbell: Hubbell Incorporated: Wiring Devices-Kellems.
3. Leviton: Leviton Mfg. Company, Inc.
4. Pass & Seymour: Pass& Seymour/Legrand.

B. BAS: Building automation system.

C. EMI: Electromagnetic interference.

D. GFCI: Ground-fault circuit interrupter.

E. Pigtail: Short lead used to connect a device to a branch-circuit conductor.

F. RFI: Radio-frequency interference.

G. SPD: Surge protective device.

H. UTP: Unshielded twisted pair.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: List of legends and description of materials and process used for pre-marking wall plates.

C. Samples: One for each type of device and wall plate specified, in each color specified.

1.5 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing-label warnings and instruction manuals that include labeling conditions.

PART 2 - PRODUCTS

2.1 GENERAL WIRING-DEVICE REQUIREMENTS

A. Wiring Devices, Components, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with NFPA 70.

C. Devices that are manufactured for use with modular plug-in connectors may be substituted under the following conditions:
   1. Connectors shall comply with UL 2459 and shall be made with stranding building wire.
   2. Devices shall comply with the requirements in this Section.

D. Devices for Owner-Furnished Equipment:
   1. Receptacles: Match plug configurations.

2. Cord and Plug Sets: Match equipment requirements.

E. Source Limitations: Obtain each type of wiring device and associated wall plate from single source from single manufacturer.

2.2 STRAIGHT-BLADE RECEPTACLES

A. Duplex Convenience Receptacles: 125 V, 20 A; comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, and FS W-C-596.
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. Eaton (Arrow Hart).
   a. Hubbell Incorporated; Wiring Device-Kellems.
   b. Leviton Manufacturing Co., Inc.
   c. Pass & Seymour/Legrand (Pass & Seymour).

B. Hospital-Grade, Duplex Convenience Receptacles: 125 V, 20 A; comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498 Supplement sd, and FS W-C-596.
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. Eaton (Arrow Hart).
   b. Hubbell Incorporated; Wiring Device-Kellems.
   c. Leviton Manufacturing Co., Inc.
   d. Pass & Seymour/Legrand (Pass & Seymour).
2. Description: Single-piece, rivet-less, nickel-plated, all-brass grounding system. Nickel-plated, brass mounting strap.

C. Isolated-Ground, Duplex Convenience Receptacles: 125 V, 20 A; comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, and FS W-C-596.
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. Eaton (Arrow Hart).
   b. Hubbell Incorporated; Wiring Device-Kellems.
   c. Leviton Manufacturing Co., Inc.
   d. Pass & Seymour/Legrand (Pass & Seymour).
2. Description: Straight blade; equipment grounding contacts shall be connected only to the green grounding screw terminal of the device and with inherent electrical isolation from mounting strap. Isolation shall be integral to receptacle construction and not dependent on removable parts.

D. Tamper-Resistant Convenience Receptacles: 125 V, 20 A; comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, and FS W-C-596.
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. Eaton (Arrow Hart).
b. Hubbell Incorporated; Wiring Device-Kellems.
c. Leviton Manufacturing Co., Inc.
d. Pass & Seymour/Legrand (Pass & Seymour).

2. Description: Labeled and complying with NFPA 70, "Health Care Facilities" Article, "Pediatric Locations" Section.

2.3 USB CHARGER DEVICES

A. Tamper-Resistant, USB Charger Receptacles: 12 V dc, 2.0 A, USB Type A; comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, UL 1310, and FS W-C-596.
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. Eaton (Arrow Hart).
b. Hubbell Incorporated; Wiring Device-Kellems.
c. Leviton Manufacturing Co., Inc.
d. Pass & Seymour/Legrand (Pass & Seymour).
2. Description: Single-piece, rivet-less, nickel-plated, all-brass grounding system. Nickel-plated, brass mounting strap.
3. USB Receptacles: Type A.
4. Line Voltage Receptacles: two pole, three wire, and self-grounding.

B. Hospital-Grade, USB Charger Receptacles: 12 V dc, 2.0 A, USB Type A; comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498 Supplement sd, UL 1310, and FS W-C-596.
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. Eaton (Arrow Hart).
b. Hubbell Incorporated; Wiring Device-Kellems.
c. Leviton Manufacturing Co., Inc.
d. Pass & Seymour/Legrand (Pass & Seymour).
2. Description: Labeled and complying with NFPA 70, "Health Care Facilities" Article, "Pediatric Locations" Section.
3. USB Receptacles: Type A.
4. Line Voltage Receptacles: two-pole, three wire, and self-grounding.

2.4 GFCI RECEPTACLES

A. General Description:
1. 125 V, 20 A, straight blade, non-feed-through type.
2. Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, UL 943 Class A, and FS W-C-596.
3. Include indicator light that shows when the GFCI has malfunctioned and no longer provides proper GFCI protection.

B. Duplex GFCI Convenience Receptacles:
   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. Eaton (Arrow Hart).
      b. Hubbell Incorporated; Wiring Device-Kellems.
      c. Leviton Manufacturing Co., Inc.
      d. Pass & Seymour/Legrand (Pass & Seymour).

C. Tamper-Resistant, Duplex GFCI Convenience Receptacles:
   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. Hubbell Incorporated; Wiring Device-Kellems.
      b. Pass & Seymour/Legrand (Pass & Seymour).

D. Hospital-Grade, Duplex GFCI Convenience Receptacles: Comply with UL 498 Supplement sd.
   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. Eaton (Arrow Hart).
      b. Hubbell Incorporated; Wiring Device-Kellems.
      c. Leviton Manufacturing Co., Inc.
      d. Pass & Seymour/Legrand (Pass & Seymour).

2.5 SPD RECEPTACLES

A. General Description: Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, UL 1449, and FS W-C-596, with integral SPD in line to ground, line to neutral, and neutral to ground.
   1. 125 V, 20 A, straight-blade type.
   2. SPD Components: Multiple metal-oxide varistors; with a nominal clamp-level rating of 400 V and minimum single transient pulse energy dissipation of 240 J, according to IEEE C62.41.2 and IEEE C62.45.
   3. Active SPD Indication: Visual and audible, with light visible in face of device to indicate device is "active" or "no longer in service."

2.6 TWIST-LOCKING RECEPTACLES

A. Twist-Lock, Single Convenience Receptacles: 125 V, 20 A; comply with NEMA WD 1, NEMA WD 6 Configuration L5-20R, and UL 498.
   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. Eaton (Arrow Hart).
      b. Hubbell Incorporated; Wiring Device-Kellems.
      c. Leviton Manufacturing Co., Inc.

d. Pass & Seymour/Legrand (Pass & Seymour).

B. Twist-Lock, Isolated-Ground, Single Convenience Receptacles: 125 V, 20 A; comply with NEMA WD 1, NEMA WD 6 Configuration L5-20R, and UL 498.
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. Eaton (Arrow Hart).
b. Hubbell Incorporated; Wiring Device-Kellems.
c. Leviton Manufacturing Co., Inc.
d. Pass & Seymour/Legrand (Pass & Seymour).
2. Grounding: Equipment grounding contacts shall be connected only to the green grounding screw terminal of the device and with inherent electrical isolation from mounting strap. Isolation shall be integral to receptacle construction and not dependent on removable parts.

2.7 PENDANT CORD-CONNECTOR DEVICES

A. Description:
1. Matching, locking-type plug and receptacle body connector.
2. NEMA WD 6 Configurations L5-20P and L5-20R, heavy-duty grade, and FS W-C-596.
3. Body: Nylon, with screw-open, cable-gripping jaws and provision for attaching external cable grip.
4. External Cable Grip: Woven wire-mesh type made of high-strength, galvanized-steel wire strand, matched to cable diameter, and with attachment provision designed for corresponding connector.

2.8 CORD AND PLUG SETS

A. Description:
1. Match voltage and current ratings and number of conductors to requirements of equipment being connected.
2. Cord: Rubber-insulated, stranded-copper conductors, with Type SOW-A jacket; with green-insulated grounding conductor and ampacity of at least 130 percent of the equipment rating.
3. Plug: Nylon body and integral cable-clamping jaws. Match cord and receptacle type for connection.

2.9 TOGGLE SWITCHES

A. Comply with NEMA WD 1, UL 20, and FS W-S-896.

B. Switches, 120/277 V, 20 A:
1. Single Pole:

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) Eaton (Arrow Hart).
   2) Hubbell Incorporated; Wiring Device-Kellems.
   3) Leviton Manufacturing Co., Inc.
   4) Pass & Seymour/Legrand (Pass & Seymour).

2. Two Pole:
   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) Eaton (Arrow Hart).
      2) Hubbell Incorporated; Wiring Device-Kellems.
      3) Leviton Manufacturing Co., Inc.
      4) Pass & Seymour/Legrand (Pass & Seymour).

3. Three Way:
   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) Eaton (Arrow Hart).
      2) Hubbell Incorporated; Wiring Device-Kellems.
      3) Leviton Manufacturing Co., Inc.
      4) Pass & Seymour/Legrand (Pass & Seymour).

4. Four Way:
   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) Eaton (Arrow Hart).
      2) Hubbell Incorporated; Wiring Device-Kellems.
      3) Leviton Manufacturing Co., Inc.
      4) Pass & Seymour/Legrand (Pass & Seymour).

C. Single-Pole, Double-Throw, Momentary-Contact, Center-off Switches: 120/277 V, 20 A; for use with mechanically held lighting contactors.
   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. Eaton (Arrow Hart).
      b. Hubbell Incorporated; Wiring Device-Kellems.
      c. Leviton Manufacturing Co., Inc.
      d. Pass & Seymour/Legrand (Pass & Seymour).

D. Convenience Receptacles: Square face, 125 V, 15 A; comply with NEMA WD 1, NEMA WD 6 Configuration 5-15R, and UL 498.
   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. Eaton (Arrow Hart).
      b. Hubbell Incorporated; Wiring Device-Kellems.
      c. Leviton Manufacturing Co., Inc.

d. Pass & Seymour/Legrand (Pass & Seymour).

E. Tamper-Resistant Convenience Receptacles: Square face, 125 V, 15 A; comply with NEMA WD 1, NEMA WD 6 Configuration 5-15R, and UL 498.
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. Eaton (Arrow Hart).
b. Hubbell Incorporated; Wiring Device-Kellems.
c. Leviton Manufacturing Co., Inc.
d. Pass & Seymour/Legrand (Pass & Seymour).
2. Description: Labeled to comply with NFPA 70, "Receptacles, Cord Connectors, and Attachment Plugs (Caps)" Article, "Tamper-Resistant Receptacles in Dwelling Units" Section.

F. Tamper-Resistant and Weather-Resistant Convenience Receptacles: Square face, 125 V, 15 A; comply with NEMA WD 1, NEMA WD 6 Configuration 5-15R, and UL 498.
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. Eaton (Arrow Hart).
b. Hubbell Incorporated; Wiring Device-Kellems.
c. Leviton Manufacturing Co., Inc.
d. Pass & Seymour/Legrand (Pass & Seymour).
2. Description: Labeled to comply with NFPA 70, "Receptacles, Cord Connectors, and Attachment Plugs (Caps)" Article, "Tamper-Resistant Receptacles in Dwelling Units" Section, when installed in wet and damp locations.

G. GFCI, Non-Feed-Through Type, Convenience Receptacles: Square face, 125 V, 15 A; comply with NEMA WD 1, NEMA WD 6 Configuration 5-15R, UL 498, and UL 943 Class A.
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. Eaton (Arrow Hart).
b. Hubbell Incorporated; Wiring Device-Kellems.
c. Leviton Manufacturing Co., Inc.
d. Pass & Seymour/Legrand (Pass & Seymour).

H. GFCI, Tamper-Resistant and Weather-Resistant Convenience Receptacles: Square face, 125 V, 15 A; comply with NEMA WD 1, NEMA WD 6 Configuration 5-15R, UL 498, and UL 943 Class A.
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. Eaton (Arrow Hart).
b. Hubbell Incorporated; Wiring Device-Kellems.
c. Pass & Seymour/Legrand (Pass & Seymour).

2. Description: Labeled to comply with NFPA 70, "Receptacles, Cord Connectors, and Attachment Plugs (Caps)" Article, "Tamper-Resistant Receptacles in Dwelling Units" Section.

I. Toggle Switches: Square Face, 120/277 V, 15 A; comply with NEMA WD 1, UL 20, and FS W-S-896.
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. Eaton (Arrow Hart).
b. Hubbell Incorporated; Wiring Device-Kellems.
c. Leviton Manufacturing Co., Inc.
d. Pass & Seymour/Legrand (Pass & Seymour).

J. Lighted Toggle Switches: Square Face, 120 V, 15 A; comply with NEMA WD 1 and UL 20.
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. Eaton (Arrow Hart).
b. Hubbell Incorporated; Wiring Device-Kellems.
c. Leviton Manufacturing Co., Inc.
d. Pass & Seymour/Legrand (Pass & Seymour).
2. Description: With LED-lighted handle, illuminated when switch is off.

2.10 WALL SWITCH SENSOR LIGHT SWITCH, ULTRASONIC

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. Eaton (Arrow Hart).
2. Hubbell Incorporated; Wiring Device-Kellems.
3. Leviton Manufacturing Co., Inc.

B. Description: Switchbox-mounted, combination, lighting-control sensor and conventional switch lighting-control unit using ultrasonic technology.
1. Connections: Provisions for connection to BAS.
2. Connections: Hard wired.
3. Connections: Wireless.
4. Rated 960 W at 120-V ac for tungsten lighting, 10 A at 120-V ac or 10 A at 277-V ac for fluorescent or LED lighting, and 1/4 hp at 120-V ac.
5. Integral relay for connection to BAS.
6. Adjustable time delay of 20 minutes.
7. Able to be locked to Manual-On mode.
8. Automatic Light-Level Sensor: Adjustable from 2 to 200 fc.
9. Comply with NEMA WD 1, UL 20, and FS W-S-896.

2.11 DIGITAL TIMER LIGHT SWITCH

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. Eaton (Arrow Hart).
   2. Hubbell Incorporated; Wiring Device-Kellems.
   3. Leviton Manufacturing Co., Inc.

B. Description: Switchbox-mounted, combination digital timer and conventional switch lighting-control unit, with backlit digital display, with selectable time interval in 10-minute increments.
   1. Rated 960 W at 120-V ac for tungsten lighting, 10 A at 120-V ac or 10 A at 277-V ac for fluorescent or LED lighting, and 1/4 hp at 120-V ac.
   2. Integral relay for connection to BAS.

2.12 WALL-BOX DIMMERS

A. Dimmer Switches: Modular, full-wave, solid-state units with integral, quiet on-off switches, with audible frequency and EMI/RFI suppression filters.

B. Control: Continuously adjustable slider; with single-pole or three-way switching. Comply with UL 1472.

C. Incandescent Lamp Dimmers: 120 V; control shall follow square-law dimming curve. On-off switch positions shall bypass dimmer module.
   1. 600 W; dimmers shall require no derating when ganged with other devices.

D. Fluorescent Lamp Dimmer Switches: Modular; compatible with dimmer ballasts; trim potentiometer to adjust low-end dimming; dimmer-ballast combination capable of consistent dimming with low end not greater than 20 percent of full brightness.

E. LED Lamp Dimmer Switches: Modular; compatible with LED lamps; trim potentiometer to adjust low-end dimming; capable of consistent dimming with low end not greater than 20 percent of full brightness.

2.13 WALL PLATES

A. Single and combination types shall match corresponding wiring devices.
   1. Plate-Securing Screws: Metal with head color to match plate finish.
   2. Material for Finished Spaces: Smooth, high-impact thermoplastic.
   3. Material for Unfinished Spaces: Smooth, high-impact thermoplastic.
   4. Material for Damp Locations: Thermoplastic with spring-loaded lift cover and listed and labeled for use in wet and damp locations.

B. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with Type 3R, weather-resistant thermoplastic with lockable cover.

2.14 POKE-THROUGH ASSEMBLIES

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. Hubbell Incorporated; Wiring Device-Kellems.
   2. Pass & Seymour/Legrand (Pass & Seymour).
   3. Square D; by Schneider Electric.
   4. Wiremold / Legrand.

B. Description:
   1. Factory-fabricated and -wired assembly of below-floor junction box with multi-channeled, through-floor raceway/firestop unit and detachable matching floor service-outlet assembly.
   2. Comply with UL 514 scrub water exclusion requirements.
   3. Service-Outlet Assembly: Pedestal type with services indicated complying with requirements in Section 27 15 13 "Communications Copper Horizontal Cabling."
   4. Size: Selected to fit nominal cored holes in floor and matched to floor thickness.
   5. Fire Rating: Unit is listed and labeled for fire rating of floor-ceiling assembly.
   6. Closure Plug: Arranged to close unused cored openings and reestablish fire rating of floor.
   7. Wiring Raceways and Compartments: For a minimum of four No. 12 AWG conductors and a minimum of four, four-pair cables that comply with requirements in Section 27 15 13 "Communications Copper Horizontal Cabling."

2.15 PREFABRICATED MULTIOUTLET ASSEMBLIES

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. Hubbell Incorporated; Wiring Device-Kellems.
   2. Wiremold / Legrand.

B. Description:
   1. Two-piece surface metal raceway, with factory-wired multioutlet harness.
   2. Components shall be products from single manufacturer designed for use as a complete, matching assembly of raceways and receptacles.

C. Raceway Material: Metal, with manufacturer's standard finish.

2.16 FINISHES

A. Device Color:
   1. Wiring Devices Connected to Normal Power System: As selected by Architect unless otherwise indicated or required by NFPA 70 or device listing.
   2. Wiring Devices Connected to Emergency Power System: Red.
   3. SPD Devices: Blue.
   4. Isolated-Ground Receptacles: Orange.

B. Wall Plate Color: For plastic covers, match device color.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with NECA 1, including mounting heights listed in that standard, unless otherwise indicated.

B. Coordination with Other Trades:
   1. Protect installed devices and their boxes. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of boxes.
   2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
   3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
   4. Install wiring devices after all wall preparation, including painting, is complete.

C. Conductors:
   1. Do not strip insulation from conductors until right before they are spliced or terminated on devices.
   2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
   3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.
   4. Existing Conductors:
      a. Cut back and pigtail or replace all damaged conductors.
      b. Straighten conductors that remain and remove corrosion and foreign matter.
      c. Pig-tailing existing conductors is permitted, provided the outlet box is large enough.

D. Device Installation:
   1. Replace devices that have been in temporary use during construction and that were installed before building finishing operations were complete.
   2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
   3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
   4. Connect devices to branch circuits using pigtails that are not less than 6 inches in length.
   5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, two-thirds to three-fourths of the way around terminal screw.

6. Use a torque screwdriver when a torque is recommended or required by manufacturer.
7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
8. Tighten unused terminal screws on the device.
9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device-mounting screws in yokes, allowing metal-to-metal contact.

E. Receptacle Orientation:
1. Install ground pin of vertically mounted receptacles down, and on horizontally mounted receptacles to the right.
2. Install hospital-grade receptacles in patient-care areas with the ground pin or neutral blade at the top.

F. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.

G. Dimmers:
1. Install dimmers within terms of their listing.
2. Verify that dimmers used for fan-speed control are listed for that application.
3. Install unshared neutral conductors online and load side of dimmers according to manufacturers' device listing conditions in the written instructions.

H. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.

I. Adjust locations of floor service outlets and service poles to suit arrangement of partitions and furnishings.

3.2 GFCI RECEPTACLES

A. Install non-feed-through-type GFCI receptacles where protection of downstream receptacles is not required.

3.3 IDENTIFICATION

A. Comply with Section 26 05 53 "Identification for Electrical Systems."

B. Identify each receptacle with panelboard identification and circuit number. Use hot, stamped, or engraved machine printing with black-filled lettering on face of plate, and durable wire markers or tags inside outlet boxes.

3.4 FIELD QUALITY CONTROL

A. Test Instruments: Use instruments that comply with UL 1436.

B. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated digital-display indicators of measurement.

C. Perform the following tests and inspections:
   1. In healthcare facilities, prepare reports that comply with recommendations in NFPA 99.
   2. Test Instruments: Use instruments that comply with UL 1436.
   3. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated digital-display indicators of measurement.

D. Tests for Convenience Receptacles:
   1. Line Voltage: Acceptable range is 105 to 132 V.
   2. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
   3. Using the test plug, verify that the device and its outlet box are securely mounted.

E. Wiring device will be considered defective if it does not pass tests and inspections.

F. Prepare test and inspection reports.

END OF SECTION

SECTION 26 28 16

ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
1. Fusible switches.
2. Nonfusible switches.
3. Receptacle switches.
4. Shunt trip switches.
5. Molded-case circuit breakers (MCCBs).
6. Molded-case switches.
7. Enclosures.

1.3 DEFINITIONS

A. NC: Normally closed.

B. NO: Normally open.

C. SPDT: Single pole, double throw.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include nameplate ratings, dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.
1. Enclosure types and details for types other than NEMA 250, Type 1.
2. Current and voltage ratings.
3. Short-circuit current ratings (interrupting and withstand, as appropriate).
4. Include evidence of a nationally recognized testing laboratory (NRTL) listing for series rating of installed devices.
5. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices, accessories, and auxiliary components.

6. Include time-current coordination curves (average melt) for each type and rating of overcurrent protective device; include selectable ranges for each type of overcurrent protective device. Provide in PDF and electronic format.

B. Shop Drawings: For enclosed switches and circuit breakers.
   1. Include plans, elevations, sections, details, and attachments to other work.
   2. Include wiring diagrams for power, signal, and control wiring.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified testing agency.

B. Seismic Qualification Data: Certificates, for enclosed switches and circuit breakers, accessories, and components, from manufacturer.
   1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
   2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
   3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

C. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For enclosed switches and circuit breakers to include in emergency, operation, and maintenance manuals.
   1. In addition to items specified in Section 01 78 23 "Operation and Maintenance Data," include the following:
      a. Manufacturer's written instructions for testing and adjusting enclosed switches and circuit breakers.
   2. Time-current coordination curves (average melt) for each type and rating of overcurrent protective device; include selectable ranges for each type of overcurrent protective device. Provide in PDF and electronic format.

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. Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.
   2. Fuse Pullers: Two for each size and type.

1.8 QUALITY ASSURANCE

A. Testing Agency Qualifications: Accredited by NETA.

1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.

1.9 FIELD CONDITIONS

A. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:
   1. Ambient Temperature: Not less than minus 22 deg F and not exceeding 104 deg F.
   2. Altitude: Not exceeding 6600 feet.

1.10 WARRANTY

A. Manufacturer's Warranty: Manufacturer and Installer agree to repair or replace components that fail in materials or workmanship within specified warranty period.
   1. Warranty Period: three year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Enclosed switches and circuit breakers shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
   1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

2.2 GENERAL REQUIREMENTS

A. Source Limitations: Obtain enclosed switches and circuit breakers, overcurrent protective devices, components, and accessories, within same product category, from single manufacturer.

B. Product Selection for Restricted Space: Drawings indicate maximum dimensions for enclosed switches and circuit breakers, including clearances between enclosures, and adjacent surfaces and other items. Comply with indicated maximum dimensions.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.

D. Comply with NFPA 70.

2.3 FUSIBLE SWITCHES

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. ABB Inc.
   2. Eaton.
   3. General Electric Company.
   4. SIEMENS Industry, Inc.; Energy Management Division.
   5. Square D; by Schneider Electric.

B. Type HD, Heavy Duty:
   1. Single throw.
   2. Three pole.
   3. 600-V ac.
   4. 200 A and smaller.
   5. UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate specified fuses.
   6. Lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

C. Accessories:
   1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
   2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
   3. Isolated Ground Kit: Internally mounted; insulated, labeled for copper and aluminum neutral conductors.
   4. Class R Fuse Kit: Provides rejection of other fuse types when Class R fuses are specified.
   5. Auxiliary Contact Kit: Two NO/NC (Form "C") auxiliary contact(s), arranged to activate before switch blades open. Contact rating - 24-V ac
   6. Hookstick Handle: Allows use of a hookstick to operate the handle.
   7. Lugs: Mechanical/Compression type, suitable for number, size, and conductor material.
   8. Service-Rated Switches: Labeled for use as service equipment.

2.4 NONFUSIBLE SWITCHES

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. Eaton.
   2. General Electric Company.
   3. SIEMENS Industry, Inc.; Energy Management Division.
   4. Square D; by Schneider Electric.

B. Type GD, General Duty, Three Pole, Single Throw, 240-V ac, 600 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept two padlocks, and interlocked with cover in closed position.

C. Type HD, Heavy Duty, Three Pole, Single Throw, 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

D. Type HD, Heavy Duty, Six Pole, Single Throw, 600-V ac, 200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

E. Type HD, Heavy Duty, Three Pole, Double Throw, 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

F. Accessories:
   1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
   2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
   3. Isolated Ground Kit: Internally mounted; insulated, labeled for copper and aluminum neutral conductors.
   4. Class R Fuse Kit: Provides rejection of other fuse types when Class R fuses are specified.
   5. Auxiliary Contact Kit: Two NO/NC (Form "C") auxiliary contact(s), arranged to activate before switch blades open. Contact rating - 24-V ac
   6. Hookstick Handle: Allows use of a hookstick to operate the handle.
   7. Lugs: Mechanical/Compression type, suitable for number, size, and conductor material.
   8. Service-Rated Switches: Labeled for use as service equipment.

2.5 RECEPTACLE SWITCHES

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. Eaton.
   2. General Electric Company.
   3. SIEMENS Industry, Inc.; Energy Management Division.
   4. Square D; by Schneider Electric.

B. Type HD, Heavy-Duty, Three Pole, Single-Throw Fusible Switch: 600-V ac, 30, 60, 100 A; UL 98 and NEMA KS 1; horsepower rated, with clips or bolt pads to accommodate specified fuses; lockable handle with capability to accept three padlocks; interlocked with cover in closed position.

C. Type HD, Heavy-Duty, Three Pole, Single-Throw Nonfusible Switch: 600-V ac, 30, 60, 100 A; UL 98 and NEMA KS 1; horsepower rated, lockable handle with capability to accept three padlocks; interlocked with cover in closed position.

D. Interlocking Linkage: Provided between the receptacle and switch mechanism to prevent inserting or removing plug while switch is in the on position, inserting any plug other than specified, and turning switch on if an incorrect plug is inserted or correct plug has not been fully inserted into the receptacle.

E. Receptacle: Polarized, three-phase, four-wire receptacle (fourth wire connected to enclosure ground lug).

F. Accessories:
1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
3. Isolated Ground Kit: Internally mounted; insulated, labeled for copper and aluminum neutral conductors.
4. Class R Fuse Kit: Provides rejection of other fuse types when Class R fuses are specified.
5. Auxiliary Contact Kit: Two NO/NC (Form "C") auxiliary contact(s), arranged to activate before switch blades open. Contact rating - 24-V ac.
6. Hookstick Handle: Allows use of a hookstick to operate the handle.
7. Lugs: Mechanical/Compression type, suitable for number, size, and conductor material.
8. Service-Rated Switches: Labeled for use as service equipment.

2.6 SHUNT TRIP SWITCHES

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. Bussmann, an Eaton business.
2. Littelfuse, Inc.
3. Mersen USA.

B. General Requirements: Comply with ASME A17.1, UL 50, and UL 98, with Class J fuse block and 200-kA interrupting and short-circuit current rating.

C. Type HD, Heavy-Duty, Three Pole, Single-Throw Fusible Switch: 600-V ac, 30, 60, 100 A; UL 98 and NEMA KS 1; integral shunt trip mechanism; horsepower rated, with clips or bolt pads to accommodate specified fuses; lockable handle with capability to accept three padlocks; interlocked with cover in closed position.

D. Type HD, Heavy-Duty, Three Pole, Single-Throw Nonfusible Switch: 600-V ac, 30, 60, 100 A; UL 98 and NEMA KS 1; integral shunt trip mechanism; horsepower rated, lockable handle with capability to accept three padlocks; interlocked with cover in closed position.

E. Control Circuit: 120-V ac; obtained from integral control power transformer, with primary and secondary fuses, with a control power transformer or source of enough capacity to operate shunt trip, pilot, indicating and control devices.

F. Accessories:
1. Oiltight key switch for key-to-test function.
2. Oiltight red ON pilot light.
3. Isolated neutral lug; 100 or 200 percent rating.
4. Mechanically interlocked auxiliary contacts that change state when switch is opened and closed.
5. Form C alarm contacts that change state when switch is tripped.
6. Three-pole, double-throw, fire-safety and alarm relay; 120-V ac or 24-V dc coil voltage.
7. Three-pole, double-throw, fire-alarm voltage monitoring relay complying with NFPA 72.
8. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
9. Isolated Ground Kit: Internally mounted; insulated, labeled for copper and aluminum neutral conductors.
10. Class R Fuse Kit: Provides rejection of other fuse types when Class R fuses are specified.
11. Auxiliary Contact Kit: Two NO/NC (Form "C") auxiliary contact(s), arranged to activate before switch blades open. Contact rating - 24-V ac.
12. Hookstick Handle: Allows use of a hookstick to operate the handle.
13. Lugs: Mechanical/Compression type, suitable for number, size, and conductor material.
14. Service-Rated Switches: Labeled for use as service equipment.

2.7 MOLDED-CASE CIRCUIT BREAKERS

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. Eaton.
2. General Electric Company.
3. NOARK Electric North America.
4. SIEMENS Industry, Inc.; Energy Management Division.
5. Square D; by Schneider Electric.

B. Circuit breakers shall be constructed using glass-reinforced insulating material. Current carrying components shall be completely isolated from the handle and the accessory mounting area.

C. Circuit breakers shall have a toggle operating mechanism with common tripping of all poles, which provides quick-make, quick-break contact action. The circuit-breaker handle shall be over center, be trip free, and reside in a tripped position between on and off to provide local trip indication. Circuit-breaker escutcheon shall be clearly marked on and off in addition to providing international I/O markings. Equip circuit breaker with a push-to-trip button, located on the face of the circuit breaker to

mechanically operate the circuit-breaker tripping mechanism for maintenance and testing purposes.

D. The maximum ampere rating and UL, IEC, or other certification standards with applicable voltage systems and corresponding interrupting ratings shall be clearly marked on face of circuit breaker. Circuit breakers shall be 100 percent rated. Circuit breaker/circuit breaker combinations for series connected interrupting ratings shall be listed by UL as recognized component combinations. Any series rated combination used shall be marked on the end-use equipment along with the statement "Caution - Series Rated System. _____ Amps Available. Identical Replacement Component Required."

E. MCCBs shall be equipped with a device for locking in the isolated position.

F. Lugs shall be suitable for 140 deg F rated wire on 125-A circuit breakers and below, 167 deg F rated wire, 194 deg F rated wire, sized according to the 167 deg F temperature rating in NFPA 70.

G. Standard: Comply with UL 489 with interrupting capacity to comply with available fault currents.

H. Thermal-Magnetic Circuit Breakers: Inverse time-current thermal element for low-level overloads and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.

I. Adjustable, Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.

J. Electronic Trip Circuit Breakers: Field-replaceable rating plug, rms sensing, with the following field-adjustable settings:
   1. Instantaneous trip.
   2. Long- and short-time pickup levels.
   3. Long- and short-time time adjustments.
   4. Ground-fault pickup level, time delay, and I-squared t response.

K. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller, and let-through ratings less than NEMA FU 1, RK-5.

L. Integrally Fused Circuit Breakers: Thermal-magnetic trip element with integral limiter-style fuse listed for use with circuit breaker and trip activation on fuse opening or on opening of fuse compartment door.

M. Ground-Fault Circuit-Interrupter (GFCI) Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).

N. Ground-Fault Equipment-Protection (GFEP) Circuit Breakers: With Class B ground-fault protection (30-mA trip).

O. Features and Accessories:
   1. Standard frame sizes, trip ratings, and number of poles.

2. Lugs: Mechanical/Compression type, suitable for number, size, trip ratings, and conductor material.
3. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge lighting circuits.
4. Ground-Fault Protection: Comply with UL 1053; integrally mounted, self-powered or remote-mounted and powered type with mechanical ground-fault indicator; relay with adjustable pickup and time-delay settings, push-to-test feature, internal memory, and shunt trip unit; and three-phase, zero-sequence current transformer/sensor.
5. Communication Capability: Circuit-breaker-mounted, Universal-mounted or Integral communication module with functions and features compatible with power monitoring and control system, specified in Section 26 09 13 "Electrical Power Monitoring and Control."
6. Shunt Trip: Trip coil energized from separate circuit, with coil-clearing contact.
7. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage without intentional time delay.
8. Auxiliary Contacts: One SPDT switch with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts, "b" contacts operate in reverse of circuit-breaker contacts.
9. Alarm Switch: One NO contact that operates only when circuit breaker has tripped.
10. Key Interlock Kit: Externally mounted to prohibit circuit-breaker operation; key shall be removable only when circuit breaker is in off position.
11. Zone-Selective Interlocking: Integral with ground-fault trip unit; for interlocking ground-fault protection function.
12. Electrical Operator: Provide remote control for on, off, and reset operations.
13. Accessory Control Power Voltage: Integrally mounted, self-powered.

2.8 MOLDED-CASE SWITCHES

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. Eaton.
2. General Electric Company.
3. NOARK Electric North America.
4. SIEMENS Industry, Inc.; Energy Management Division.
5. Square D; by Schneider Electric.

B. Description: MCCB with fixed, high-set instantaneous trip only, and short-circuit withstand rating equal to equivalent breaker frame size interrupting rating.

C. Standard: Comply with UL 489 with interrupting capacity to comply with available fault currents.

D. Features and Accessories:
1. Standard frame sizes and number of poles.
2. Lugs:

a. Mechanical/Compression type, suitable for number, size, trip ratings, and conductor material.
b. Lugs shall be suitable for 140 deg F rated wire on 125-A circuit breakers and below, 167 deg F rated wire, 194 deg F rated wire, sized according to the 167 deg F temperature rating in NFPA 70.

3. Ground-Fault Protection: Comply with UL 1053; remote-mounted and powered type with mechanical ground-fault indicator; relay with adjustable pickup and time-delay settings, push-to-test feature, internal memory, and shunt trip unit; and three-phase, zero-sequence current transformer/sensor.
4. Shunt Trip: Trip coil energized from separate circuit, with coil-clearing contact.
5. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage without intentional time delay.
6. Auxiliary Contacts: Two SPDT switches with "a" and "b" contacts; "a" contacts mimic switch contacts, "b" contacts operate in reverse of switch contacts.
7. Alarm Switch: One NC contact that operates only when switch has tripped.
8. Key Interlock Kit: Externally mounted to prohibit switch operation; key shall be removable only when switch is in off position.
9. Zone-Selective Interlocking: Integral with ground-fault shunt trip unit; for interlocking ground-fault protection function.
10. Electrical Operator: Provide remote control for on, off, and reset operations.
11. Accessory Control Power Voltage: Integrally mounted, self-powered.

2.9 ENCLOSURES

A. Enclosed Switches and Circuit Breakers: UL 489, NEMA KS 1, NEMA 250, and UL 50, to comply with environmental conditions at installed location.

B. Enclosure Finish: The enclosure shall be finished with gray baked enamel paint, electrodeposited on cleaned, phosphatized steel (NEMA 250 Type 1 or gray baked enamel paint, electrodeposited on cleaned, phosphatized galvannealed steel (NEMA 250 Types 3R)

C. Conduit Entry: NEMA 250 Types 4, 4X, and 12 enclosures shall contain no knockouts. NEMA 250 Types 7 and 9 enclosures shall be provided with threaded conduit openings in both endwalls.

D. Operating Mechanism: The circuit-breaker operating handle shall be externally operable with the operating mechanism being an integral part of the box, not the cover or directly operable through the dead front trim of the enclosure (NEMA 250 Type 3R). The cover interlock mechanism shall have an externally operated override. The override shall not permanently disable the interlock mechanism, which shall return to the locked position once the override is released. The tool used to override the cover interlock mechanism shall not be required to enter the enclosure in order to override the interlock.

E. Enclosures designated as NEMA 250 Type 4, 4X stainless steel, 12, or 12K shall have a dual cover interlock mechanism to prevent unintentional opening of the enclosure cover when the circuit breaker is ON and to prevent turning the circuit breaker ON when the enclosure cover is open.

F. NEMA 250 Type 7/9 enclosures shall be furnished with a breather and drain kit to allow their use in outdoor and wet location applications.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.
   1. Commencement of work shall indicate Installer's acceptance of the areas and conditions as satisfactory.

3.2 PREPARATION

A. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:
   1. Notify Architect, Construction Manager and Owner no fewer than seven days in advance of proposed interruption of electric service.
   2. Indicate method of providing temporary electric service.
   3. Do not proceed with interruption of electric service without Architect, Construction Manager and Owner written permission.
   4. Comply with NFPA 70E.

3.3 ENCLOSURE ENVIRONMENTAL RATING APPLICATIONS

A. Enclosed Switches and Circuit Breakers: Provide enclosures at installed locations with the following environmental ratings.
   1. Indoor, Dry and Clean Locations: NEMA 250, Type 1.
   2. Outdoor Locations: NEMA 250, Type 3R.
   3. Kitchen Areas: NEMA 250, Type 4X, stainless steel.
   4. Other Wet o Damp, Indoor Locations: NEMA 250, Type 4.
   5. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: NEMA 250, Type 12.
   6. Hazardous Areas Indicated on Drawings: NEMA 250, Type 7 with cover attached by Type 316 stainless steel bolts.

3.4 INSTALLATION

A. Coordinate layout and installation of switches, circuit breakers, and components with equipment served and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

B. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.

C. Comply with mounting and anchoring requirements specified in Section 26 05 48.16 "Seismic Controls for Electrical Systems."

D. Temporary Lifting Provisions: Remove temporary lifting of eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

E. Install fuses in fusible devices.

F. Comply with NFPA 70 and NECA 1.

3.5 IDENTIFICATION

A. Comply with requirements in Section 26 05 53 "Identification for Electrical Systems."
   1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
   2. Label each enclosure with engraved metal or laminated-plastic nameplate.

3.6 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

C. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

D. Perform tests and inspections with the assistance of a factory-authorized service representative.

E. Tests and Inspections for Switches:
   1. Visual and Mechanical Inspection:
      a. Inspect physical and mechanical condition.
      b. Inspect anchorage, alignment, grounding, and clearances.
      c. Verify that the unit is clean.
      d. Verify blade alignment, blade penetration, travel stops, and mechanical operation.
      e. Verify that fuse sizes and types match the Specifications and Drawings.

f. Verify that each fuse has adequate mechanical support and contact integrity.
g. Inspect bolted electrical connections for high resistance using one of the two following methods:
    1) Use a low-resistance ohmmeter.
        a) Compare bolted connection resistance values to values of similar connections. Investigate values that deviate from those of similar bolted connections by more than 50 percent of the lowest value.
    2) Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method in accordance with manufacturer's published data or NETA ATS Table 100.12.
        a) Bolt-torque levels shall be in accordance with manufacturer's published data. In the absence of manufacturer's published data, use NETA ATS Table 100.12.
h. Verify that operation and sequencing of interlocking systems is as described in the Specifications and shown on the Drawings.
i. Verify correct phase barrier installation.
j. Verify lubrication of moving current-carrying parts and moving and sliding surfaces.

2. Electrical Tests:
    a. Perform resistance measurements through bolted connections with a low-resistance ohmmeter. Compare bolted connection resistance values to values of similar connections. Investigate values that deviate from adjacent poles or similar switches by more than 50 percent of the lowest value.
    b. Measure contact resistance across each switchblade fuseholder. Drop values shall not exceed the high level of the manufacturer's published data. If manufacturer's published data are not available, investigate values that deviate from adjacent poles or similar switches by more than 50 percent of the lowest value.
    c. Perform insulation-resistance tests for one minute on each pole, phase-to-phase and phase-to-ground with switch closed, and across each open pole. Apply voltage in accordance with manufacturer's published data. In the absence of manufacturer's published data, use Table 100.1 from the NETA ATS. Investigate values of insulation resistance less than those published in Table 100.1 or as recommended in manufacturer's published data.
    d. Measure fuse resistance. Investigate fuse-resistance values that deviate from each other by more than 15 percent.
    e. Perform ground fault test according to NETA ATS 7.14 "Ground Fault Protection Systems, Low-Voltage."

F. Tests and Inspections for Molded Case Circuit Breakers:
1. Visual and Mechanical Inspection:
    a. Verify that equipment nameplate data are as described in the Specifications and shown on the Drawings.
    b. Inspect physical and mechanical condition.
    c. Inspect anchorage, alignment, grounding, and clearances.
    d. Verify that the unit is clean.
    e. Operate the circuit breaker to ensure smooth operation.

f. Inspect bolted electrical connections for high resistance using one of the two following methods:
   1) Use a low-resistance ohmmeter.
      a) Compare bolted connection resistance values to values of similar connections. Investigate values that deviate from those of similar bolted connections by more than 50 percent of the lowest value.
   2) Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method in accordance with manufacturer's published data or NETA ATS Table 100.12.
      a) Bolt-torque levels shall be in accordance with manufacturer's published data. In the absence of manufacturer's published data, use NETA ATS Table 100.12.
g. Inspect operating mechanism, contacts, and chutes in unsealed units.
h. Perform adjustments for final protective device settings in accordance with the coordination study.

2. Electrical Tests:
   a. Perform resistance measurements through bolted connections with a low-resistance ohmmeter. Compare bolted connection resistance values to values of similar connections. Investigate values that deviate from adjacent poles or similar switches by more than 50 percent of the lowest value.
   b. Perform insulation-resistance tests for one minute on each pole, phase-to-phase and phase-to-ground with circuit breaker closed, and across each open pole. Apply voltage in accordance with manufacturer's published data. In the absence of manufacturer's published data, use Table 100.1 from the NETA ATS. Investigate values of insulation resistance less than those published in Table 100.1 or as recommended in manufacturer's published data.
   c. Perform a contact/pole resistance test. Drop values shall not exceed the high level of the manufacturer's published data. If manufacturer's published data are not available, investigate values that deviate from adjacent poles or similar switches by more than 50 percent of the lowest value.
   d. Perform insulation resistance tests on all control wiring with respect to ground. Applied potential shall be 500-V dc for 300-V rated cable and 1000-V dc for 600-V rated cable. Test duration shall be one minute. For units with solid state components, follow manufacturer's recommendation. Insulation resistance values shall be no less than two megohms.
   e. Determine the following by primary current injection:
      1) Long-time pickup and delay. Pickup values shall be as specified. Trip characteristics shall not exceed manufacturer's published time-current characteristic tolerance band, including adjustment factors.
      2) Short-time pickup and delay. Short-time pickup values shall be as specified. Trip characteristics shall not exceed manufacturer's published time-current characteristic tolerance band, including adjustment factors.
      3) Ground-fault pickup and time delay. Ground-fault pickup values shall be as specified. Trip characteristics shall not exceed manufacturer's published time-current characteristic tolerance band, including adjustment factors.

4) Instantaneous pickup. Instantaneous pickup values shall be as specified and within manufacturer's published tolerances.

f. Test functionality of the trip unit by means of primary current injection. Pickup values and trip characteristics shall be as specified and within manufacturer's published tolerances.

g. Perform minimum pickup voltage tests on shunt trip and close coils in accordance with manufacturer's published data. Minimum pickup voltage of the shunt trip and close coils shall be as indicated by manufacturer.

h. Verify correct operation of auxiliary features such as trip and pickup indicators; zone interlocking; electrical close and trip operation; trip-free, anti-pump function; and trip unit battery condition. Reset all trip logs and indicators. Investigate units that do not function as designed.

i. Verify operation of charging mechanism. Investigate units that do not function as designed.

3. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

4. Perform the following infrared scan tests and inspections and prepare reports:

a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each enclosed switch and circuit breaker. Remove front panels so joints and connections are accessible to portable scanner.

b. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each enclosed switch and circuit breaker 11 months after date of Substantial Completion.

c. Instruments and Equipment: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.

5. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.

G. Enclosed switches and circuit breakers will be considered defective if they do not pass tests and inspections.

H. Prepare test and inspection reports.

1. Test procedures used.
2. Include identification of each enclosed switch and circuit breaker tested and describe test results.
3. List deficiencies detected, remedial action taken, and observations after remedial action.

3.7 ADJUSTING

A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.

B. Set field-adjustable circuit-breaker trip ranges as specified in Section 26 05 73.16 "Coordination Studies."

END OF SECTION

SECTION 26 32 13

SPARK IGNITED ENGINE-DRIVEN GENERATOR SETS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Spark-Ignited Engine.
2. Natural Gas Fuel Supply System.
3. Control and monitoring.
4. Generator overcurrent and fault protection.
5. Generator, exciter, and voltage regulator.
6. Outdoor engine generator enclosure (where selected).
7. Vibration isolation devices (where applicable).

B. Related Requirements:
1. Section 262313 "Paralleling Low-Voltage Switchgear" for controls and paralleling equipment for large or multiple parallel engine generators.
2. Section 263343 "Battery Chargers" for remote engine battery chargers.
3. Section 263600 "Transfer Switches" for transfer switches including sensors and relays to initiate automatic-starting and -stopping signals for engine generators.

1.2 DEFINITIONS

A. EPS: Emergency power supply.

B. EPSS: Emergency power supply system.

C. Operational Bandwidth: The total variation from the lowest to highest value of a parameter over the range of conditions indicated, expressed as a percentage of the nominal value of the parameter.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.
1. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
2. Include thermal damage curve for generator.
3. Include time-current characteristic curves for generator protective device.
4. Include fuel consumption in gallons per hour (liters per hour) at 0.8 power factor at 0.5, 0.75, and 1.0 times generator capacity.
5. Include generator efficiency at 0.8 power factor at 0.5, 0.75, and 1.0 times generator capacity.
6. Include airflow requirements for cooling and combustion air in cubic feet per minute (cubic meters per minute) at 0.8 power factor, Provide Drawings indicating requirements and limitations for location of air intake and exhausts.
7. Include generator characteristics, including, but not limited to, kilowatt rating, efficiency, reactances, and short-circuit current capability.

B. Shop Drawings:
   1. Dimensioned Outline Drawings of Equipment Unit: With engine and generator mounted on rails, identify center of gravity and total weight for provided components; fuel tank, enclosure, silencer, base tank, each piece of equipment not integral to the engine generator.
   2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
   3. Identify fluid drain ports and clearance requirements for proper fluid drain.
   4. Design calculations for selecting vibration isolators and seismic restraints and for designing vibration isolation bases.
   5. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include base weights.
   6. Include diagrams for power, signal, and control wiring. Complete schematic, wiring, and interconnection diagrams indicating terminal markings for engine generators and functional relationship between all electrical components.
   7. Rigging Information: Indicate location of each lifting attachment, generator-set center of gravity, and total package weight in submittal drawings.

1.4 INFORMATIONAL SUBMITTALS

A. Seismic Qualification Data: Certificates, for engine generator, accessories, and components, from manufacturer.
   1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
   2. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

B. Source Quality-Control Reports: Including, but not limited to, the following:
   1. Certified summary of prototype-unit test report. Perform tests at rated load and power factor. Provide the following test results:
      a. Maximum Power Level
      b. Maximum Motor Starting (sKVA)
      c. Structural Soundness
      d. Torsional Analysis
      e. Transient Response
      f. Alternator Temperature Rise
      g. Engine Cooling Requirements (unit mounted radiator)
      h. Harmonic Analysis (per IEEE-115 and ANSI-100)
      i. Voltage Regulation
      j. Endurance Testing
   2. Certified Test Reports: For components and accessories that are equivalent, but not identical, to those tested on prototype unit.
   3. Report of factory test on units to be shipped for this Project, indicating evidence of compliance with specified requirements.
   4. Report of sound generation.
   5. Report of exhaust emissions indicating compliance with applicable regulations.
   6. Certified Torsional Vibration Compatibility: Comply with NFPA 110.

C. Field quality-control reports. Field start up report and unit in-service documentation, including load bank test results if applicable.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For packaged engine generators to include in emergency, operation, and maintenance manuals. Include manufacturer's recommended maintenance and periodic testing plan in accordance with NFPA 110, Chapter 8.

B. Furnish extra materials required by local Authority Having Jurisdiction (AHJ) and defined in project documents that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1.6 QUALITY ASSURANCE

A. The generator set covered by these specifications shall be designed, tested, rated, assembled and installed in accordance with all applicable standards below:
1. CSA C22.2, No. 14-M91 Industrial Control Equipment.
2. CSA C22.2, No. 100 Motors and Generators
3. CSA 282-15
4. EN 61000-6
5. EN 55011
6. FCC Part 15 Subpart B
7. ISO 8528
8. IEC 61000
9. UL 508
10. UL 2200
11. UL 142
12. UL 6200
13. Designed to allow for installed compliance to NFPA 37, NFPA 70, NFPA 99 and NFPA 110

B. Manufacturer Qualifications:
1. Current certificate holder for ISO 9001 compliance.
2. The power system shall be produced by a manufacturer who has produced this type of equipment for a period of at least 25 years and who maintains a service organization of factory-authorized generator technicians available twenty-four hours a day throughout the year.
3. Manufacturing and assembly of products must be done in the United States using domestically sourced materials to the extent practical.

C. Installer Qualifications: An authorized representative who is trained and certified by the manufacturer on stationary power systems.

1.7 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to repair or replace components of packaged engine generators and associated auxiliary components that fail in materials or workmanship within specified warranty period.
1. Warranty: 5 Year Comprehensive from date of Substantial Completion.
2. A Comprehensive Warranty is defined as the manufacturer covering replacement parts, labor, and limited technician travel costs for covered warranty repairs during the listed warranty period. A Limited warranty is defined as the manufacturer

covering replacement parts, labor, and limited technician travel costs for the first 2 years and then replacement parts for the remainder of the listed warranty period.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Generac Power Systems, Inc.; 100 kW, 9L with a K0130124Y21 - 130kW alternator. The Three Phase generator shall be rated for 100 kW at 480 volts and 60 Hz, at 0.8 power factor lagging while operating at a maximum ambient temperature of 77 Fahrenheit and maximum altitude of 600 feet above sea level without reduction in electrical output capacity. Comparable products by one of the following will also be considered:
   1. Caterpillar, Inc.
   2. Cummins Power Generation.

B. Source Limitations: Obtain packaged engine generators and auxiliary components from single source from single manufacturer. "Source Limitations: Obtain packaged engine generators and auxiliary components from single supplier. The equipment supplied and installed shall meet the requirements of NEC and all applicable local codes and regulations. All equipment shall be new, of current production. There shall be one source responsibility for warranty; parts and service through a local representative with factory certified service personnel.

C. Requests for substitutions shall be made a minimum of ten (10) days prior to bid date. Manufacturers catalog data and a completed generator sizing model using the proposed manufacturer's generator sizing software shall accompany each request and authorized acceptance shall be addenda only. Should any substitutions be made, the contractor shall bear responsibility for the installation, coordination and operation of the system as well as any engineering and redesign costs, which may result from such substitutions.

2.2 PERFORMANCE REQUIREMENTS

A. Seismic – non-OSHPD: Provide materials, bracing, and mounting to ensure generator will withstand, and continue to operate, through a seismic event. Present seismic calculations and certificate for the specific model generator in accordance with the relevant IBC and ASCE standard. This will include drawings of the generator and mounting details. Seismic Performance: Engine generator housing, sub-base fuel tank, engine-generator assembly, batteries, battery racks, silencers, sound attenuating equipment, accessories, and components to withstand the effects of earthquake motions determined in accordance with ASCE/SEI 7 when required on the project.

B. NFPA Compliance:
   1. Comply with NFPA 37.
   2. Comply with NFPA 70.
   3. Comply with NFPA 99.
   4. Comply with NFPA 110 requirements for Level 1 EPSS.

C. UL Compliance: Engine generator assembly and factory enclosure (if provided) shall be UL 2200 listed.

D. Engine Exhaust Emissions: Comply with applicable US EPA, State and Local Government requirements. Spark-ignited Stationary Emergency: Engines shall be

certified by the manufacturer to comply with 40 CFR Part 60 Subpart JJJJ, Table 1, Emission Standards for Stationary Emergency SI Engines and Table 2, Requirements for Performance Tests.

2.3 ENGINE GENERATOR ASSEMBLY DESCRIPTION

A. Factory-assembled and -tested, water-cooled engine, with brushless generator and accessories.

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 use.

C. Power Rating: Standby.

D. Service Load: The generator set shall be a Generac model 100 kW, 9L with a K0130124Y21 - 130kW alternator. It shall provide 100 kW and 125 kVA while operating at the maximum ambient operating temperature and elevation specified in the project documents.

E. Power Factor: 0.8 lagging.

F. Frequency: 60 Hz.

G. Voltage: 480 Volts ac.

H. Phase: Three Phase, Four Wire.

I. Induction Method: Naturally aspirated or Turbocharged.

J. Governor: Adjustable isochronous, with speed sensing.

K. Mounting Frame: Structural steel framework to maintain alignment of mounted components without depending on concrete foundation. Provide lifting attachments sized and spaced to prevent deflection of base during lifting and moving.

L. Nameplates: For each major system component to identify manufacturer’s name, model and serial number of component.

M. Engine Generator Performance:
   1. Steady-State Voltage Operational Bandwidth: 3 percent of rated output voltage from no load to full load.
   2. Transient Voltage Performance: Not more than 10.21 percent variation for 50 percent step-load increase or decrease at unity power factor. Voltage shall recover and remain within the steady-state operating band within three seconds.
   3. Steady-State Frequency Operational Bandwidth: 0.5 percent of rated frequency from no load to full load.
   4. Steady-State Frequency Stability: When system is operating at any constant load within the rated load, there shall be no random speed variations outside the steady-state operational band and no hunting or surging of speed.

5. Transient Frequency Performance: Less than 3.5 Hertz variation for 50 percent step-load increase or decrease at unity power factor. Frequency shall recover and remain within the steady-state operating band within five seconds.
6. Output Waveform: At no load, harmonic content measured line to line or line to neutral shall not exceed 5 percent total and 3 percent for single harmonics. Telephone influence factor, determined in accordance with NEMA MG 1, shall not exceed 50 percent.
7. Sustained Short-Circuit Current: For a three-phase, bolted short circuit at system output terminals, system shall supply a minimum of 300 percent of rated full-load current for not less than 10 seconds and then clear the fault automatically, without damage to generator system components.
8. Start time to comply with NFPA system requirements.

2.4 ENGINE PERFORMANCE

A. Fuel: Natural gas shall be "pipeline grade" meeting the following conditions:
1. Methane number 80 or greater.
2. High heating value shall be within the range of 950 - 1,150 BTU/scf.
3. Hydrogen sulfide shall not exceed 0.3 g/100 scf.
4. Total sulfur shall not exceed 20 g/100 scf.
5. Water vapor content shall not exceed 0.32 g/100 scf.

B. Rated Engine Speed: 1800 rpm.

C. Lubrication System to be engine mounted.
1. Oil filter shall be engine-mounted replaceable cartridge type with integral bypass valve, in accordance with manufacturer recommendations.
2. Thermostatic Control Valve: Control flow in system to maintain optimum oil temperature. Unit shall be capable of full flow and is designed to be fail-safe.
3. Crankcase Drain: Arranged for complete gravity drainage to an easily removable container with no disassembly and without use of pumps, siphons, special tools, or appliances.

D. Jacket Coolant Heater: Jacket water heater shall be sized per NFPA110 and UL listed to ensure that genset will start within the specified time period and ambient conditions.

E. Integral Cooling System: Closed loop, liquid cooled, with radiator factory mounted on engine generator set mounting frame and integral engine-driven coolant pump.
1. Coolant: Solution of 50 percent ethylene-glycol-based antifreeze and 50 percent water, with anticorrosion additives as recommended by engine manufacturer.
2. Expansion Tank: Constructed of welded steel plate and rated to withstand maximum closed-loop coolant system pressure for engine used. Equip with gauge glass and petcock.
3. Temperature Control: Self-contained, thermostatic-control valve modulates coolant flow automatically to maintain optimum constant coolant temperature as recommended by engine manufacturer.
4. Maximum Ambient Operating Temperature on Radiator: 104 degrees F (40 degrees C).
5. Coolant Hose: Flexible assembly with inside surface of nonporous rubber and outer covering of aging-, UV-, and abrasion-resistant fabric.

a. Rating: 50-psig (345-kPa) maximum working pressure with coolant at 180 deg F (82 deg C), and noncollapsible under vacuum.
b. Meets SAE 100R1A Type S, EN853 1SN, ISO 1436-1 Type 1SN
c. a Fittings: Flanges or steel pipe nipples with clamps to suit piping and equipment connections.

F. Muffler/Silencer:
1. Critical type, sized as recommended by engine manufacturer and selected with exhaust piping system to not exceed engine manufacturer's engine backpressure requirements.

G. Air-Intake Filter: Heavy duty, engine-mounted air cleaner with replaceable dry-filter element and "blocked filter" indicator.

H. Starting System: 12 or 24-V electric, with negative ground.
1. Cranking Cycle: As required by NFPA 110 for system level specified.
2. Battery: Lead acid, with capacity within ambient temperature range specified in "Performance Requirements" Article to provide specified cranking cycle as required by NFPA 110 for system level specified.
3. Battery-Charging Alternator: Factory mounted on engine with solid-state voltage regulation and 35 minimum continuous rating.
4. Battery Charger: Current-limiting, automatic-equalizing, and float-charging type designed for lead-acid batteries. Unit shall comply with UL 1236 and NFPA 110 Section 5.6.4.6 for Level 1 systems.:

2.5 FUEL SYSTEM – NATURAL GAS

A. Comply with NFPA 37.

B. Operating Pressure: 11 inches of water column.

C. Flowrate: Maximum gas flow demand at 100% load: 1280 cubic feet per hour.

2.6 CONTROL AND MONITORING

A. Automatic Starting System Sequence of Operation: When mode-selector switch on the control and monitoring panel is in the automatic position, remote-control contacts in one or more separate automatic transfer switches initiate starting and stopping of engine generator. When mode-selector switch is switched to the on position, engine generator starts. The off position of same switch initiates engine generator shutdown. When engine generator is running, specified system or equipment failures or derangements automatically shut down engine generator and initiate alarms.

B. Manual Starting System Sequence of Operation: Switching on-off switch on the generator control panel to the on position starts engine generator. The off position of same switch initiates engine generator shutdown. When engine generator is running, specified system or equipment failures or derangements automatically shut down engine generator and initiate alarms.

C. Provide minimum run time control set for 15 minutes with override only by operation of a remote emergency-stop switch.

D. Control panel must comply with UL 6200. The controller shall meet ASTM B117 (salt spray test).

E. Connection to Building Management: Provide connections for data transmission of indications to remote data terminals via Modbus.

F. Environmentally Hardened Design: Open circuit boards, edge cards, and PC ribbon cable connections are unacceptable.

G. PCB Construction: Circuit boards with surface-mounted components to provide vibration durability. Circuit boards utilizing large capacitors or heat sinks must utilize encapsulation methods to securely support these components.

H. Configuration:
   1. Operating and safety indications, protective devices, basic system controls, and engine gauges shall be grouped in a common control and monitoring panel mounted on the engine generator. Mounting method shall isolate the control panel from engine generator vibration. Panel powered from the engine generator battery.

I. Control and Monitoring Panel:
   1. Digital engine generator controller with integrated touch screen, controls, and microprocessor, capable of local and remote control, monitoring, and programming, with battery backup.
   2. Instruments: Located on the control and monitoring panel and viewable during operation.
      a. Engine lubricating-oil pressure gauge.
      b. Engine-coolant temperature gauge.
      c. DC voltmeter (alternator battery charging).
      d. Running-time meter.
      e. AC voltmeter, for each phase.
      f. AC ammeter, for each phase.
      g. AC frequency meter.
      h. Generator-voltage adjusting feature.
   3. Controls and Protective Devices: Controls, shutdown devices, and common alarm indication, including the following:
      a. Cranking control equipment.
      b. Run-Off-Auto switch.
      c. Control switch not in automatic position alarm.
      d. Overcrank alarm.
      e. Overcrank shutdown device.
      f. Low-water temperature alarm.
      g. High engine temperature pre-alarm.
      h. High engine temperature.
      i. High engine temperature shutdown device.
      j. Overspeed alarm.
      k. Overspeed shutdown device.
      l. Low fuel main tank.
         1) Low-fuel-level alarm shall be initiated when the level falls below that required for operation for duration required for the indicated EPSS class.

m. Coolant low-level alarm.
n. Coolant low-level shutdown device.
o. Coolant high-temperature prealarm.
p. Coolant high-temperature alarm.
q. Coolant low-temperature alarm.
r. Coolant high-temperature shutdown device.
s. EPS load indicator.
t. Battery high-voltage alarm.
u. Low cranking voltage alarm.
v. Battery-charger malfunction alarm.
w. Battery low-voltage alarm.
x. Lamp test.
y. Contacts for local and remote common alarm.
z. Remote manual stop shutdown device.
aa. Total engine run hours, non-resettable.
bb. Engine generator metering, including voltage, current, hertz, kilowatt, kilovolt ampere, and power factor.

J. Engine Generator Metering: Comply with [Section 260913 "Electrical Power Monitoring and Control."] [Section 262713 "Electricity Metering."] [Section 260913 "Electrical Power Monitoring and Control" and Section 262713 "Electricity Metering."]

K. External Alarm & Status Relays: Provide a separate terminal block, factory wired to Form C dry contacts, for each alarm and status condition required by Building Management or other external systems as shown on electrical drawings.

L. Common Remote Panel with Common Audible Alarm: Include necessary contacts and terminals in control and monitoring panel. Remote panel shall be powered from the engine generator battery.

M. Remote Alarm Annunciator: An LED indicator light labeled with proper alarm conditions shall identify each alarm event, and a common audible signal shall sound for each alarm condition. Silencing switch in face of panel shall silence signal without altering visual indication. Connect so that after an alarm is silenced, clearing of initiating condition will reactivate alarm until silencing switch is reset. Cabinet and faceplate are surface- or flush-mounting type to suit mounting conditions indicated.
1. Overcrank alarm.
2. Low water-temperature alarm.
3. High engine temperature pre-alarm.
4. High engine temperature alarm.
5. Low lube oil pressure alarm.
6. Overspeed alarm.
7. Low fuel main tank alarm.
8. Low coolant level alarm.
9. Low cranking voltage alarm.
10. Contacts for local and remote common alarm.
11. Audible-alarm silencing switch.
12. Air shutdown damper when used.
13. Run-Off-Auto switch.
14. Control switch not in automatic position alarm.

15. Fuel tank derangement alarm.
16. Fuel tank high-level shutdown of fuel supply alarm.
17. Lamp test.
18. Low-cranking voltage alarm.
19. Generator overcurrent-protective-device not-closed alarm.

N. Remote Emergency-Stop Switch: Provide remote emergency stop switch in quantity and style as shown on electrical drawings. Electrical contractor to coordinate exact location with engineer and local AHJ.

O. Data Logging:
1. Event Logging – the controller keeps a record of up to 8,000 events with date and time locally for warning and shutdown faults. This event log can be downloaded onto a USB storage device or onto a PC through the service program.
2. Event Snapshot – the control system shall capture 15 seconds of critical data around the time a fault or warning. This data shall be viewable on the controller and downloadable.
3. Data Logging – the controller shall allow customized parameters to be logged based on a start trigger from the controller interface.
   a. The parameters are selectable from all monitored parameters.
   b. The sample period shall be configurable from 1 second to 1 day.
   c. The collected data shall be stored on a USB storage device plugged into the control panel.

2.7 GENERATOR OVERCURRENT AND FAULT PROTECTION

A. Overcurrent protective devices shall be coordinated to optimize selective tripping when a short circuit occurs.
1. Overcurrent protective devices for the entire EPSS shall be coordinated to optimize selective tripping when a short circuit occurs. Coordination of protective devices shall consider both utility and EPSS as the voltage source.
2. Overcurrent protective devices for the EPSS shall be accessible only to authorized personnel.

B. Generator Overcurrent Protective Device:
1. Unit mounted circuit breakers. Rating, ampacity, accessories, as shown on drawings or as listed below:
2. Molded-case circuit breaker, thermal-magnetic type; 100 percent rated; complying with UL 489:
   a. Tripping Characteristic: Designed specifically for generator protection.
   b. Trip Rating: Matched to generator output rating.
   c. Shunt Trip: Connected to trip breaker when engine generator is shut down by other protective devices.
   d. Mounting: Adjacent to, or integrated with, control and monitoring panel.

C. Generator Controller Integrated Alternator Protective Functions:
1. Short-time I^2t function : Generator controller-based function shall continuously monitor current level in each phase of alternator output, integrate alternator heating effect over time, and predict when thermal damage of alternator will occur. As overcurrent heating effect on the alternator approaches the thermal

damage point of the unit, protector switches the excitation system off, opens the generator disconnect device, and shuts down the engine generator. When signaled by generator protector or other engine generator protective devices, a shunt-trip device in the generator disconnect switch shall open the switch to disconnect the generator from load circuits.

2. Long-time function: Initiates a generator overload alarm when generator has operated at an overload equivalent to 110 percent of full-rated load for 60 seconds. Indication for this alarm is integrated with other engine generator malfunction alarms. Contacts shall be available for load shed functions.
3. Short-circuit fault clearing: Under single- or three-phase fault conditions, regulates generator to 300 percent of rated full-load current for up to 10 seconds.
4. Senses clearing of a fault by other overcurrent devices and controls recovery of rated voltage to avoid overshoot.
5. Ground Fault Protection: Comply with NFPA 70, section 215 "Feeder Ground-Fault Protection of Equipment". When configured for ground fault protection; trip generator protective device(s) on ground fault."

2.8 GENERATOR, EXCITER, AND VOLTAGE REGULATOR

A. Comply with NEMA MG 1.

B. Drive: Generator shaft shall be directly connected to engine shaft. Exciter shall be rotated integrally with generator rotor.

C. Electrical Insulation: Class H.

D. Stator-Winding Leads: Brought out to terminal box to permit future reconnection for other voltages if required.

E. Range: Provide range of output voltage by adjusting the excitation level.

F. Construction shall prevent mechanical, electrical, and thermal damage due to vibration, overspeed up to 125 percent of rating, and heat during operation at 110 percent of rated capacity. Stator shall be skewed construction to minimize harmonic voltage distortion.

G. Enclosure: Drip proof.

H. Instrument Transformers: Mounted within generator enclosure.

I. Voltage Regulator:
1. Voltage Regulator: Solid-state type, separate from exciter. The digital voltage regulator shall be microprocessor based with fully programmable operating and protection characteristics. The regulator shall maintain steady-state generator output voltage within +/- 0.25% for any constant load between no load and full load. The regulator shall be capable of sensing true RMS. The regulator shall provide an adjustable Volts/Hz slope regulation characteristic in order to optimize voltage and frequency response for site conditions.
2. Alternator Excitation: Permanent Magnet Generator (PMG) shall provide excitation power for optimum motor starting and short circuit performance.
3. The generator must accept rated load in one-step.

4. System Transient Voltage Performance: Alternator shall be capable of supplying 361 sKVA with a voltage dip not more than 35% at 0.3 starting power factor. Sustained voltage dip data or manufacturer-published SKVA numbers based on unity PF alternator-only dynamometer testing will not be accepted.

J. Windings: Two-thirds pitch stator winding and fully linked amortisseur winding.

2.9 OUTDOOR ENGINE GENERATOR ENCLOSURE

A. Basis of design is a Sound Level 2.

B. Generator packaged within manufacturer's weather protective, sound attenuated enclosure. Enclosure and generator set shall be UL 2200 Listed as a system.

C. Enclosure Construction: Minimum 14 gauge construction. Roof construction shall be raised-seam, gasket-free interlocking panels. Rivets shall not be used on external painted surfaces. Design shall be rodent resistant.

D. Doors shall be equipped with lift-off pin and sleeve type hinges to allow access to the engine, alternator, and control panel. Hinges shall be adjustable for door alignment. Hinges and all exposed fasteners shall be stainless steel. Each door shall be equipped with minimum 2-point latching mechanism and identical keys. Perimeter of all door openings shall include polyethylene gasket.

E. Upward discharging exhaust hood for engine cooling airflow and exhaust.

F. Engine exhaust silencer mounted within enclosure discharge hood.

G. Enclosure Finish: Electrostatic applied powered paint, baked and finished to manufacturer's specifications. Finish system shall be subjected to the following tests:
1. ASTM D1186 - 87; 2.5+ mil Paint Thickness
2. ASTM D3363 - 92a; Material Hardness
3. ASTM D522 - B; Resistance to Cracking
4. ASTM D3359 - B; Adhesion
5. ASTM B117 D 1654; Resistant to Salt Water Corrosion
6. ASTM D1735 D 1654; Resistant to Humidity
7. ASTM 2794 93 (2004); Impact Resistance
8. SAE J1690 - UV Protection"

H. Enclosure Color: Manufacturer's standard color, or custom color matched based on architect's design with color sample provided to generator manufacturer.

I. Wind Rating: Enclosure shall be constructed to attain basic wind speed rating of 110 MPH; WIF 1.15, Exposure Category "C", Building Classification "Enclosed", Topographic Factor Kzt = 1. Wind Design Pressures: windward, 20.6 lb/ft^2; leeward, -12.9 lb/ft^2; roof, -18.0 lb/ft^2."

J. Snow Load Rating: Minimum 70 pounds per square foot.

K. Engine-Cooling Airflow through Enclosure: Maintain temperature rise of system components within required limits when unit operates at 110 percent of rated load for

two hours with ambient temperature at top of range specified in system service conditions.

L. Sound Insulation: Enclosure and air discharge hood completely lined with reflective silver mylar faced sound attenuating closed cell foam that meets UL 94 HF1 standards for flammability (FMVSS 302 test method). Roof sound insulation panels shall include additional mechanical retention.

M. Sound Performance: The engine generator, while operating at full rated load, shall not exceed 75.00 dBA average measured at 23 ft (7 meters) from the engine generator in a free field environment.

N. Louvers: Fixed-engine, cooling-air inlet and discharge. Stormproof and drainable louvers prevent entry of rain and snow.

O. Convenience Outlet: Factory-wired convenience 120v duplex-outlet within enclosure, GFCI.

2.10 VIBRATION ISOLATION DEVICES

A. Elastomeric Isolator Pads: Oil- and water-resistant elastomer or natural rubber, arranged in single or multiple layers, molded with a nonslip pattern and galvanized-steel baseplates of sufficient stiffness for uniform loading over pad area, and factory cut to sizes that match requirements of supported equipment for units with a ratings 750kw or below.
1. Material: Standard neoprene separated by steel shims.

B. Spring Isolators: Freestanding, steel, open-spring isolators with seismic restraint for units with a rating larger than 750kw.
1. Housing: Steel with resilient vertical-limit stops to prevent spring extension due to wind loads or if weight is removed; factory-drilled baseplate bonded to 1/4-inch-(6-mm-) thick, elastomeric isolator pad attached to baseplate underside; and adjustable equipment-mounting and -leveling bolt that acts as blocking during installation.
2. Outside Spring Diameter: Not less than 80 percent of compressed height of the spring at rated load.
3. Minimum Additional Travel: 50 percent of required deflection at rated load.
4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
6. Minimum Deflection: 0.5.

C. Vibration isolation devices shall not be used to accommodate misalignments or to make bends.

2.11 SOURCE QUALITY CONTROL

A. Prototype Testing: Factory test engine generator using same engine model, constructed of identical or equivalent components and equipped with identical or equivalent accessories.
1. Tests: Comply with IEEE 115 and with NFPA 110, Level 1 Energy Converters.

B. Project-Specific Equipment Tests: Before shipment, factory test engine generator and other system components and accessories manufactured specifically for this Project. Perform tests at rated load and power factor. Include the following tests:
   1. Test components and accessories furnished with installed unit that are not identical to those on tested prototype to demonstrate compatibility and reliability.
   2. Test generator, exciter, and voltage regulator as a unit.
   3. Full load run.
   4. Maximum power.
   5. Voltage regulation.
   6. Transient and steady-state governing.
   7. Single-step load pickup.
   8. Safety shutdowns.
   9. Report factory test results within 10 days of completion of test.

2.12 FINISHES

A. Indoor and Outdoor Enclosures and Components: Manufacturer's standard finish over corrosion-resistant pretreatment and compatible primer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas, equipment bases, and conditions, with Installer present, for compliance with requirements for installation and other conditions affecting packaged engine generator performance.

B. Examine roughing-in for piping systems and electrical connections. Verify actual locations of connections before packaged engine generator installation.

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

3.2 PREPARATION

A. Interruption of Existing Electrical Service: Do not interrupt electrical service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electrical service in accordance with requirements indicated:
   1. Notify Project Manager in advance of proposed interruption of electrical service.
   2. Do not proceed with interruption of electrical service without written permission.

3.3 INSTALLATION

A. Comply with NECA 1 and NECA 404.

B. Comply with packaged engine generator manufacturers' written installation and alignment instructions and with NFPA 110.

C. Equipment Mounting:
   1. Install packaged engine generators on cast-in-place concrete equipment bases or steel dunnage as indicated on drawings.
   2. Coordinate size and location of mounting bases for packaged engine generators.
   3. Install unit with vibration isolation devices described in section 2.11.

D. Tests and Inspections: The supplier of the electric generating plant and associated items covered herein shall provide factory certified technicians to inspect 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.

E. NFPA 110 Acceptance Tests: Perform tests required by NFPA 110 that are additional to those specified here, including, but not limited to, single-step full-load pickup test.

F. Battery and Charger Tests:
   1. Measure charging voltage and voltages between available battery terminals for full-charging and float-charging conditions.
   2. Verify that measurements are within manufacturer's specifications."

G. System Integrity Tests: Verify proper installation, connection, and integrity of each element of engine generator system before and during system operation. Check for air, exhaust, and fluid leaks.

H. Coordinate tests with tests for transfer switches and run them concurrently.

I. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation for generator and associated equipment.

J. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

K. Remove and replace malfunctioning units and retest and reinspect as specified above.

L. Retest: Correct deficiencies identified by tests and observations, and retest until specified requirements are met.

M. Report results of tests and inspections in writing. Record adjustable relay settings and measured insulation resistances, time delays, and other values and observations.

3.4 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain packaged engine generators.

3.5 FIELD QUALITY CONTROL

A. Tests and Inspections: The supplier of the electric generating plant and associated items covered herein shall provide factory certified technicians to inspect 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.

B. NFPA 110 Acceptance Tests: Perform tests required by NFPA 110 that are additional to those specified here, including, but not limited to, single-step full-load pickup test.

C. Battery and Charger Tests:
1. Measure charging voltage and voltages between available battery terminals for full-charging and float-charging conditions.
2. Verify that measurements are within manufacturer's specifications."

D. System Integrity Tests: Verify proper installation, connection, and integrity of each element of engine generator system before and during system operation. Check for air, exhaust, and fluid leaks.

E. Coordinate tests with tests for transfer switches and run them concurrently.

F. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation for generator and associated equipment.

G. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

H. Remove and replace malfunctioning units and retest and reinspect as specified above.

I. Retest: Correct deficiencies identified by tests and observations, and retest until specified requirements are met.

J. Report results of tests and inspections in writing. Record adjustable relay settings and measured insulation resistances, time delays, and other values and observations.

3.6 MAINTENANCE SERVICE

A. Repair Service Capabilities:
1. The generator set supplier shall maintain service parts inventory for the entire power system at a central location which is accessible to the service location 24 hours per day, 365 days per year. The manufacturer of the generator set shall maintain a central parts inventory to support the supplier, covering all the major components of the power system, including: engines, alternators, control systems, paralleling electronics, and power transfer equipment.
2. The generator set shall be serviced by a local service organization that is trained and factory certified in generator set service. The supplier shall maintain an inventory of power system replacement parts in the local service location. Service vehicles shall be stocked with critical replacement parts. The service organization shall be on call 24 hours per day, 365 days per year. The service organization shall be physically located within 50 miles of the site.
3. The manufacturer shall maintain model and serial number records of each generator set provided for at least 20 years.

B. Preventative Maintenance Service Agreement: The supplier shall include as a line item adder in the proposal, a one-year maintenance service agreement. The maintenance

shall be performed by factory authorized service technicians capable of servicing both the engine generator set(s) and the transfer switch(es). This agreement shall include semi-annual preventative maintenance visits to verify operation and/or complete the following:

1. All periodic engine maintenance as recommended by the service manual.
2. All electrical controls maintenance and calibrations as recommended by the manufacturer.
3. All auxiliary equipment as a part of the emergency systems.
4. The supplier shall guarantee emergency service.
5. All expendable maintenance items are to be included in this agreement.
6. A copy of this agreement and a schedule shall be provided in the submittal documents, detailing scope of work and preventative maintenance service visit interval.

3.7 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain packaged engine generators.

END OF SECTION

SECTION 26 36 23

AUTOMATIC TRANSFER SWITCH

PART 1 - GENERAL

1.1 SCOPE

A. Furnish and install automatic transfer switch(es) with number of poles, amperage, voltage, and withstand current ratings as shown on the plans. Basis of design is a Generac TX Series Non-Service Entrance Rated Automatic Transfer Switch, Open - In Phase Transfer, 400 A, 3 Pole 4 Wire 480V, Transfer Switch in a NEMA 1 Enclosure. Each automatic transfer shall consist of a mechanically held power transfer switch unit and a microprocessor controller, interconnected to provide complete automatic operation. All transfer switches and control panels shall be the product of the same manufacturer.

1.2 ACCEPTABLE MANUFACTURERS

A. Automatic transfer switches shall be Generac TX Series. Any alternative shall be submitted to the consulting engineer in writing at least 10 days prior to bid. Each alternate bid must list any deviations from this specification.

1.3 CODES AND STANDARDS

The automatic transfer switches and accessories shall conform to the requirements of:

A. UL 1008 - Standard for Automatic Transfer Switches

B. NFPA 70 - National Electrical Code (2017 version and later for start circuit monitoring)

C. NEC Articles 700, 701, 702, 708

D. NFPA 99 – Health Care Facilities

E. NFPA 110 – Emergency and Standby Power Systems

F. IEEE Standard 446 – IEEE Recommended Practice for Emergency and Standby Power Systems for Commercial and Industrial Applications

G. NEMA Standards ICS10, MG1, MG250, ICS6, AB1

H. ANSI C62.41

I. International Standards Organization: ISO 8528, 9001.

J. Where seismic rating and/or certification is required: IBC 2018, OSHPD

PART 2 - PRODUCTS

2.1 MECHANICALLY HELD TRANSFER SWITCH

A. The basis of design is the Generac TX Series Transfer switch that utilities a knife blade mechanically latching design with maintenance free contacts. The transfer switch unit shall be electrically operated and mechanically held. The open transition switch shall be mechanically interlocked to ensure only one of two possible positions, normal or emergency. The delayed transition switch shall be mechanically interlocked to ensure one of three possible positions, normal and emergency.

B. 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.

C. All main contacts shall be silver composition. Switches shall have segmented blow-on construction for high withstand current capability and be protected by separate arcing contacts.

D. A manual operating handle shall be provided for maintenance purposes.

E. Designs utilizing components of or parts thereof which are not intended for continuous duty, repetitive switching, or transfer between two active power sources are not acceptable.

F. Where neutral conductors must be switched, the ATS shall be provided with fully rated neutral transfer contacts.

G. Where neutral conductors are to be solidly connected, a neutral terminal plate with fully rated AL-CU pressure connectors shall be provided.

H. The switch shall be capable of the following methods of transfer: Open with In-Phase transition only, Time Delay in Neutral transition, or In-Phase transition with a default to Time Delay in Neutral.

I. The transfer switch shall have a Seismic Certification to the requirements of the international Building Code of electrical equipment.

2.2 ATS CONTROL WITH INTEGRATED USER INTERFACE PANEL

A. The basis of design is the Generac TXC-100 Controller with Integrated User Interface Panel which is voltage agnostic for service purposes removing the need for technicians to carry and support control panels for every available voltage. Any manufacturers that provide a controller or control panel that does not meet this requirement should notify the consulting engineer before bidding.

B. 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.

C. 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, and include standard on-board serial communications capability.

D. A user accessible USB port shall be provided to facilitate firmware updates, uploading of switch operational parameters, downloading of event history and switch operational statistics. This USB port shall be front accessible without opening the ATS door.

E. The controller shall provide single and three phase capability 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.

F. The controller power supply shall be field-configurable to operate on 120V through 480V systems without the need for transformers.

G. Control logic shall be backed up with a rechargeable, user-replaceable lithium-ion battery that shall also maintain control power for up to 60 minutes in the event no source power is available.

H. The controller shall be enclosed with a protective cover and be mounted separately from the transfer switch unit for safety and ease of maintenance.

I. The controller shall meet or exceed the requirements for Electromagnetic Compatibility (EMC) as follows:
   1. IEC 61000 – 4 – 3 Radiated RF Field Immunity
   2. IEC 61000 – 4 – 4 Electrical Fast Transient/Burst Immunity
   3. IEC 61000 – 4 – 5 Surge Immunity
   4. IEC 61000 – 4 – 6 Conducted RF Immunity
   5. IEC 61000 – 4 -11 Voltage Dips and Interruptions
   6. EN 61000 – 6 - 2 Industrial Immunity Requirements EN 61000-6-4 - Radiated Emissions
   7. EN 61000 – 6 - 4 Conducted Emissions
   8. CISPR 11 – Conducted RF Emissions and Radiated RF Emissions

2.3 ENCLOSURE

A. The basis of design is a Generac TX Series Non-Service Entrance Rated Transfer Switch in a NEMA 1 enclosure, with dimensions no larger than 51 Inches in Height, 24.4 Inches in Width, and 12 Inches In Depth. Larger enclosures than the basis of design will need to be approved by the Consulting Engineer to ensure there is enough wall space and appropriate clearance.
   1. Provide a temperature and humidity controlled anti-condensation heater for all NEMA 3R and 4X enclosed units. Heater shall be an available option on NEMA 1 enclosures, when called for on plans. Heater cover to indicate a hot surface.

   2. The switch mechanism and controller shall be easily removable from the enclosure in the field. This requirement will facilitate easy single-person installation on wall mounted switches, conduit fitting, and cable pulling while

minimizing risk of damage and/or contamination of ATS components during the installation process.

3. Controller human interface and USB port shall be visible and operational through the enclosure door, without the need for personal protective equipment, avoiding arc-flash hazard for routine checks of the controller status.

PART 3 - OPERATIONS

3.1 CONTROLLER DISPLAY AND KEYPAD

A. A backlit four-line graphical LCD display and human interface shall be an integral part of the controller for viewing all available data and setting desired operational parameters. Operational parameters shall also be available for viewing and limited control through the RS-485 communications port.

B. All instructions and controller settings shall be easily accessible, readable, and accomplished without the use of codes, calculations, or instruction manuals.

C. The user interface shall be provided with test/reset modes. The test mode will simulate a normal source failure. The reset mode shall bypass the time delays on either transfer to emergency or retransfer to normal.

D. The following parameters shall only be adjustable only by authorized service personnel:
1. Nominal line voltage and frequency
2. Single or three phase sensing on normal
3. Transfer operating mode configuration, (open transition, or delayed transition)

3.2 VOLTAGE AND FREQUENCY SENSING

A. Voltage and frequency on both the normal and emergency sources (as noted below) shall be continuously monitored, with the following pickup, dropout, and trip settings capabilities; values shown as percentage of nominal unless otherwise specified.

Voltage and Frequency Settings	Range	Default Value
Source 1 (Normal) is Genset	Yes or No	No
Source 1 Undervoltage Dropout	50-97%	85%
Source 1 Undervoltage Pickup	52-99%	90%
Source 1 Overvoltage Dropout	105-120%	110%
Source 1 Overvoltage Pickup	103-118%	105%
Source 1 Underfrequency Dropout	90-97%	90%
Source 1 Underfrequency	91-99%	95%

Pickup		
Source 1 Overfrequency Dropout	103-110%	105%
Source 1 Overfrequency Pickup	101-109%	102%
Source 1 Voltage Imbalance Drop	5-20%	5%
Source 1 Voltage Imbalance Pickup	3-18%	3%
Source 1 Warmup Time	0-1800s	3s
Source 1 Cooldown Time	0-1800s	1800s
Source 1 Minimum Run Time	300-1800s	1200s
Source 2 is Generator	Yes or No	Yes
Source 2 Undervoltage Dropout	50-97%	85%
Source 2 Undervoltage Pickup	52-99%	90%
Source 2 Overvoltage Dropout	105-120%	110%
Source 2 Overvoltage Pickup	103-118%	105%
Source 2 Underfrequency Dropout	90-97%	90%
Source 2 Underfrequency Pickup	91-99%	99%
Source 2 Overfrequency Dropout	103-110%	105%
Source 2 Overfrequency Pickup	101-109%	102%
Source 2 Voltage Imbalance Drop	5-20%	5%
Source 2 Voltage Imbalance Pickup	3-18%	3%
Source 2 Minimum Run Time	300-1800s	1200s
Source 2 Warmup Time	0-1800s	3s
Source 2 Cooldown Time	0-1800s	1800s
Phase Rotation Check	ABC, CBA, OFF	ABC
Supply Overvoltage	350 VAC	Fixed
Manual Return to Normal	Yes or No	
Time Delay Settings		
Transfer to Emergency	120s max	30s
Re-transfer to Normal	1,800s max	1,800s
Time Delay Neutral	120s max	30s
Engine Cool Down	300-1,800s	1,800s
Delayed Transition Time	120s max	120s
Elevator Signal	120s max	30s
In Phase Transfer	Yes or No	
In Phase Synchronization	Time 60-3600s	300s
Preferred Source	S1, S2	S1
Voltage Imbalance Enable	Yes or No	

Voltage Imbalance Timeout	10-30s max	20s

B. Repetitive accuracy of all settings shall be within 1% at +25C.

C. Voltage and frequency settings shall be field adjustable in 1% increments either locally with the display and keypad or remotely via RS-485 communications port access.

D. Source status screens shall be provided for both normal & emergency to provide digital readout of voltage and frequency.

E. The backlit graphical display shall have multiple language capability. Languages can be selected from the user interface.

3.3 TIME DELAYS

A. A Line Interrupt delay shall be provided to override momentary normal source outages, delay all transfer and engine starting signals; adjustable 0 to 120 seconds. It shall be possible to bypass the time delay from the controller user interface.

B. An Engine Warm Up delay shall be provided for extended engine RPM stabilization where fast transfer to the emergency source is not required; adjustable 0 to 1,800 seconds. It shall be possible to bypass the time delay from the controller user interface.

C. A Transfer to Emergency delay shall be provided for controlled sequencing of loads to the emergency source; adjustable from 0 to 120 seconds. It shall be possible to bypass the time delay from the controller user interface.

D. A Retransfer to Normal delay shall be provided to ensure stability of the normal source, adjustable from 0 to 1,800 seconds. Time delay shall be automatically bypassed if the emergency source fails and normal source is acceptable.

E. An Engine Minimum Runtime delay shall be provided to reduce nuisance starts when the normal source power is unstable but does not trigger a transfer to the emergency source, adjustable from 5 to 30 minutes. Operates in conjunction with Engine Cool Down delay.

F. An Engine Cool Down delay shall be provided; adjustable 300 – 1,800 seconds.

G. A Delayed Transition delay shall be provided to ensure sufficient time for motor voltage decay for transition between live sources; adjustable from 0 – 120 seconds.

H. An Elevator Signal Before Transfer output signal shall be provided to drive an external relay for selective load disconnect control. The controller shall have the ability to activate an adjustable 0 to 120 second delay in any of the following modes:

1. Prior to transfer only.
2. Prior to and after transfer.
3. Normal to emergency only.
4. Emergency to normal only.

5. Normal to emergency and emergency to normal.
6. All transfer conditions or only when both sources are available.

I. For special applications (i.e., three sources), the option to select the Preferred Source.

J. All adjustable time delays shall be field adjustable without the use of special tools or software.

Time Delay Summary Table:

Time Delay Description	Range	Default Value
Line Interrupt Delay	0 – 120 sec.	3 sec.
Engine Warm Up Delay	0 – 1,800 sec.	3 sec.
Transfer to Emergency	0 – 120 sec.	3 sec.
Retransfer to Normal	0 – 1,800 sec.	1,800 sec.
Engine Minimum Run Time	5 – 30 min.	5 min.
Engine Cool Down	300 – 1,800 sec.	1,800 sec.
Delayed Transition (Center Off Position)	0 – 120 sec.	120 sec.
Elevator Signal Before Transfer	0 – 120 sec.	0 sec.
Preferred Source	Normal (S1), Emerg. (S2)	Normal (S1)

3.4 EXTERNAL CONTROL INTERFACES AND INDICATORS

A. Communications connectors, user interface and display shall be accessible and usable without presenting an arc-flash hazard.

B. Customer inputs shall be optically isolated for wider compatibility with external systems. This will protect the controller from external surges and transient voltages.

C. Surge Protection for the ATS controls shall be provided.

D. Replaceable fuses to protect the power supply to the ATS control panel.

E. A set of contacts rated 5 amps, 30 VDC shall be provided for a low-voltage engine start signal. The start signal shall prevent dry cranking of the engine by requiring the generator set to reach proper output and run for the duration of the Engine Minimum Runtime setting, regardless of whether the normal source restores before the load is transferred.

F. Engine starting contacts shall facilitate start-circuit monitoring to comply with the 2017 and later versions of NFPA 70 Article 700.10 (D)(3).

G. Two sets of Form-C auxiliary contacts rated 10 amps, 250 VAC shall be provided to indicate the switch actuator position, including center-off for Time Delay Neutral switches or a Permissive (Emergency Inhibit) condition.

H. A single General Alarm (summary alarm) indication shall light up the alert indicator and de-energize the configured common alarm output relay for external monitoring.

I. LED indicating lights shall be provided; one to indicate when the ATS is connected to the normal source and one to indicate when the ATS is connected to the emergency source.

J. LED indicating lights shall be provided and energized by controller outputs. The lights shall provide true source availability of the normal and emergency source, as determined by the voltage sensing trip and reset settings for each source.

K. LED indicating light shall be provided to indicate switch not in automatic mode (manual).

L. LED indicating light shall be provided to indicate any alarm condition.

M. The controller shall have two programmable inputs and one programmable output as standard; with an optional expansion board to add up to four programmable input/outputs. Programmable I/O conditions shall include:

Programmable Output	Programmable Input
Source 1 – Two Wire Start	Permissive (Emergency Inhibit)
Source 2 – Two Wire Start	Remote Engine Fast Test
Engine Exercising	Remote Engine Normal Test
Engine Warmup	ATS Timer
Signal Before Transfer	Initiate Demand Response
General Alarm	
Source 1 Good	
Source 2 Good	

N. System Status - The controller LCD display shall include a System Status screen which shall be accessible from any point in the menu system by depressing the “ESC” key until you arrive at the System Status screen. This screen shall display a clear description of the active operating sequences and switch position. Operational status information displayed shall include:
1. Source 1 status (good or bad)
2. Source 2 status (good or bad)
3. Any active timer
4. Permissive (Emergency Inhibit when active)

3.5 TRANSFER AND EXERCISE CONTROLS

A. The following standard features shall be built into the controller, capable of being activated through keypad programming as required by the user:

1. Provide the ability to select “commit/no commit to transfer” to determine whether the load should be transferred to the emergency generator if the normal source restores before the generator is ready to accept the load.
2. An engine generator exercising timer shall be provided to configure daily, day of week, weekly, bi-weekly, or monthly testing of an engine generator set at a

specified time of day with or without load for a programmable period (Engine Minimum Runtime).

3. Terminals shall be provided for a remote contact to signal the ATS to transfer to emergency for remote test. Test signal can be enabled through the keypad or digital input. Transfer to emergency for demand response can be enabled by digital input.
4. For In-Phase Transfer Switch Designs: An in-phase monitor shall be provided in the controller such that the transfer occurs with less than ten degrees phase angle difference between sources. The monitor shall control transfer so that motor load inrush currents do not exceed normal starting currents and shall not require external control of power sources. In-phase switch transfer time shall not exceed 25ms.
5. For Delayed Transition Transfer Switch Designs: Terminals shall be provided for a remote contact to signal the ATS to load-shed (Permissive is removed) and move to a center-off position. When the load-shed signal is removed (Permissive is restored), the ATS shall reclose to the emergency. If normal source is good during load-shed the ATS shall transfer to and remain on normal source.

3.6 DATA LOGGING AND DIAGNOSTICS

A. Controllers that require multiple screens to determine system status or display “coded” system status messages, which must be explained by references in the operator’s manual are not permissible.

1. Controller & Contactor Health Monitoring with visual and auxiliary contact status shall be provided.
2. Communications Interface – The controller shall be capable of interfacing, through a standard RS-485 serial communication port with a network of transfer switches.
3. Data Logging – The controller shall have the ability to log data and to maintain the last 200 events, even in the event of total power loss. The following events shall be time and date stamped and maintained in a non-volatile memory:

    a. Date, time and reason for transfer normal to emergency.
    b. Date, time and reason for transfer emergency to normal.
    c. Date, time and reason for engine start.
    d. Date and time engine stopped.
    e. Date and time emergency source available.
    f. Date and time emergency source not available.

PART 4 - ADDITIONAL FEATURES AND ACCESSORIES

4.1 ADDITIONAL OPTIONAL FEATURES

A. Line Interrupt Time Delay. - Not Selected

B. Integrating Metering with current transformer. - Not Selected

C. Manual Retransfer to Generator. - Not Selected

D. Permissive (Emergency Inhibit). - Not Selected

E. Chicago Toolkit. - Not Selected

F. Expanded Input/Output Module. - Not Selected

G. Pad Lockable Control. - Not Selected

H. Temperature and Humidity Controlled Heater for NEMA1. - Not Selected

I. Transient Voltage Surge Suppressor (TVSS). - Not Selected

PART 5 - ADDITIONAL REQUIREMENTS

5.1 WITHSTAND AND CLOSING RATINGS

A. The ATS shall be rated to close on and withstand the available RMS symmetrical short circuit current at the ATS terminals with the type of overcurrent protection shown on the plans. The basis of design for this project is a Generac TX Series Non-Service Entrance Rated Automatic Transfer Switch with a 35ka 3 Cycle Rating, 35ka (.05 seconds) Time Based Rating, and a 65ka Specific Breaker Rating transfer switches from other manufacturers with ratings less than provided in this section will need to be approved by the Consulting Engineer to ensure compatibility with the project.

B. Provide a temperature and humidity controlled anti-condensation heater for all NEMA 3R and 4X enclosed units. Heater shall be an available option on NEMA 1 enclosures, when called for on plans. Heater cover to indicate a hot surface.

C. The switch mechanism and controller shall be easily removable from the enclosure in the field. This requirement will facilitate easy single-person installation on wall mounted switches, conduit fitting, and cable pulling while minimizing risk of damage and/or contamination of ATS components during the installation process.

D. Controller human interface and USB port shall be visible and operational through the enclosure door, without the need for personal protective equipment, avoiding arc-flash hazard for routine checks of the controller status.

5.2 TESTS AND CERTIFICATION

A. The complete ATS 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.

B. The ATS manufacturer shall be certified to ISO 9001: 2015 International Quality Standard and the manufacturer shall have third party certification verifying quality assurance in design/development, production, installation, and servicing in accordance with ISO 9001: 2015.

5.3 SERVICE REPRESENTATION

A. The ATS manufacturer shall support a service organization of company-employed personnel located throughout the contiguous United States. The service center's personnel must be factory trained and must be on call 24 hours a day, 365 days a year.

B. The manufacturer shall maintain records of switch shipments, by serial number, for a minimum of 10 years.

5.4 WARRANTY

A. The basis of design is a Generac TX Series Non-Service Entrance Rated Automatic Transfer Switch Comprehensive 5 Year Warranty.

B. A Basic Warranty is defined as the manufacturer covering replacement parts for the listed amount of the warranty period.

C. The Comprehensive Warranty is defined as the manufacturer covering replacement parts, labor, and limited technician travel costs for covered warranty repairs during the listed warranty period.

D. The switch mechanism and controller shall be easily removable from the enclosure in the field. This requirement will facilitate easy single-person installation on wall mounted switches, conduit fitting, and cable pulling while minimizing risk of damage and/or contamination of ATS components during the installation process.

E. Controller human interface and USB port shall be visible and operational through the enclosure door, without the need for personal protective equipment, avoiding arc-flash hazard for routine checks of the controller status.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Aggregate.
2. Asphalt paving.
3. Seal coat.
4. Wood headers and stakes.
5. Pavement marking.

1.2 RELATED REQUIREMENTS

A. Section 01 5000, Temporary Facilities and Controls.

B. Section 01 6116, Volatile Organic Compound (VOC) Restrictions, for VOC limits pertaining to adhesives, sealants, fillers, primers, and coatings.

C. Section 01 8113, Sustainable Design Requirements, for CAL-Green general requirements and procedures.

D. Section 31 2333, Trenching and Backfilling.

1.3 REFERENCES AND STANDARDS

A. California Building Code (CBC), edition as noted on the Drawings, as adopted by the California Division of the State Architect (DSA).

B. California Green Building Standards Code (CAL Green), edition as noted on the Drawings, as adopted by the California Division of the State Architect (DSA).

C. Local Jurisdiction: Any work within the street, highway or right-of-way shall be performed in accordance with the requirement of the governmental agencies having jurisdiction, and shall not begin until all of those governing authorities have been notified.

D. ASTM International (ASTM):

1. D698-00 Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, Using 5.5 lb (2.49 Kg) Rammer and 12 inch (304.8 mm) Drop.
2. D1556-00 Test Method for Density of Soil in Place by the Sand-Cone Method.
3. D1557-02 Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10 lb. (4.54 Kg) Rammer and 18 inch (457 mm) Drop.
4. D6628-16 Standard Specification for Color of Pavement Marking Materials.
5. D3017-05 Test Methods for Moisture Content of Soils and Soil-Aggregate Mixture by Nuclear Methods (Shallow Depth).
6. D4318-05 Test Method for Liquid Limit, Plastic Limit, and Plasticity Limit.

E. CALTRANS Standard Specifications.

F. CAL-OSHA, Title 8, Section 1590 (e).

1.4 ADMINISTRATION REQUIREMENTS

A. Submittal Procedures:

1. Action Submittals and Informational Submittals shall be submitted in accordance with Section 01 3300, Submittal Procedures.
2. Closeout Submittals shall be submitted in accordance with Section 01 7700, Closeout Procedures.
3. Sustainable Design Submittals shall comply with the additional requirements of Section 01 8113, Sustainable Design Requirements.

1.5 ACTION SUBMITTALS

A. Provide supplier's descriptive literature for all products to demonstrate compliance with specified attributes.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Contractor / Installer.

B. Sustainable Design:

1. General
   a. Submit information necessary to establish and document compliance with the California Green Building Standards Code.
   b. Sustainable design submittals are in addition to other submittals.
2. The following information shall be provided:
   a. Adhesives and Sealants: Evidence of compliance that products meet maximum VOC content limits specified in Section 01 6116.
   b. Paints and Coatings: Evidence of compliance that products meet maximum VOC content limits specified in Section 01 6116.

1.7 CLOSEOUT SUBMITTALS

A. Guarantee: Submit subcontractor's guarantee.

1.8 QUALITY ASSURANCE

A. Contractor / Installer shall have been in business for five (5) years providing/finishing similar size projects and complexity.

B. Contractor shall be solely responsible for all subgrades built. Any repairs resulting from inadequate compaction is the responsibility of the contractor.

C. The representatives of the Owner's testing lab will not act as supervisor of construction, nor will they direct construction operations. Neither the presence of the Owner's testing lab representatives nor the testing by the Owner's testing lab shall excuse the contractors or subcontractors for defects discovered in their work during or following completion of the project. Correcting inadequate compaction is the sole responsibility of the contractor.

D. Use only new materials and products, unless existing materials or products are specifically shown otherwise on the Drawings to be salvaged and re-used.

E. All materials, components, assemblies, workmanship and installation are to be observed by the Owner's Project Inspector. Work not so inspected is subject to uncovering and replacement.

F. Contractor shall provide verification that asphalt mix temperature meets the requirements of this specification at time of application.

G. Tests (See Part 1, Article "Testing").

1.9 DELIVERY, STORAGE AND HANDLING

A. Transport, store and handle in strict accord with the local jurisdiction.

1.10 FIELD CONDITIONS

A. Environmental Requirements:

1. Base Course: Do not lay base course on muddy subgrade, during wet weather, or when atmospheric temperature is below 40 degrees F.
2. Asphalt Surfacing: Do not apply asphaltic surfacing on wet base, during wet weather, or when atmospheric temperature is below 50 degrees F.

1.11 EXISTING SITE CONDITIONS

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

1.12 PROTECTION

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

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

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

D. Surface Drainage: Provide for surface drainage during period of construction in manner to avoid creating nuisance to adjacent areas. The contractor shall make a reasonable effort on a daily basis to keep all excavations and the site free from water during entire progress of work, regardless of cause, source, or nature of water.

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

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

1.13 SEASONAL LIMITS

A. No fill material shall be placed, spread or rolled during unfavorable weather conditions. When work is interrupted by rains, fill operations shall not be resumed until field tests indicate that moisture content and density of fill are satisfactory.

1.14 TESTING

A. General: Refer to Section 01 4523 – TESTING & INSPECTION SERVICES AND STRUCTURAL TESTS AND INSPECTIONS LIST, DSA-103.

B. Geotechnical Engineer: Owner is retaining a Geotechnical Engineer to determine compliance of fill with Specifications, and to direct adjustments in fill operations. Costs of Geotechnical Engineer will be borne by Owner; except those costs incurred for re-tests or re-inspection will be paid by Owner and backcharged to Contractor.

PART 2 - PRODUCTS

2.1 DESIGN AND PERFORMANCE CRITERIA

A. Sustainable Design:

1. VOC emissions for field-applied adhesives, sealants, and sealant primers must comply with limits specified in Section 01 6116.
2. VOC emissions for field-applied paints and coatings must comply with limits specified in Section 01 6116.

2.2 MATERIALS

A. Sterilant: Soil sterilizer shall be CIBA GEIGY's Pramatol 25-E, Treflan EC or Thompson-Hayward Casoron.

1. Soil sterilizer shall be applied in strict accordance with manufacturer's instructions.

B. Base Course Aggregate: State Specifications, Section 26, Class 2 aggregate base (3/4" max.).

C. Asphalt Binder: Steam-refined paving asphalt conforming to State Specifications, Section 92, viscosity grade PG 64-10. Asphalt binder additives for HMA per Caltrans approved list of manufacturers.

D. Liquid Asphalt Tack Coat: Per CALTRANS section 94.

E. Surface Course Aggregate: Mineral aggregates for Type "B" asphalt concrete, conforming to State Specifications 39-2.02, Type B, ½" maximum, medium grading. 3/8" maximum grading at Playcourt.

F. Seal Coat: shall be a pre-mixed asphalt emulsion blended with select fillers and fibers such as:

1. "Park-Top No. 302", Western Colloid Products.
2. "Overcoat", Reed and Gram.
3. "Drivewalk", Conoco Oil.

G. Wood Headers and Stakes: Pressure treated.

H. Pavement Marking: Colors as directed by Architect. Colors of painted traffic stripes and pavement markings must comply with ASTM D6628.

1. Waterborne traffic line - colors white, yellow and red, State specification PTWB-01R3.
2. Waterborne traffic line for the international symbol of accessibility and other curb markings – blue, red and green, Federal specification TT-P-1952F.

I. Pavement Epoxy; K-Lite; Ktepx-590; Ennis Epoxy HPS2 or an approved equal.

J. Crack Filler; QPR model CAR08, 10oz asphalt crack filler; Star STA-FLEX Trowel Grade crack filler or approved equal.

K. Reclaimed Asphalt Paugment (RAP). HMA Type A or Type B may be produced using RAP providing it does not exceed 15% or the aggregate blend.

2.3 MIXES

A. General: Plant mixed conforming to State Specifications, Section 39, Type B, ½" maximum, medium grading. 3/8" maximum grading shall be used at hardcourt.

B. Temperature of Hot Mix Asphalt: Not less than 275 degrees F nor more than 325 degrees F when added to aggregate.

C. Temperature of Hot Mix Aggregate: Not less than 250 degrees F nor more than 325 degrees F when asphalt is added.

D. Temperature of Hot Mix Asphalt Concrete: Asphalt shall be not less than 285 degrees at time of application, nor more than 350 degrees. Asphalt not meeting the required temperature shall not be used.

E. Temperature of Warm Mix Asphalt: Mixing and placement; per the approved manufactures heat range recommendations for mixing and placement.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Conditions of Work in Place: Subsurfaces which are to receive materials specified under this Section shall be carefully examined before beginning work hereunder, and any defects therein shall be reported, in writing, to the Architect. Work shall not be started until such defects have been corrected. Starting of work shall imply acceptance of conditions as they exist.

3.2 PREPARATION

A. Sub-Grade: Clean, shape and compact to hard surface free from elevations or depressions exceeding 0.05’ in 10' from true plan. Compact per Section 31 0000. Compaction and moisture content shall be verified immediately prior to placement of aggregate base. Proof roll subbase in presence of geotechnical engineer prior to placement of aggregate base.

3.3 INSTALLATION

A. Headers:

1. General: Install as edging to asphalt paving, except where adjoining existing pavement, concrete curbs, walks or building.
2. Existing Headers: Remove existing headers where new paving will join existing. Saw cut existing asphalt to provide clean edge.
3. Lines and Levels: Install true to line and grade. Cut off tops of stakes 2-inches below top of header so they will not be visible on completion of job.

B. Asphalt Paving:

1. Base Course: Install in accord with State Specifications, Section 26. Compact to relative compaction of not less than 95%, ASTM D1557. The material shall be deposited on the subgrade in such a manner as to provide a uniform section of material within five percent tolerance of the predetermined required depth. Deposition will be by spreader box or bottom dump truck to prevent segregation of the material. The material so deposited on the subgrade shall have sufficient moisture which, in the opinion of the Architect is adequate to prevent excessive segregation. It shall then be immediately spread to its planned grade and cross section. Undue segregation of material, excessive drifting or spotting of material will not be permitted. If in the opinion of the site geotechnical engineer, the material

is unsuitably segregated, it shall be removed or completely reworked to provide the desired uniformity of the material.

a. Moisture content and compaction of base material shall be tested immediately prior to placement of asphalt paving.

2. Sterilant: Apply specified material at manufacturer's recommended rate. Applicator of sterilant material shall be responsible for determining location of all planter areas. Apply specified material over entire base course area just prior to application of asphalt. Follow manufacturer's printed directions.

3. Liquid Asphalt Tack Coat: Apply as "tack coat" to all vertical surfaces of existing paving, curbs, walks, and construction joints in surfacing against which paving is to be placed.

4. Asphalt Concrete Surface Course:

   a. Comply with State Specifications, 39-6 except as modified below.

      1) Final gradation shall be smooth, uniform and free of ruts, humps, depressions or irregularities, with a minimum density of 91% of the theoretical maximum specific gravity determined by California Test Method #309. Maximum variation 1/8 inch in 10' when measured with steel straightedge in any one direction. Test paved areas for proper drainage by applying water to cover area. Correct portions that do not drain properly by patching with plant mix. In no case shall accessible parking spaces or loading and unloading areas exceed 2% slope in any direction.

      2) Asphalt material shall be delivered to the project site in a covered condition to maintain acceptable temperature.

5. Placement and adjustment of Frames, Covers, Boxes and Grates: The Contractor shall set and adjust to finish grade all proposed and existing frames, covers, boxes, and grates of all manholes, drop inlets, drain boxes, valves, cleanouts, electrical boxes and other appurtenant structures prior to placement of asphaltic concrete.

6. Water Testing: All paved areas shall be water tested, to check drainage, in the presence of the project inspector prior to placement of seal coat. The surface of asphalt paving shall not vary more than 1/8 inch above or below the grade established on the plans. If variations in grade are present, they will be corrected by overlaying paving and/or pavement removal and replacement as directed by the Architect.

7. Patching: Cut existing paving square and plumb at all edges to be joined by new paving. In trenches; grind existing asphalt on each side of trench 3” wide x ½ the depth of the section. Apply tact coat to vertical surfaces before installing new work. Warp carefully to flush surface, with seal over joints, and feather edge. Sawcut, remove and patch existing paving where cutting is necessary for installation of piping or conduits under Divisions 15, 16 and 33.

8. Seal Coat:

   a. Seal coat shall be applied no sooner than 30 days from time of asphalt placement.

   b. Surface Preparation: surface shall be clean of all dirt, sand, oil or grease. Hose down entire area with a strong jet of water to remove all debris. Remove soft, loose, or otherwise damaged areas of asphalt concrete to full

depth of damage and replace with compacted asphalt concrete as specified herein. Minor holes and imperfections may be patched using hot mix asphalt or mastic using sand/SS-1-H. Use wire brush for removal of oil and grease; prime with shellac or synthetic resin as recommended by manufacturer of pavement sealer material.

c. Seal Coat Seal Application: Thoroughly mix materials in the presence of the onsite inspector. Failure to do so will be cause for rejection. Apply in accordance with manufacturer's written instructions.
   a. The minimum application rate for each applied coat shall be 30gals per 1000 sq. ft. Two coats of sealcoat will be required.
   b. Clean-Up and Precautions: As recommended by pavement sealer material manufacturer.

d. Clean-Up and Precautions: As recommended by pavement sealer material manufacturer.

C. Pavement Marking: painted pavement markings shall be done only after the seal coat has thoroughly dried. On clean surfaces to be painted with traffic paint of dust, dirt, grime, oil, rust or other contaminants which will impair the quality of work or interfere with proper bond of paint coats. Surfaces shall be cleaned to the extent and by whatever means that will satisfactorily accomplish the purpose without damage to asphalt concrete. Provide measured layouts, temporary markings, templates, and other means necessary to provide required marking. Prepare and apply paint in accordance with manufacturer's instructions; paint shall be applied by spray and shall achieve complete coverage free from voids and thin spots. Where indicated on the Drawings, paint parking stall strips, lettering, arrows, accessible symbols, playground markings, game striping, maps, etc. on concrete paving or asphalt concrete paving. Paint stripes shall be 4 inches wide (except otherwise indicated) and applied with two (2) coats of herein specified Traffic Line Paint; white (except as otherwise specified or indicated).

1. International Accessible Symbol: Symbol shall be white figures on a blue background. Blue shall be equal to color PMS 933C. Lines and symbols shall be accurately formed and true to line and form; lines shall be straight and uniform in width. Painted edges shall be clean cut and free from raggedness, and corners shall be cut sharp and square. Tolerances: Apply striping within a tolerance 1/2 inch in 50 feet. Apply markings and striping to widths indicated with a tolerance of 1/4 inch on straight sections and 1/2 inch on curved sections.

D. Colors: As directed by Architect

3.4 CLEANING

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

B. Clean excess material from surface of all concrete walks and utility structures.

END OF SECTION

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Received from WCEI: December 18, 2020, Format Updated 9-8-21

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Concrete curbs and gutters.
2. Concrete pavement, sidewalks and ramps.
3. Steel reinforcing for flatwork and curbs.

1.2 RELATED REQUIREMENTS

A. Section 01 4523, Testing & Inspection Services.

B. Section 01 6116, Volatile Organic Compound (VOC) Restrictions; for VOC limits pertaining to adhesives, sealants, fillers, primers, and coatings.

C. Section 01 8113, Sustainable Design Requirements, for CAL-Green general requirements and procedures.

D. Section 03 2000, Concrete Reinforcing.

E. Section 32 1200, Asphalt Concrete Paving.

1.3 REFERENCES AND STANDARDS

A. California Building Code (CBC), edition as noted on the Drawings, as adopted by the California Division of the State Architect (DSA).

B. California Green Building Standards Code (CALGreen), edition as noted on the Drawings, as adopted by the California Division of the State Architect (DSA).

C. American Concrete Institute (ACI):

1. 117: Specification for Tolerances for Concrete Construction and Materials and Commentary.
2. 211.1: Standard Practice for Selecting Proportions for Normal, Heavyweight and Mass Concrete.
3. 301: Specifications for Structural Concrete.
4. 302.1R: Guide to Concrete Floor and Slab Construction.
5. 305R: Guide to Hot Weather Concreting.
6. 306R: Guide to Cold Weather Concreting.
7. 308R: Guide to External Curing of Concrete.
8. 318: Building Code Requirements for Structural Concrete and Commentary.
9. 347R: Guide to Formwork for Concrete.

D. ASTM International (ASTM):

1. A615/A615M: Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
2. A706/A706M: Standard Specification for Deformed and Plain Low-Alloy Steel Bars for Concrete Reinforcement.
3. C33/C33M: Standard Specification for Concrete Aggregates.
4. C94/C94M: Standard Specification for Ready-Mixed Concrete.
5. C143/C143M: Standard Test Method for Slump of Hydraulic-Cement Concrete.
6. C150C150M: Standard Specification for Portland Cement.
7. C260/C260M: Standard Specification for Air-Entraining Admixtures for Concrete.
8. C309: Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
9. C330/C330M: Standard Specification for Lightweight Aggregates for Structural Concrete.
10. C494/C494M: Standard Specification for Chemical Admixtures for Concrete.
11. C618: Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.
12. C920: Standard Specification for Elastomeric Joint Sealants.
13. C1107/C1107M: Standard Specification for Packaged Dry, Hydraulic Cement Grout (Non-Shrink).
14. C1315: Standard Specification for Liquid Membrane-Forming Compounds Having Special Properties for Curing and Sealing Concrete.
15. D1751: Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
16. D5893/D5893M: Standard Specification for Cold Applied, Single Component, Chemically Curing Silicone Joint Sealant for Portland Cement Concrete Pavements.

E. Concrete Reinforcing Steel Institute (CRSI):

1. Manual of Standard Practice.
2. Placing Reinforcing Bars.

F. State of California, Department of Transportation (Caltrans):

1. Division of Engineering Services:
   a. California Test 342: Method of Test for Surface Skid Resistance with the California Portable Skid Test.
2. Standard Specifications.
   a. Section 51, Concrete Structures.
   b. Section 52, Reinforcement.
   c. Section 73, Concrete Curbs and Sidewalks.
   d. Section 90, Concrete.

G. US Government General Services Administration (GSA/SAE):

1. GSA/SAE AMS-STD-595A: Colors Used In Government Procurement.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Submittal Procedures:

1. Action Submittals shall be submitted in accordance with Section 01 3300, Submittal Procedures.
2. Closeout Submittals shall be submitted in accordance with Section 01 7700, Closeout Procedures.
3. Sustainable Design Submittals shall comply with the additional requirements of Section 01 8113, Sustainable Design Requirements.

1.5 ACTION SUBMITTALS

A. Shop Drawings: Joint pattern layout for walks and pavement.

B. Product Data:

1. A complete list of materials proposed to be used for the site concrete work including, but not limited to, sand, gravel, admixtures, surface treatments, coloring agents, sealers, cast-in-place accessories, forming and curing products, concrete mix designs, reinforcing materials, joint materials, curing materials, and detectable warning surface.
2. Manufacturer's descriptive literature for products proposed for use. Include installation instructions, and maintenance instructions.

C. Concrete Mix Design: The Contractor shall submit three copies of each proposed mix design for each class of concrete in accordance with ACI 301, Sections 3.9 "Proportioning on the Basis of Previous Field Experience or Trial Mixture," or 3.10 "Proportioning Based on Empirical Data." The Contractor shall submit a separate mix design for concrete to be placed by pumping, in addition to the mix design for concrete to be placed directly from the truck chute.

1. The following information shall be included in the concrete mix design:
   a. Proportions of cement, fine and coarse aggregate, and water.
   b. Water-cement ratio, 28-day compressive design strength, slump, and air content.
   c. Type of cement and aggregate.
   d. Special requirements for pumping.
   e. Range of ambient temperature and humidity for which design is valid.
   f. Special characteristics of mix, which require precautions in mixing, placing, or finishing techniques to achieve specified finished product.
2. Do not begin concrete production until mixes have been reviewed and approved by Engineer.
   a. Review of mix design by the Architect and Engineer shall in no way relieve the subcontractor of his responsibility for the performance of the concrete.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer.

B. Delivery tickets as specified for ready-mixed concrete.

C. Sustainable Design:

1. General:
   a. Submit information necessary to establish and document compliance with the California Green Building Standards Code.
   b. Sustainable design submittals are in addition to other submittals.
2. The following information shall be provided:
   a. Adhesives and Sealants: Evidence of compliance that products meet maximum VOC content limits specified in Section 01 6116.
   b. Paints and Coatings: Evidence of compliance that products meet maximum VOC content limits specified in Section 01 6116.

1.7 CLOSEOUT SUBMITTALS

A. Guarantee: Submit subcontractor’s guarantee.

1.8 QUALITY ASSURANCE

A. Qualifications:

1. Manufacturer of ready-mixed concrete products shall meet ASTM C94/C94M requirements for production facilities and equipment.

B. Design, erect, support, brace and maintain formwork and shoring to safely support all loads that might be applied until such loads can be carried by concrete.

C. The Contractor shall perform work in accordance with ACI 301.

D. Use only new materials and products.

E. Single-Source Responsibility: Use materials and products of one manufacturer whenever possible.

F. Materials, components, assemblies, workmanship and installation are to be observed by the Owner's Project Inspector. Work not so inspected is subject to uncovering and replacement.

G. Testing to determine compliance with the work of this Section will be the responsibility of the Contractor.

1. Cement and reinforcing shall be tested in accordance with CBC Section 1910A. Testing of reinforcing may be waived in accordance with Section 1910A.2 when approved by the Engineer and DSA.

2. Testing will be performed by an independent testing and inspecting agency in accordance with Section 01 4523, Testing and Inspection Services, and paid for by the Owner.
3. Refer to Article FIELD QUALITY CONTROL in Part 3 of this Section for additional requirements.
4. Cost of retests and coring due to low strength or defective concrete will be paid by the Owner and back-charged to the Contractor.

H. Sieve analysis from testing laboratories identifying rock/sand percentages within the concrete mix; or class 2 aggregate base shall have the current Project name and Project location identified on the report. Outdated analytical reports greater than 90 days old will not be accepted.

I. Mockups: Provide on-site mockup panels for each type of exposed colored concrete flatwork showing texture and color before proceeding with finish to be used on this Project.

1. Construct sample panels after review and approval of samples.
2. Size: Minimum 5 feet square and have at least one longitudinal and one transverse joint unless a more specific note indicates otherwise on Drawings.
3. Construct sample panels at location approved by Architect.
4. Construct sample panels in ample time to allow for finishing and curing before requesting Architect to review.
5. Follow procedures used on accepted samples.
6. Include saw-cut and tooled joints to match method and appearance proposed for use in completed work.
7. Prepare successive sample panels as required until finish, color, and appearance is approved by Architect.
8. Do not remove sample panels until authorized in writing by the Architect and all concrete work has been approved.

1.9 DELIVERY, STORAGE AND HANDLING

A. Deliver undamaged products to job in manufacturer's sealed containers and/or original bundles with tags and labels intact.

B. Store materials in protected, dry conditions off of ground and in areas so as to not interfere with the progress of the Work.

C. Transport, store and handle in strict accordance with the manufacturer's written recommendations.

D. Store cement in weather tight building, permitting easy inspection and identification. Protect from dampness. Lumpy or stale cement will be rejected.

E. Aggregates: Prevent excessive segregation, or contamination with other materials or other sizes of aggregate. Use only one supply source for each aggregate stock pile.

1.10 FIELD CONDITIONS

A. Make and be responsible for all field dimensions necessary for proper fitting, slopes, and completion of work. Report discrepancies to Architect before proceeding.

B. Do not place concrete during rain without adequate protection.

C. The Contractor shall conform to ACI 306R when mixing and placing concrete during cold weather. Provide sufficient protection when daily temperatures drop below 40 degrees F.

D. The Contractor shall conform to ACI 305R when mixing and placing concrete during hot weather. When air temperature exceeds 100 degrees F adjust concrete mix with retarding admixture in design mix, and adequately test and take additional measures as directed by concrete supplier.

E. The Contractor shall maintain access for vehicular and pedestrian traffic as required for other construction activities. Use temporary striping, flagmen, barricades, warning signs, and warning lights as required.

F. Placing in hot weather: Comply with ACI 305R. Concrete shall be delivered, placed and finished in a sufficiently short period of time to avoid surface dry checking.

1. Concrete shall not exceed 85 degrees F at time of placement.
2. Concrete shall be kept wet continuously after tempering until implementation of curing compound procedure in accordance with this specification.
3. Evaporation Retarder: Apply evaporation retarder to concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 pounds per square foot per hour, 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.

G. Placing in Cold Weather: Comply with ACI 306R. Protect from frost or freezing. No antifreeze admixtures are permitted.

1. When placing concrete during freezing or near-freezing weather, mix shall have temperature of at least 50 degrees F but not more than 90 degrees F.
2. Concrete shall be maintained at temperature of at least 50 degrees F for not less than 72 hours after placing or until it has thoroughly hardened.
3. Provide necessary thermal coverings for any flat work exposed to freezing temperatures.

PART 2 - PRODUCTS

2.1 DESIGN AND PERFORMANCE CRITERIA

A. Contractor shall comply with requirements applicable to this Section for concrete materials, admixtures, bonding materials, curing materials, surface sealers and others as required.

B. Concrete walking surfaces shall have a coefficient of friction not less than 0.30 and will be subject to testing to verify compliance as specified in Article FIELD QUALITY CONTROL.

1. The coefficient of friction will be measured by California Test 342 before pavement is opened to public traffic, but not sooner than 7 days after concrete placement.
2. Contractor shall notify the Architect and Project Inspector of pavement having a coefficient of friction less than 0.30.

C. Sustainable Design:

1. VOC emissions for field-applied adhesives, sealants, and sealant primers must comply with limits specified in Section 01 6116.
2. VOC emissions for field-applied paints and coatings must comply with limits specified in Section 01 6116.

2.2 FORMING MATERIALS

A. Form Material: Steel, wood, or other suitable material of size and strength to resist movement during concrete placement and to retain horizontal and vertical alignment until removal. Use straight forms, free of distortion and defects. Use flexible spring steel forms or laminated boards to form radius bends as required. The forms shall be of a depth equal to the depth of curbing or sidewalk, and so designed as to permit secure fastening together at the tops. Coat forms with non-staining type coating that will not discolor or deface surface of concrete.

1. Concrete Exposed to View: 5/8-inch minimum APA B-B Plyform, steel or “Sonotube” forms by Sunoco, 888-875-8754, or equal.
2. Concrete Concealed from View: 5/8-inch minimum APA B-B Plyform, steel or 1 x 8 DF, Number 2 Grade or better.

B. Form Ties: Snap off metal of fixed length, leaving no metal within 1-1/2 inches of surface and no fractures, spalls or other surface defects larger than 1 inch diameter; manufactured by Burke, Dayton Superior, or equal.

C. Spreaders: Metal. Wood is not permitted.

D. Form Coating: Coat forms with non-staining material that will not discolor or deface surface of concrete or leave any residue on concrete that would interfere with surface coating as approved by the Architect.

E. Chamfer Strips: Rigid polyvinyl chloride, 3/4-inch x 3/4-inch, in maximum possible lengths, manufactured by Burke, Greenstreak, Vulco, or equal.

2.3 REINFORCING MATERIALS

A. Reinforcement Bars: New billet steel deformed bars conforming to requirements of ASTM A615/A615M or ASTM A706/A706M; Grade 60.

1. Bars for dowels installed through expansion joints or construction joints to existing sidewalks or concrete features shall be smooth or if deformed shall be sleeved on one end for slippage.

B. Reinforcing Supports: Galvanized metal chairs or spacers or metal hangers, accurately placed 3 feet on center each way, staggered, with each support securely fastened to steel reinforcement in place.

1. Bottom bars in footings may be supported with 3-inch concrete blocks with embedded wire ties.
2. Concrete supports without wire ties will not be allowed.

2.4 CONCRETE MATERIALS

A. Cement: Portland cement in accordance with ASTM C150/C150M, Type II, low alkali.

B. Concrete Aggregates: Graded from coarse to fine in accordance with ASTM C33/C33M.

1. Normal Weight Aggregates: Clean and free from deleterious coatings, clay balls, roots, and other extraneous materials, and in conformance with ASTM C33/C33M, except as otherwise specified. Combined grading shall meet limits of ASTM C33/C33M.
   a. Size: Not be larger than one-fifth of the narrowest dimension between forms, or larger than three-fourths of the minimum clear spacing between reinforcing bars.
2. Lightweight Aggregates:
   a. General: Durable particles suitably processed, washed and screened without adherent coatings, free of materials with deleterious reactivity to alkali in cement, and conforming to ASTM C330/C330M.
   b. Fine aggregate shall be natural sand, or sand prepared from stone or gravel, with grains free of silt, loam and clay.

C. Water: Potable, clean, and in accordance with ASTM C94/C94M, free from injurious amounts of oil, acids, alkalis, salts, scale, organic materials or other deleterious matter, and in compliance with ACI 318 Section 26.4.1.3.

D. Fly Ash: Western Fly Ash, conforming to ASTM C618 for Class N or Class F materials and in accordance with CBC Section 1903A.6.

1. Class C is not permitted.
2. Proportions: Not more than 15 percent (by weight) may be substituted for portland cement.

2.5 ADMIXTURES

A. Water Reducing Admixture: Admixture to improve placing, reduce water cement ratio and ultimate shrinkage; “WRDA 64” by GCP Applied Technologies, or equal conforming to ASTM C494/C494M and ACI 318 Section 3.6.

1. Water reducing admixture may be used subject to prior approval by the Architect, Engineer, and the Testing Lab.
2. Proposed product and quantity shall be included in original design mix.

B. Air-Entraining Admixture: “Daravair 1000” by GCP Applied Technologies or equal conforming to ASTM C260 and ACI 318, section 26.4.1.4.

1. Proportion air entraining concrete to attain specified minimum 28-day compressive strength.
2. Total air entrainment in concrete shall be not less than 4 percent or more than 6 percent of the volume of concrete.

2.6 CURING MATERIALS

A. Clear Curing Compound: Water-based membrane-forming concrete curing compound in accordance with ASTM C309 and C1315; “Aqua Resin Cure Clear” by Burke CO, “1100” by W.R. Meadows, or equal.

2.7 ADDITIONAL MATERIALS AND COMPONENTS

A. Concrete Bonding Agent: The following, or equal, conforming to ASTM C1059/C1059M.

1. “Weld-Crete” by Larson Products Corporation, 800-633-6668.
2. “Daraweld C” by GCP Applied Technologies, 877-423-6491.

B. Patching Mortar: One-component, trowel applied, migrating-corrosion-inhibitor enhanced, polymer-modified, shrinkage-compensated, fiber reinforced, micro-silica enhanced, cementitious repair mortar for horizontal, vertical, and overhead applications; “Meadow-Crete GPS” by W.R. Meadows, or equal.

C. Non-Shrink Grout: Premixed, non-metallic, no chlorides, non-staining and non-shrinking conforming to ASTM C1107/C1107M; “MasterFlow 713” by Master Builders Solutions, a division of BASF, 800-433-9517, or equal.

D. Drainage Rock Base: 3/4-inch aggregate size conforming to Class 2 Aggregate Base as defined in Caltrans Standard Specifications Section 26, or equal clean free-draining gravel or crushed rock as recommended by the Geotechnical Engineer.

E. Expansion Joint Material: Preformed 3/8-inch fiber material, with bituminous binder manufactured for use as concrete expansion joint material and conforming to ASTM D1751 and approved by Architect.

1. Furnish joint fillers in one-piece lengths for full width being placed, wherever possible. Where more than one length is required, lace or clip joint-filler sections together.

F. Joint Sealant for Expansion Joints in Concrete: Weather and UV resistant, single component, cold applied silicone sealant, Type S, conforming to ASTM D5893/D5893M; ASTM C920, Grade P, Class 25, Use T.

1. Self-Leveling: “DOWSIL 890-SL Silicone Joint Sealant” by Dow Chemical Company, or equal.
2. At Slopes Exceeding 5 Percent: Non-sagging; “DOWSIL 888 Silicone Joint Sealant” by Dow Chemical Company, or equal.
3. Color: As standard with manufacturer.

G. Pre-Formed Plastic Expansion Joint Caps: Polystyrene, with removable tops; “Snap Cap” by W. R. Meadows, Tex-Trude expansion caps, or equal.

2.8 CONCRETE DESIGN AND CLASS

A. Designed Strength and Classes of Concrete: The following mixes are not applicable to concrete items exceeding 4 feet in height above the adjacent grade.

1. Class “B”: Concrete shall have 1 inch maximum size aggregate, shall have 3000 pounds per square inch minimum at 28 day strength with a maximum water to cementitious ratio no greater than 0.50.
    a. Location of Use: Exterior slabs, including walks, vehicular paved surfaces, manhole bases, poured-in-place drop inlets, curbs, valley gutters, curb and gutter, and other concrete of like nature.
2. Class "D" concrete of 1 inch maximum size aggregate shall have 3500 pounds per square inch 28 day strength with a maximum water to cementitious materials ratio of 0.55.
    a. Location of Use: Footings and retaining walls not attached to buildings, and planter walls, monument signs, and other site concrete not described for use in Class “B”.

B. Slump Limits: Provide concrete, at point of final discharge of proper consistency as tested in accordance with ASTM C143/C143M with slumps of 4 inches, plus or minus 1 inch.

C. Mix Design: Concrete shall be designed for strength in accordance with provisions of CBC Section 1905A.

1. Should the Contractor desire to pump concrete, a modified mix design will need to be submitted for review.
2. Fly ash may be used in concrete to improve workability in amounts up to 15 percent of the total cementitious weight.

D. Air Entrainment: Provide at concrete paving / flatwork, including concrete ramps and stairs in accordance with local jurisdiction minimum requirements, but no less than 3 percent of the volume of concrete.

E. Glare Reduction Additive:

1. General:
    a. Provide at exterior concrete slabs, walks, ramps, stairs, including bleachers, and other exposed flatwork to eliminate glare.

b. Omit glare reduction colorant where color hardener, integral color, and stain treatment of concrete are scheduled.

2. Quantity: As required to match approved sample but not exceed 2 pounds of colorant per cubic yard of concrete.
3. Add colorant to mix in accordance with manufacturer's printed instructions.

2.9 MIXING OF CONCRETE

A. Conform to requirements of CBC Chapter 19A.

B. Concrete shall be mixed until there is uniform distribution of material and mass is uniform and homogenous; mixer must be discharged completely before the mixer is recharged.

C. Concrete shall be Ready-Mixed Concrete: Mix and deliver in accordance with the requirements set forth in ASTM C94/C94M and ACI 301. Batch Plant inspection may be waived in accordance with CBC Section 1705A.3.3, when approved by the Project Engineer and DSA.

1. Furnish batch certificates for each batch discharged and used in the work.
2. Approved Testing Laboratory shall check the first batching at the start of the work and furnish mix proportions to the Licensed Weighmaster.
3. Licensed Weighmaster shall identify materials as to quantity and to certify to each load by ticket.
4. Delivery tickets are to accompany each truck and shall be kept in the job superintendent’s file. Delivery tickets must indicate the following information or be subject to rejection:
   a. Name of Project.
   b. Supplier of concrete.
   c. Truck identity and ticket serial number.
   d. Date of delivery.
   e. Brand of cement.
   f. Cement content.
   g. Strength classification.
   h. Batching time.
   i. Point of deposit.
   j. Total amount of water.
   k. Weight of aggregate.
   l. Daily temperature.
   m. Number of cubic yards in load.
   n. Admixture content.
   o. Name of Contractor.
   p. Name of driver.
   q. Time loaded and first mixing of concrete.
   r. Reading of revolution counter.

5. Ticket shall be transmitted to Project Inspector by truck driver with load identified thereon. Project Inspector will not accept load without load ticket identifying mix and will keep daily record of pours, identifying each truck, its load and time of receipt, and will transmit two copies of record to DSA.
6. At end of project, Weighmaster shall furnish affidavit to DSA on form satisfactory to DSA, certifying that all concrete furnished is in conformance with proportions established by mix designs.
7. Placement of concrete shall occur as rapidly as possible after batching and in a manner which will assure that the required quality of the concrete is maintained. In no case may concrete be placed more than 90 minutes from batch time.
    a. When air temperature is between 85 and 90 degrees F, reduce maximum batching to discharge time from 90 minutes to 75 minutes.
    b. When air temperature is above 90 degrees F, reduce maximum batching to discharge time to 60 minutes.
8. Water may be added to the mix only if neither the maximum permissible water-cement ratio nor the maximum slump is exceeded.
    a. The quantity of water used for each batch shall be accurately measured.
    b. In no case shall more than 10 gallons of water be added to a full 9-yard load, or 1 gallon per yard on remaining concrete within the drum, providing load tag indicates at time of mixing at plant an allowance for additional water.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Confirm general layout, grade, and joint pattern layout with the Architect prior to placing concrete.

B. Verify that gradients and elevations of the base are correct, and that the base is dry.

C. Contractor shall report in writing to the Architect prevailing conditions that will adversely affect satisfactory execution of the work of this Section.

1. Do not proceed with work until unsatisfactory conditions have been corrected.

D. Forms and reinforcements are subject to approval by the Project Inspector as specified in Article FIELD QUALITY CONTROL.

3.2 PREPARATION

A. Remove frost, water, and other foreign materials from form surfaces, reinforcement, and embedded items against which concrete will be placed.

B. When the ambient temperature necessitates the use of cold or hot weather concreting, make provisions in advance of concrete placement.

C. Before placing concrete, clean tools and equipment, and remove debris from areas to receive concrete.

D. Clean reinforcing and other embedded items of coatings, oil, mud and soil that may impair bond with concrete.

E. Slab-On-Grade: After subgrade has been approved by Geotechnical Engineer, install specified drainage rock base material to thickness shown. Rock base shall be implemented and compacted in accordance with the Geotechnical Report and recommendations of the Geotechnical Engineer.

3.3 INSTALLATION – FORMWORK

A. Form material shall be straight, true, sound and able to withstand deformation due to loading and effects of moist curing. Materials which have warped or delaminated, or require more than minor patching of contact surfaces, shall not be reused.

B. Build forms to shapes, lines, grades and dimensions indicated. Construct formwork to maintain tolerances required by ACI 301. Forms shall be substantial, tight to prevent leakage of concrete, and properly braced and tied together to maintain position and shape. Butt joints tightly and locate on solid backing. Chamfer corners where indicated. Form bevels, grooves and recesses to neat, straight lines. Construct forms for easy removal without hammering, wedging or prying against concrete.

C. Space clamps, ties, hangers and other form accessories so that working capacities are not exceeded by loads imposed from concrete or concreting operations.

D. Build openings into vertical forms at regular intervals if necessary to facilitate concrete placement, and at bottoms of forms to permit cleaning and inspection.

E. Build in securely braced temporary bulkheads, keyed as required, at planned locations of construction joints.

F. Before placement of reinforcing steel, coat faces of all forms to prevent absorption of moisture from concrete and to facilitate removal of forms. Apply specified material in conformance with manufacturer's written directions.

1. Seal all cut edges.
2. Before re-using form material, inspect, clean thoroughly, and recoat.

G. Slope tie-wires downward to outside of wall.

H. Brace, anchor and support all cast-in items to prevent displacement or distortion.

I. During and immediately after concrete placing, tighten forms, posts and shores. Readjust to maintain grades, levels and camber.

J. Concrete Paving, Curbs, Curb and Gutters, Ramps:

1. Expansion Joints: Install at locations indicated, and so that maximum distance between joints is 20 feet for exterior concrete unless otherwise shown. Expansion joint material shall be full depth of concrete section. Recess for snap cap and sealant when required.

2. Curbs, Valley Gutter, and Curb & Gutter: Install expansion joints at 60 feet on center, except when placing adjacent to concrete walks, the expansion joints shall align with the expansion joints shown for the concrete walks. Expansion joint material shall be full depth of concrete section. Recess for snap cap and sealant when required.
3. Isolation Joints: 3/8-inch felt between walls and exterior slabs or walks so that paved areas are isolated from all vertical features, unless specifically noted otherwise on plans.
4. Exterior Concrete Paving: Install expansion joints at 20 feet on center maximum, both directions, unless shown otherwise on plans.
5. Ramps: Whether shown or not, all ramps shall have control joints and expansion joints.
    a. Control joints on ramps shall be aligned and placed in between the vertical posts for the handrails. The curbs, if required shall have control joints that align with the handrail posts.
    b. Expansion joints shall be placed at the upper, intermediate, and bottom landings.

K. Inspection: Refer to Article FIELD QUALITY CONTROL.

3.4 INSTALLATION – REINFORCING

A. General: Reinforcing shall be accurately placed at locations indicated on the drawings within required tolerances and providing required clearances. Reinforcement shall be secured prior to placement of concrete such that tolerances and clearances are maintained. Coverage shall be in accordance with Section 1907A.7 of the CBC.

1. Reinforcement must be in place before concreting is begun.
2. Keep a person on the job to maintain position of reinforcing as concrete is placed.
3. All expansion and construction joints in concrete shall have dowels of size and spacing as shown on the Drawings, or as approved by Architect.
4. Give notice whenever pipes, conduits, sleeves, and other construction interferes with placement; obtain method of procedure to resolve interferences.

B. Additional reinforcing steel shall be placed around all utility boxes, valve boxes, manhole frames and covers that are located within the concrete placements.

1. The bars shall be placed so that there will be a minimum of 1-1/2-inch clearance and a maximum of 3-inch clearance. The reinforcing steel shall be placed mid-depth of concrete slab.

C. At right angles or intersections of concrete walks, additional 2 feet x 2 feet #5, 90 degree bars shall be added at all inside corners for additional crack control. The bars shall be placed 2 inches from concrete forms and supports, at mid-depth of slab.

D. Reinforcing steel shall be adequately supported by approved devices on centers close enough to prevent any sagging.

E. Placing Tolerances:

1. In accordance with ACI 301 or CRSI/WCRSI Recommended Practice for Placing Reinforcing Bars, unless otherwise shown.
2. Clear distance between parallel bars in a layer shall be no less than 1 inch, the maximum bar diameter shall not exceed 1-1/2 times the maximum size of coarse aggregate.

F. Splices:

1. General: Unless otherwise shown on drawings, splice top reinforcing at midspan between supports, splice bottom reinforcing at supports, and stagger splices. Bar laps shall be wired together. Reinforcing steel laps shall be as follows:
   a. Length of Lap Splices in Concrete:
      1) No. 4 bar: 24 inches minimum.
      2) No. 5 Bar: Not less than 62 bar diameters.
      3) No. 6 Bar: 56 inches minimum.
      4) No. 7 Bars and Larger: Not less than 93 bar diameters.
   b. All splices shall be staggered at 5 feet minimum from adjacent splices.

G. Inspection: Refer to Article FIELD QUALITY CONTROL.

3.5 PLACING OF CONCRETE – GENERAL

A. Adjacent finish surfaces shall be protected at all times during the concrete pour and finishing. Verify that all formwork is tight and leak-proof before concrete is poured. Finish work defaced during the concrete pour and finishing shall be replaced at no extra cost to Owner.

B. Remove wood chips, sawdust, dirt, loose concrete and other debris just before concrete is to be poured. Use compressed air for inaccessible areas. Remove all standing water from excavations.

C. Transport concrete from mixer to place of final deposit as rapidly as practicable by methods which will prevent separation or loss of ingredients. Deposit as close as practicable in final position to avoid re-handling or flowing. Partially hardened concrete must not be deposited in work. Concrete shall not be wheeled directly on top of reinforcing steel.

D. Keep excavations free of standing water, but moisture condition sub-grade before concrete placement.

E. Placing: Once started, continue concrete pour continuously until section is complete between predetermined construction joints. Prevent splashing of concrete onto adjacent forms or reinforcement and remove such accumulation of hardened or partially hardened concrete from forms or reinforcement before work proceeds in that area. Free fall of concrete shall not to exceed 4'-0" in height. If necessary, provide lower openings in forms to inject concrete and to reduce fall height.

F. Remove form spreaders as placing of concrete progresses.

G. Place footings as monolithic and in one continuous pour.

H. Compacting: Concrete shall be compacted by mechanical vibrators.

1. Concrete shall be thoroughly worked around reinforcement and embedded fixtures and into corners of forms.
2. Vibrating shall not be applied to concrete which has already begun to initially set or be continued so long as to cause segregation of materials.

3.6 REMOVAL OF FORMS

A. Remove without damage to concrete surfaces.

1. Sequence and timing of form removal shall insure complete safety of concrete structure.
2. Forms shall remain in place for not less than the following periods of time. These periods represent cumulative number of days during which temperature of air in contact with concrete is 60 degrees F and above.
   a. Vertical Forms of Foundations, Walls and All Other Forms Not Covered Below: 5 days.
   b. Concrete Paving Edge Screeds or Forms: 7 days.
3. Concrete shall not be subjected to superimposed loads (structure or construction equipment) until it has attained its full design strength and not for a period of at least 21 days after placing. Concrete systems shall not be subjected to construction loads in excess of design loads.

B. Patching: Install specified patching mortar per manufacturer's recommendations. Repairs to defective concrete which affect the strength of any structural concrete member or component are subject to approval by the architect and DSA.

3.7 CONCRETE PAVING

A. Concrete paving shall be formed and finished to required line and grades true and flat with a maximum tolerance of 1/8-inch in 10 feet for flatness and to slopes indicated.

B. Concrete vibrator shall be used to assist concrete placement. Contractor shall have spare concrete vibrator on site during concrete placement.

C. Thoroughly water and soak the concrete paving subgrade as required to achieve required moisture content prior to the concrete pour.

1. Provide damming as required to keep water within the formed area and to allow for proper saturation of the subgrade.
2. Remove standing water before concrete placement.

D. Construction Joints:

1. Keep exposed concrete face of construction joints continuously moist from time of initial set until placing of concrete; thoroughly clean contact surface by chipping entire surface not earlier than 5 days after initial pour to expose clean hard aggregate solidly embedded, or by approved method that will assure equal bond, such as green cutting.

2. If contact surface becomes contaminated with soil, sawdust or other foreign matter, clean entire surface and re-chip entire surface to assure proper adhesion.

3.8 FINISHING

A. Concrete Paving: Finish surface as required by ACI 302.1R using manual and vibrating screeds to place concrete level and smooth.

1. Under no circumstances shall water be added to the top surface of freshly placed concrete.
2. Use “jitterbugs” or other special tools designed for the purpose of forcing the course aggregate below the surface leaving a thick layer of mortar 1 inch in thickness.
3. After tamping the concrete, wood float surface to a true and even plane.
4. After floating with a wood bull float, make 2 passes with a steel Fresno trowel to start sealing the concrete surface.
5. While concrete is still wet but sufficiently hardened to bear a persons’ weight on knee boards, start troweling with a steel hand trowel or a machine trowel in larger areas. Use sufficient pressure to bring moisture to surface.
6. After surface moisture has disappeared, finish concrete utilizing steel, hand or power trowel.
7. Completed surface shall be free from trowel marks, depressions, ridges or other blemishes. Tolerance for flatness shall be 1/8-inch in 10 feet.
8. Provide final finish as follows, unless otherwise indicated:
    a. Medium Broom Finish: Typical finish to be used at all exterior walks, stairs and ramps. Brooming direction shall run perpendicular to slope to form non-slip surface.

B. Curb Finish: Steel trowel.

C. Joints and Edges:

1. Mark-off exposed joints, where indicated, with 1/4-inch radius x 1 inch deep jointer or edging tool. Joints shall be clean, cut straight and parallel or square with respect to concrete walk edge.
2. Tool edges of control joints, walk edges, and wherever concrete walk adjoins other material or vertical surfaces. Expansion joints shall be constructed as detailed on plans.
3. The expansion joints shall be full depth as shown in the Drawings. Failure to do so will result in non-compliance and shall be immediately machine cut by the Contractor at its expense.

D. Exposed Concrete Surface Finishing, Not Including Top Surface of Flatwork:

1. Remove fins and rough spots immediately following removal of forms from concrete which is to be left exposed. Damaged and irregular surfaces and holes left by form clamps and sleeves shall be patched with grout.

2. Tie wires are to be removed to below exposed surface and holes pointed up with neat cement paste similar to procedure noted under "After patching" in subparagraph below.
    a. Removal of tie wires shall extend to distance of 2 inches below established grade lines.
    b. Ends of tie wires shall be cut off flush at other, unexposed locations.
    c. Care shall be taken during pointing to match adjacent finishes of exposed concrete surface.
3. After patching, concrete that is to remain exposed shall be sacked with a grout mixture of 1-part cement, 1-1/2-parts fine sand and sufficient water to produce a consistency of thick paint.
    a. After first wetting the concrete surface, apply mixture with a brush and immediately float entire surface vigorously using a wood float. Keep damp during periods of hot weather.
    b. When set, excess grout shall be scraped from wall with edge of steel trowel, allowed to set for a time, then wiped or rubbed with dry burlap.
    c. Entire finishing operation of an area shall be completed on the same day. This treatment shall be carried to 4 inches below grade, and all patching and sacking shall be done immediately upon removal of the forms.

3.9 CURING

A. Formed Concrete:

1. Keep forms and top on concrete between forms continuously wet until removal of forms, 7 days minimum.
2. Maintain exposed concrete in a continuous wet condition for 14 days following removal of forms.

B. Concrete Paving, Curb, Curb and Gutter, Valley Gutter:

1. Cure utilizing curing compound. If applicable, the Contractor shall verify that the approved curing compound is compatible with the approved colorant system.
2. Curing compound shall be applied in a wet puddling application. Spotty applications shall be reason for rejection and possibly concrete removal and replacement at the contractor’s expense with no compensation from the Owner.

3.10 SEALANT

A. Apply sealant in compliance with manufacturer's instructions, using hand guns or pressure equipment with proper nozzle size, on clean, dry, properly prepared substrates.

B. Force sealants into joint against sides of joint to make uniform. Avoid pulling of the sealant from the sides. Fill sealant space completely with sealant.

C. Finished joints shall be straight, uniform, smooth, and neatly finished.

D. Remove any excess sealant from adjacent surfaces of joints utilizing the manufacturer's recommended solvent and cleaning processes. Leave the work in a neat, clean condition.

3.11 FIELD QUALITY CONTROL

A. Inspection of Forms and Reinforcing:

1. Approval of forms and reinforcing steel must be received from Project Inspector prior to pouring concrete.
2. Notice of readiness to place first pour shall be given to Project Inspector, DSA, Architect, and Engineer not less than 48 hours prior to placement of concrete to allow for inspection.
3. Pouring of concrete shall not proceed prior to completing requested adjustments to forms and reinforcing and without approval of Project Inspector.

B. Testing of Concrete:

1. Frequency and Samples for Testing:
   a. Four identical cylinder samples for strength tests of each class of concrete placed each day shall be taken not less than once a day, or not less than once for each 50 cubic yards of concrete, or not less than once for each 2,000 square feet of surface area for slabs or walls.
   b. In addition, samples for strength tests for each class of concrete shall be taken for seven-day tests at the beginning of the concrete work or whenever the mix or aggregate is changed.
2. Testing:
   a. Slump: Each truck's concrete shall be tested for slump before concrete is placed.
   b. Strength:
      1) Tests for strength will be conducted by Testing Agency on one cylinder at 7 days and two cylinders at 28 days. The fourth remaining cylinder will be available for testing at 56 days if the 28-day cylinder test results do not meet the required design strength.
      2) On a given project, if the total volume of concrete is such that the frequency of specified testing would provide less than five strength tests for a given class of concrete, tests shall be made from at least five randomly selected batches or from each batch if fewer than five batches are used.

C. Slip-Resistance Testing: Owner's Testing Agency will perform testing on flatwork to verify compliance with specified slip-resistance.

1. The coefficient of friction will be measured by California Test 342 before pavement is opened to public traffic, but not sooner than 7 days after concrete placement
2. Where paving is determined to have a coefficient of friction less than 0.30, Contractor is to repair and/or replace these surfaces at no cost to Owner.

3.12 CLEANING

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

B. Clean excess material from surface of all concrete walks and utility structures.

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

D. Comply with any additional requirements of additive manufacturer for colored concrete.

3.13 PROTECTION

A. Protect work and materials of this Section prior to and during installation, and protect the installed work and materials of other trades.

B. In the event of damage during construction, make all repairs and replacements necessary to the approval of the Architect, at no additional cost to the Owner.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Chain link fences
2. Gates and gate hardware.
3. Privacy slats.

1.2 RELATED REQUIREMENTS

A. Section 01 6116, Volatile Organic Compound (VOC) Restrictions, for VOC limits pertaining to adhesives, sealants, fillers, primers, and coatings.

B. Section 01 8113, Sustainable Design Requirements, for CAL-Green general requirements and procedures.

C. Section 32 1600, Site Concrete.

1.3 REFERENCES AND STANDARDS

A. California Building Code (CBC), edition as noted on the drawings, as adopted by the California Division of the State Architect (DSA).

B. California Green Building Standards Code (CAL Green), edition as noted on the drawings, as adopted by the California Division of the State Architect (DSA).

C. Chain Link Fence Manufacturers' Institute (CLFMI):

1. Products Manual.

D. ASTM International (ASTM):

1. A153: Zinc Coating (Hot Dip) on Iron and Steel Products.
2. A392: Zinc Coated Steel Chain Link Fence Fabric.
3. A653/A653M: Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
4. A780/A 780M: Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.
5. C33/C33M: Standard Specification for Concrete Aggregates.
6. C94: Ready-mixed Concrete.
7. C150/C150M: Standard Specification for Portland Cement.
8. F668: Poly Vinyl Chloride (PVC) Coated Steel Chain Link Fence Fabric.
9. F934: Standard Colors for Poly Vinyl Chloride (PVC) Coated Chain Link.
10. F969: Standard Practice for Construction of Chain-Link Tennis Court Fence.

11. F1083: Pipe, Steel, Hot-Dipped Zinc Coated (Galvanized) Welded, for Fence Structures.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Submittal Procedures:

1. Action Submittals and Informational Submittals shall be submitted in accordance with Section 01 3300, Submittal Procedures.
2. Closeout Submittals shall be submitted in accordance with Section 01 7700, Closeout Procedures.
3. Sustainable Design Submittals shall comply with the additional requirement of Section 01 8113, Sustainable Design Requirements.

1.5 ACTION SUBMITTALS

A. Shop Drawings: Submit showing all parts, connections and anchorages, adjacent materials, fully dimensioned and noted. Indicate plan layout, spacing of components, post foundation dimensions, hardware anchorage and schedule of components.

B. Products Data: Submit list and complete descriptive data of all products proposed for use. Include manufacturer's specifications, published warranty or guarantee, installation instructions, and maintenance instructions.

C. Samples:

1. Chain-link fabric, approximately 12 inches square, in selected color.
2. Hardware and fittings if requested by Architect.

1.6 INFORMATIONAL SUBMITTALS

A. Sample of manufacturer’s warranty.

B. Sustainable Design:

1. General:
   a. Submit information necessary to establish and document compliance with the California Green Building Standards Code.
   b. Sustainable design submittals are in addition to other submittals.
2. The following information shall be provided:
   a. Paints and Coatings: Evidence of compliance that products meet maximum VOC content limits specified in Section 01 6116.

1.7 CLOSEOUT SUBMITTALS

A. Warranty/Guarantee: Submit executed warranty and Subcontractor’s guarantee.

1.8 QUALITY ASSURANCE

A. Use only new materials and products, unless existing materials or products are specifically shown otherwise on the Drawings to be salvaged and re-used.

B. Use materials and products of one manufacturer whenever possible.

C. All materials, components, assemblies, workmanship and installation are to be observed by the Owner's Project Inspector. Work not so inspected is subject to uncovering and replacement.

1.9 DELIVERY, STORAGE AND HANDLING

A. Deliver undamaged products to job in manufacturer's sealed containers and/or original bundles with tags and labels intact.

B. Store materials in protected, dry conditions off of ground and in areas so as to not interfere with the progress of the work.

C. Transport, store and handle in strict accord with the manufacturer's written recommendations.

1.10 FIELD CONDITIONS

A. Make and be responsible for all field dimensions necessary for proper fitting and completion of work. Report discrepancies to Architect before proceeding.

1.11 WARRANTY

A. Manufacturer: In addition to the Contractor’s and Subcontractor’s Guarantee, furnish Owner with manufacturer’s fully executed written warranty for chain link fencing against defects in materials and workmanship.

PART 2 - PRODUCTS

2.1 DESIGN AND PERFORMANCE CRITERIA

A. Industry Standards: Materials and installation shall conform to the requirements of the Chain Link Fence Manufacturers Institute (CLFMI) "Product Manual."

B. Regulatory Requirements: Pedestrian gates and related hardware shall comply with applicable codes, including provisions for accessibility required by CBC and the Americans with Disabilities Act “Designs for Accessible Design.” Comply with the most stringent.

C. Use new components free from defects affecting service and appearance.

D. Sizes specified or shown are minimum.

E. Provide ferrous material except as otherwise indicated or specified.

F. Sustainable Design:

1. VOC emissions for field-applied paints and coatings must comply with limits specified in Section 01 6116.

2.2 WORKMANSHIP

A. Galvanizing: Hot dip galvanize ferrous materials after fabrication. Repair zinc coating damaged in shop or during field erection by re-coating with hot repair compound, Re Galv, Galvalloy, Galveweld-alloy, or equal, applied in accord with manufacturer's recommendations.

2.3 MATERIALS

A. Galvanized Fabric: Steel wire with no less than 1.20 ounce of zinc coating per square foot (Class 1) of surface area and complying with ASTM A 392.

1. Typical:
   a. Wire Diameter: 9 gage, coated size.
   b. Mesh Opening: 2 inches.
2. Edges: Knuckle fabric at bottom and at top selvage.
3. Fabric widths shall be one piece.

B. Pre-Woven Privacy Slats: Extruded high density polyethylene (HDPE), color pigments, and ultra violet (UV) inhibitors uniquely styled for mechanical insertion into chain link wire during weaving process; PDS Fence Products by Pexco, 800-755-7528, or equal.

1. Width: 3-1/2 inches and 5 inches.
2. Color: As selected by Architect.

C. Standard Privacy Slats: Extruded high density polyethylene (HDPE), color pigments, and ultra violet (UV) inhibitors; PDS “Bottom Lock” slats by Pexco, 800-755-7528, or equal.

1. Size: As recommended by manufacturer for mesh opening size.
2. Color: As selected by Architect from manufacturer’s standard colors. Allow up to 8 options minimum.
3. Slats shall provide 95 percent privacy.

D. Security Fabric: 16 gauge galvanized sheet metal in conformance with ASTM A653/A653M, 1.3 pounds per square foot, with round hole perforations; McNichols item number 1431141638 as specified and the basis of design, or equal.

1. Perforations shall be 3/16” holes on a 1/4” stagger.
2. Open Area: 51 percent.
3. Finish: Prime and paint as specified in Section 09 9100, Painting, prior to installation.

E. Security Fabric U-Edging: 14 gauge. galvanized hot rolled U shaped edging, 1 inch tall face x 3/8 inch opening width; McNichols quality U-Edging, item number 4003801410 as specified and the basis of design, or equal.

F. Round Steel Pipe Fence Framework:

1. Round steel pipe and rail, Schedule 40 standard weight pipe, in accordance with ASTM F1083, 1.8 oz/sq. ft (550 g/sq. m) hot dip galvanized zinc exterior and 1.8 oz/sq. ft (550 g/sq. m) hot dip galvanized zinc interior coating.
   a. Regular Grade: Minimum steel yield strength 30,000 psi (205 MPa)
   b. High Strength Grade: Minimum yield strength 50,000 psi (344 MPa)

G. Line Posts:

1. Without Slats or Windscreen: Regular Grade.
   a. To 8’-0” High Maximum: 2-3/8 inch outside diameter pipe at 3.65 pounds per linear foot.
   b. 8’-1” to 10’-0” High Maximum: 2-7/8 inch outside diameter pipe at 5.79 pounds per linear foot.
   c. 10’-1” to 12’-0” High Maximum: 4-1/2 inch outside diameter pipe at 10.79 pounds per linear foot.
2. With Slats or Windscreen: High Strength Grade.
   a. To 8’-0” High Maximum: 4 1/2 inch outside diameter pipe at 9.11 pounds per linear foot.
   b. 8’-1” to 10’-0” High Maximum: 5-9/16 inch outside diameter pipe at 14.62 pounds per linear foot.
   c. 10’-1” to 12’-0” High Maximum: 5-9/16 Inch outside diameter pipe at 14.62 pounds per linear foot.

H. End, Corner and Pull Posts: End, corner and pull posts shall also comply with gate post requirements, where occurs.

1. Without Slats or Windscreen: Regular Strength.
   a. To 8’-0” High Maximum: 2-7/8 inch outside diameter pipe at 5.79 pounds per linear foot.
   b. 8’-1” to 10’-0” High Maximum: 4 inch outside diameter pipe at 9.11 pounds per linear foot.
   c. 10’-1” to 12’-0” High Maximum: 5-9/16 inch outside diameter pipe at 14.62 pounds per linear foot.
2. With Slats or Windscreen: High Strength Grade.
   a. To 8’-0” High Maximum: 4-1/2 inch outside diameter pipe at 10.79 pounds per linear foot.
   b. 8’-1” to 10’-0” High Maximum: 5-9/16 inch outside diameter pipe at 14.62 pounds per linear foot.
   c. 10’-1” to 12’-0” High Maximum: 6-5/8 inch outside diameter pipe at 18.97 pounds per linear foot.

I. Gate Posts, Single Leaf: Gate posts shall also comply with End, Corner and Pull Post requirements.

1. To 6 Feet Wide: 2-7/8 inch outside diameter pipe at 5.79 pounds per linear foot.
2. 6 Feet to 12 Feet Wide: 4-1/2 inch outside diameter pipe at 10.79 pounds per linear foot.
3. 12 Feet. to 18 Feet Wide: 6-5/8 inch outside diameter pipe at 18.97 pounds per linear foot.

J. Post caps: Cast or malleable iron ball or acorn shape; with opening for top rail.

K. Top Rail, Bottom Rails, and Braces: 1-5/8" outside diameter pipe at 2.27 pounds per linear foot., or 1-5/8 inch x 1-1/4 inch roll formed section, 14 gauge.

1. Brace Assembly:
   a. Equally spaced between top rail and bottom fabric selvage and run from end, gate, or corner post to first line posts with suitable malleable iron fittings.
   b. Truss from line post to end, gate, or corner post with 3/8 inch round rod.

L. Wire Ties: Specified spacing is minimum. Manufacturer's standard procedure may require more ties.

1. Tying Fabric to Posts: 9 gauge steel wire spaced 12 inches on center.
2. Tying Fabric to Rails and Braces: 9 gauge steel wire spaced 24 inches on center.

M. Bands: 14 gauge x 1 inch wide steel spaced 15 inches on center. for securing stretcher bars to end and gate posts.

1. Bands may be used in conjunction with special fitting for securing rails to end and gate posts.
2. Chamfer to ease projecting edges of bands.

2.4 GATES

A. Frames:

1. Gate Leaves to 6 Feet Wide: 1-5/8 inch outside diameter pipe at 2.27 pounds per linear foot.
2. Gate Leaves Over 6 Feet Wide: 2 inch outside diameter pipe at 2.72 pounds per linear foot.
3. Provide additional horizontal and vertical pipe or tube as necessary to assure proper gate operation and attachment of fabric and hardware.

B. Diagonal Bracing: Provide adjustable length 3/8 inch truss rods on non-welded gate frames and welded gate frames where corner rigidity is insufficient to insure no sag.

C. Fabric: As specified for fence.

D. Gate Assembly:

1. Weld or assemble gate frame with malleable or pressed steel fittings and rivets to provide rigid connections.
2. Install fabric with stretcher bars at vertical edges, which may also be used at top and bottom edges.
3. Securely attach stretcher bars and fabric to frame on all sides at 15 inches on center.
4. Attach hardware with rivets or by other means which will provide security against removal.

E. Gate Hardware:

1. General: Hardware at disabled accessible gates shall meet accessibility, including mounting, of the ADA and CBC. Comply with the most stringent.
2. Hinges: Malleable iron, pressed or forged steel, non-liftoff type, easy noiseless operation and long wear, offset to permit 180 degree gate opening.
   a. Provide 1-1/2 pair hinges for each leaf over 6 feet nominal height.
   b. Ball and socket hinges not acceptable.
3. Fork Latch: Malleable iron, drop fork latch which permits operation of the gate from either side, with padlock eye provided as integral part of latch.
4. Kick Plates: 10 inches tall x width of gate x 14 gauge minimum, smooth uninterrupted surfaced, galvanized steel.
   a. Mount on the bottom edge of gate at the push side. Mount on both sides at two-way swing gates.
   b. Bottom edge of plate shall be not more than 3 inches above the top of the walk.
   c. Plate shall be welded to the fence frame and shall allow the gate to be opened by a wheelchair footrest without creating a trap or hazardous condition.
   d. Provide at pedestrian gates that are within the disabled accessible path of travel
5. Gate Stop and Holder: Malleable iron.
   a. Stop shall automatically engages gate frame and holds it in open position.
   b. Provide at vehicle gates.
6. Double Gates: Provide cane bolt and ground set keeper with locking device and padlock eyes designed as integral part of latch, requiring one padlock for locking both leaves.

2.5 ADDITIONAL MATERIALS AND COMPONENTS

A. Galvanizing-Repair Paint: Minimum 82 percent zinc-dust-content paint for regalvanizing welds in galvanized steel and closely matching appearance of hot-dip galvanizing; “Galvilite” by ZRC Worldwide, or equal.

B. Concrete:

1. Materials:
   a. Portland cement, ASTM C 150.

b. Aggregate: ASTM C33.

c. Water: Potable and free from substances harmful to concrete.

2. Mix materials to obtain low slump concrete with 28 day compressive strength of 2,500 psi.

a. Maximum Size Aggregate: 1-1/2 inch.

b. Re-tempering not permitted.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General:

1. Execute work in accord with best trade practice for industrial fence installations.
2. Make welds neat and secure, grind off excess exposed metal.
3. Securely set posts plumb in alignment at proper depth and height, and rigid bracing where needed; install fabric under tension and securely tie to posts, rails and braces.
4. Gates shall move freely without sag.

B. Setting Posts:

1. General: Space posts as indicated but not more than 10 feet on center.
2. Pour and tamp concrete leaving no voids.

a. Check posts for vertical and top alignment and hold in position.

b. Dome top of concrete and trowel smooth to shed water away from post.

c. Align posts in footings as follows:

3. Without Slats or Windscreen: Footings for End, corner and pull posts shall also comply with gate post requirements, where occurs.

a. Line Posts to 8’-0” High Maximum: 1’-0” diameter, 3’-3” minimum embedment.

b. End, Corner and Pull Posts to 8’-0” High Maximum: 1’-0” diameter, 4’-3” minimum embedment.

c. Line Posts 8’-1” to 10’-0” High Maximum: 1’-0” diameter, 3’-9” minimum embedment.

d. End, Corner and Pull Posts 8’-1” to 10’-0” High Maximum: 1’-6” diameter, 5’-3” minimum embed.

e. Line Posts 10’-1” to 12’-0” High Maximum: 1’-6” diameter, 5’-0” minimum embedment.

f. End, Corner and Pull Posts 10’-1” to 12’-0” High Maximum: 1’-6” diameter, 6’-0” minimum embed.

4. With Slats or Windscreen:

a. Line Posts to 8’-0” High Maximum: 1’-6” diameter, 5’-3” minimum embedment.

b. End, Corner and Pull Posts to 8’-0” High Maximum: 1’-6” diameter, 5’-6” minimum embedment.

c. Line Posts 8’-1” to 10’-0” High Maximum: 1’-6” diameter, 6’-0” minimum embedment.

d. End, Corner and Pull Posts 8’-1” to 10’-0” High Maximum: 1’-6” diameter, 6’-0” minimum embed.

e. Line Posts 10’-1” to 12’-0” High Maximum: 1’-6” diameter, 6’-9” minimum embedment.

f. End, Corner and Pull Posts 10’-1” to 12’-0” High Maximum: 2’-0” diameter, 7’-0” minimum embed.

5. Single Leaf Gates: Footings for gate posts shall also comply with End, Corner and Pull Post requirements.

a. To 6 Feet Wide: 12 inch diameter, 36 inch embedment.

b. 6’-1” wide to 12 Feet Wide: 16 inch diameter, 48 inch minimum embedment.

c. 12’-1” wide to 18’-0” wide: 24 inch diameter, 54 inch minimum embedment.

C. Where posts occur adjacent to structures or other work where concrete foundations may conflict with post footing, block out to allow post installation or use off-set post. Hold post 4 inches clear from face of structure.

D. Fabric: Leave about 1-1/2 inches between ground and bottom barbs.

1. Pull fabric taut and tie to posts, and rails.
2. Install fabric on security side of fence.
3. Fabric shall remain under tension after pulling force is released.

E. Gates:

1. Install gates plumb, level and secure, with full swing or slide without interference.
2. Install ground set items in substantial concrete mass for adequate anchorage.

F. Tie Wires:

1. Install with one tight turn to hold fabric firmly to frame.
2. Bend ends of wire inward to prevent hazard to persons or apparel.

G. Fasteners:

1. Install nuts for tension band and hardware bolts on side of fence opposite fabric side.
2. Spoil ends of bolts to prevent removal of nuts.

3.2 ADJUSTING

A. Repair exposed zinc coatings damaged in shop or during field erection using specified repair system and in compliance with ASTM A 780.

B. Adjust gated hardware for smooth operation and lubricate where necessary.

END OF SECTION

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Last Updated: February 25, 2022