EXHIBIT 1 (TECHNICAL SPECIFICATONS)

CD&E

ENGINEERING · MANAGEMENT

PROJECT SPECIFICATIONS
CHEMEHUEVI WELL SITE IMPROVEMENTS
100% Construction Documents

DATE: 2025-5-6
PROJECT: PH23-W33, WA06-24
CONTRACT #: 75H70120D00025

INDIAN HEALTH SERVICE · PHS · 1955 ·

TABLE OF CONTENTS

Division 01 General Requirements

SECTION 012200
UNIT PRICES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. List of unit prices, for use in preparing Bids.

B. Measurement and payment criteria applicable to Work performed under a unit price payment method.

C. Defect assessment and non-payment for rejected work.

1.02 COSTS INCLUDED

A. Unit Prices included on the Bid Form shall include full compensation for all required labor, products, tools, equipment, plant, transportation, services and incidentals; erection, application or installation of an item of the Work; overhead and profit.

1.03 UNIT QUANTITIES SPECIFIED

A. Quantities indicated in the Bid Form are for bidding and contract purposes only. Quantities and measurements of actual Work will determine the payment amount.

1.04 MEASUREMENT OF QUANTITIES

A. Measurement methods delineated in the individual specification sections complement the criteria of this section. In the event of conflict, the requirements of the individual specification section govern.

B. Assist by providing necessary equipment, workers, and survey personnel as required.

1.05 PAYMENT

A. Payment for Work governed by unit prices will be made on the basis of the actual measurements and quantities of Work that is incorporated in or made necessary by the Work and accepted by the COR, multiplied by the unit price.

1.06 DEFECT ASSESSMENT

A. Replace Work, or portions of the Work, not complying with specified requirements.

B. If, in the opinion of COR, it is not practical to remove and replace the Work, COR will direct one of the following remedies:

1. The defective Work will be partially repaired to the instructions of the COR, and the unit price will be adjusted to a new unit price at the discretion of COR.

C. The authority of COR to assess the defect and identify payment adjustment is final.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION 012200

SECTION 012300
ALTERNATES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Procedures for pricing Alternates.

1.02 ACCEPTANCE OF ALTERNATES

A. Alternates quoted on Bid Forms will be reviewed and accepted or rejected at Owner's option. Accepted Alternates will be identified in the Owner-Contractor Agreement.

B. Coordinate related work and modify surrounding work to integrate the Work of each Alternate.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION 012300

SECTION 012500
SUBSTITUTION PROCEDURES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Procedural requirements for proposed substitutions.

1.02 RELATED REQUIREMENTS

A. Section 012200 - Unit Prices, for additional unit price requirements.

B. Section 012300 - Alternates, for product alternatives affecting this section.

C. Section 013000 - Administrative Requirements: Submittal procedures, coordination.

D. Section 016000 - Product Requirements: Fundamental product requirements, product options, delivery, storage, and handling.

1.03 DEFINITIONS

A. Substitutions: Changes from Contract Documents requirements proposed by Contractor to materials, products, assemblies, and equipment.
   1. Substitutions for Cause: Proposed due to changed Project circumstances beyond Contractor's control.
      a. Unavailability.
      b. Regulatory changes.
   2. Substitutions for Convenience: Proposed due to possibility of offering substantial advantage to the Project.
      a. Substitution requests offering advantages solely to the Contractor will not be considered.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 GENERAL REQUIREMENTS

A. A Substitution Request for products, assemblies, materials, and equipment constitutes a representation that the submitter:
   1. Has investigated proposed product and determined that it meets or exceeds the quality level of the specified product, equipment, assembly, or system.
   2. Agrees to provide the same warranty for the substitution as for the specified product.
   3. Agrees to coordinate installation and make changes to other work that may be required for the work to be complete, with no additional cost to Owner.
   4. Waives claims for additional costs or time extension that may subsequently become apparent.

B. Document each request with complete data substantiating compliance of proposed substitution with Contract Documents. Burden of proof is on proposer.

C. Content: Include information necessary for tracking the status of each Substitution Request, and information necessary to provide an actionable response.
   1. No specific form is required. Contractor's Substitution Request documentation must include the following:
      a. Project Information:
      b. Substitution Request Information:
         1) Indication of whether the substitution is for cause or convenience.
         2) Reference to particular Contract Document(s) specification section number, title, and article/paragraph(s).
         3) Description of Substitution.
         4) Reason why the specified item cannot be provided.
         5) Differences between proposed substitution and specified item.

6) Description of how proposed substitution affects other parts of work.

c. Attached Comparative Data: Provide point-by-point, side-by-side comparison addressing essential attributes specified, as appropriate and relevant for the item:
   1) Physical characteristics.
   2) In-service performance.
   3) Warranties.

d. Impact of Substitution:
   1) Savings to Owner for accepting substitution.
   2) Change to Contract Time due to accepting substitution.

D. Limit each request to a single proposed substitution item.
   1. Submit an electronic document, combining the request form with supporting data into single document.

3.02 RESOLUTION

A. Engineer may request additional information and documentation prior to rendering a decision. Provide this data in an expeditious manner.

B. Engineer will notify Contractor in writing of decision to accept or reject request.

3.03 ACCEPTANCE

A. Accepted substitutions change the work of the Project. They will be documented and incorporated into work of the project by Change Order, Construction Change Directive, Architectural Supplementary Instructions, or similar instruments provided for in the Conditions of the Contract.

3.04 CLOSEOUT ACTIVITIES

A. See Section 017800 - Closeout Submittals, for closeout submittals.

B. Include completed Substitution Request Forms as part of the Project record. Include both approved and rejected Requests.

END OF SECTION 012500

SECTION 013000
ADMINISTRATIVE REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. General administrative requirements.

B. Preconstruction meeting.

C. Site mobilization meeting.

D. Progress meetings.

E. Construction progress schedule.

F. Contractor's daily reports.

G. Submittals for review, information, and project closeout.

H. Requests for Interpretation (RFI) procedures.

I. Submittal procedures.

1.02 GENERAL ADMINISTRATIVE REQUIREMENTS

A. Comply with requirements of Section 017000 - Execution and Closeout Requirements for coordination of execution of administrative tasks with timing of construction activities.

B. Make the following types of submittals to CO:
   1. Requests for Interpretation (RFI).
   2. Requests for substitution.
   3. Shop drawings, product data, and samples.
   4. Test and inspection reports.
   5. Design data.
   6. Manufacturer's instructions and field reports.
   7. Applications for payment and change order requests.
   8. Progress schedules.
   9. Coordination drawings.
   10. Correction Punch List and Final Correction Punch List for Substantial Completion.
   11. Closeout submittals.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 PRECONSTRUCTION MEETING

A. Schedule meeting after Notice of Award.

B. Attendance Required:
   1. Owner.
   2. Engineer.
   3. Contractor.

C. Agenda:
   1. Execution of Owner-Contractor Agreement.
   2. Submission of executed bonds and insurance certificates.
   3. Distribution of Contract Documents.
   4. Submission of list of subcontractors, list of products, schedule of values, and progress schedule.
   5. Procedures and processing of field decisions, submittals, substitutions, applications for payments, proposal request, Change Orders, and Contract closeout procedures.
   6. Scheduling.

D. Record minutes and distribute copies within two days after meeting to participants, with two copies to Engineer, Owner, participants, and those affected by decisions made.

3.02 SITE MOBILIZATION MEETING

A. COR will schedule meeting at the Project site prior to Contractor occupancy.

B. Attendance Required:
   1. Contractor.
   2. Owner.
   3. Engineer.
   4. Contractor's superintendent.
   5. Major subcontractors.

C. Agenda:
   1. Use of premises by Owner and Contractor.
   2. Owner's requirements.
   3. Construction facilities and controls provided by Owner.
   4. Temporary utilities provided by Owner.
   5. Survey and building layout.
   6. Security and housekeeping procedures.
   7. Schedules.
   8. Application for payment procedures.
   9. Procedures for testing.
   10. Procedures for maintaining record documents.
   11. Requirements for start-up of equipment.
   12. Inspection and acceptance of equipment put into service during construction period.

D. Record minutes and distribute copies within two days after meeting to participants, with two copies to Engineer, Owner, participants, and those affected by decisions made.

3.03 PROGRESS MEETINGS

A. Schedule and administer meetings throughout progress of the work at maximum monthly intervals.

B. Attendance Required:
   1. Contractor.
   2. Owner.
   3. Engineer.
   4. Contractor's superintendent.
   5. Major subcontractors.

C. Agenda:
   1. Review minutes of previous meetings.
   2. Review of work progress.
   3. Field observations, problems, and decisions.
   4. Identification of problems that impede, or will impede, planned progress.
   5. Review of submittals schedule and status of submittals.
   6. Maintenance of progress schedule.
   7. Corrective measures to regain projected schedules.
   8. Planned progress during succeeding work period.
   9. Maintenance of quality and work standards.
   10. Effect of proposed changes on progress schedule and coordination.
   11. Other business relating to work.

D. Record minutes and distribute copies within two days after meeting to participants, with two copies to Engineer, Owner, participants, and those affected by decisions made.

3.04 CONSTRUCTION PROGRESS SCHEDULE

A. Within 10 days after date of the Agreement, submit preliminary schedule defining planned operations for the first 60 days of work, with a general outline for remainder of work.

B. If preliminary schedule requires revision after review, submit revised schedule within 10 days.

C. Within 20 days after review of preliminary schedule, submit draft of proposed complete schedule for review.
   1. Include written certification that major contractors have reviewed and accepted proposed schedule.

D. Within 10 days after joint review, submit complete schedule.

E. Submit updated schedule with each Application for Payment.

3.05 SUBMITTALS FOR REVIEW

A. When the following are specified in individual sections, submit them for review:
   1. Product data.
   2. Shop drawings.
   3. Samples for selection.
   4. Samples for verification.

B. Submit to COR for review for the limited purpose of checking for compliance with information given and the design concept expressed in Contract Documents.

C. Samples will be reviewed for aesthetic, color, or finish selection.

D. After review, provide copies and distribute in accordance with SUBMITTAL PROCEDURES article below and for record documents purposes described in Section 017800 - Closeout Submittals.

3.06 SUBMITTALS FOR INFORMATION

A. When the following are specified in individual sections, submit them for information:
   1. Design data.
   2. Certificates.
   3. Test reports.
   4. Inspection reports.
   5. Manufacturer's instructions.
   6. Manufacturer's field reports.
   7. Other types indicated.

B. Submit for COR's knowledge as contract administrator or for Owner.

3.07 SUBMITTALS FOR PROJECT CLOSEOUT

A. Submit Correction Punch List for Substantial Completion.

B. Submit Final Correction Punch List for Substantial Completion.

C. When the following are specified in individual sections, submit them at project closeout in compliance with requirements of Section 017800 - Closeout Submittals:
   1. Project record documents.
   2. Operation and maintenance data.
   3. Warranties.
   4. Bonds.
   5. Other types as indicated.

D. Submit for Owner's benefit during and after project completion.

3.08 SUBMITTAL PROCEDURES

A. General Requirements:
   1. Use a single transmittal for related items.

2. Sequentially identify each item. For revised submittals use original number and a sequential numerical suffix.
3. Identify: Project; Contractor; subcontractor or supplier; pertinent drawing and detail number; and specification section number and article/paragraph, as appropriate on each copy.

END OF SECTION 013000

SECTION 013526
SAFETY REQUIREMENTS

PART 1 GENERAL

1.01 REFERENCE STANDARDS

A. 29 CFR 1910 - Occupational Safety and Health Standards; Current Edition.

B. 29 CFR 1926 - Safety and Health Regulations for Construction; Current Edition.

C. 29 CFR 1926.502 - Fall protection systems criteria and practices; Current Edition.

D. NFPA 10 - Standard for Portable Fire Extinguishers; 2022.

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

F. NFPA 70B - Recommended Practice for Electrical Equipment Maintenance; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

G. NFPA 70E - Standard for Electrical Safety in the Workplace; 2024.

H. NFPA 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations; 2022, with Errata (2021).

1.02 APPLICABLE PUBLICATIONS:

A. Latest publications listed below form part of this Article to extent referenced. Publications are referenced in text by basic designations only.

B. American Society of Safety Engineers (ASSE):

1. A10.1-2011 ..... Pre-Project & Pre-Task Safety and Health PlanninG
2. A 10.34-2012 ..... Protection of the Public on or Adjacent to Construction Sites
3. A 10.38-2013 ..... Basic Elements of an Employer's Program to Provide a Safe and Healthful Work Environment American National Standard Construction and Demolition Operations

C. American Society for Testing and Materials (ASTM):

1. E84-2013 ..... Surface Burning Characteristics of Building Materials

D. The Facilities Guidelines Institute (FGI)

1. FGI Guidelines for Design and Construction of Hospitals, latest version
2. FGI Guidelines for Design and Construction of Outpatient Facilities, latest version

E. National Fire Protection Association (NFPA):

1. 10 ..... Standard for Portable Fire Extinguisher
2. 30 ..... Flammable and Combustible Liquids Code
3. 51 B ..... Standard for Fire Prevention During Welding, Cutting and Other Hot Work
4. 70 ..... National Electrical Code
5. 70B ..... Recommended Practice for Electrical Equipment Maintenance
6. 70E ..... Standard for Electrical Safety in the WorkplacE
7. 99 ..... Health Care Facilities Code
8. 101 ..... Life Safety Code
9. 241 ..... Standard for Safeguarding Construction, Alteration, and Demolition Operations

F. The Joint Commission (T JC)

1. T JC Manual ..... Comprehensive Accreditation and Certification Manual

G. U.S. Occupational Safety and Health Administration (OSHA):

1. 29 CFR 1910 ... . Safety and Health Regulations for General Industry
2. 29 CFR 1926 ..... Safety and Health Regulations for Construction Industry

1.03 DEFINITIONS:

A. Critical Lift. A lift with the hoisted load exceeding 75% of the crane's maximum capacity; lifts made out of the view of the operator (blind picks); lifts involving two or more cranes; personnel being hoisted; and special hazards such as lifts over occupied facilities, loads lifted close to power-lines, and lifts in high winds or where other adverse environmental conditions exist; and any lift which the crane operator believes is critical.

B. OSHA "Competent Person" (CP). One who is capable of identifying existing and predictable hazards in the surroundings and working conditions which are unsanitary, hazardous or dangerous to employees, and who has the authorization to take prompt corrective measures to eliminate them (see 29 CFR 1926.32(f)).

C. "Qualified Person" means one who, by possession of a recognized degree, certificate, or professional standing, or who by extensive knowledge, training and experience, has successfully demonstrated his ability to solve or resolve problems relating to the subject matter, the work, or the project.

D. High Visibility Accident. Any mishap which may generate publicity or high visibility.

E. Accident/Incident Criticality Categories:

1. No impact - near miss incidents that should be investigated but are not required to be reported to the Government;
2. Minor incident/impact - incidents that require first aid or result in minor equipment damage (less than $5000). These incidents must be investigated but are not required to be reported to the Government;
3. Moderate incident/impact -Any work-related injury or illness that results in:
    a. Days away from work (any time lost after day of injury/illness onset);
    b. Restricted work;
    c. Transfer to another job;
    d. Medical treatment beyond first aid;
    e. Loss of consciousness;
4. A significant injury or illness diagnosed by a physician or other licensed health care professional, even if it did not result in (1) through (5) above or,
5. Any incident that leads to major equipment damage (greater than $5000).

F. These incidents must be investigated and are required to be reported to the Government;

1. Major incident/impact - Any mishap that leads to fatalities, hospitalizations, amputations, and losses of an eye as a result of contractors' activities. Or any incident which leads to major property damage (greater than $20,000) and/or may generate publicity or high visibility. These incidents must be investigated and are required to be reported to the Government as soon as practical, but not later than 2 hours after the incident.

G. Medical Treatment. Treatment administered by a physician or by registered professional personnel under the standing orders of a physician. Medical treatment does not include first aid treatment even through provided by a physician or registered personnel.

1.04 REGULATORY REQUIREMENTS:

A. In addition to the detailed requirements included in the provisions of this contract, comply with 29 CFR 1926, comply with 29 CFR 1910 as incorporated by reference within 29 CFR 1926, comply with ASSE A 10.34, and all applicable ffederal, state, and local} laws, ordinances,

criteria, rules and regulations. Submit matters of interpretation of standards for resolution before starting work. Where the requirements of this specification, applicable laws, criteria, ordinances, regulations, and referenced documents vary, the most stringent requirements govern except with specifiC approval and acceptance by the Contracting Officer Representative.

1.05 ACCIDENT PREVENTION PLAN (APP):

A. The APP (aka Construction Safety & Health Plan) shall interface with the Contractor's overall safety and health program. Include any portions of the Contractor's overall safety and health program referenced in the APP in the applicable APP element and ensure it is site-specific. The Government considers the Prime Contractor to be the "controlling authority" for all worksite safety and health of each subcontractor(s). Contractors are responsible for informing their subcontractors of the safety provisions under the terms of the contract and the penalties for noncompliance, coordinating the work to prevent one craft from interfering with or creating hazardous working conditions for other crafts, and inspecting subcontractor operations to ensure that accident prevention responsibilities are being carried out.

B. The APP shall be prepared as follows:

1. Written in English by a qualified person who is employed by the Prime Contractor articulating the specific work and hazards pertaining to the contract (model language can be found in ASSE A 10.33). Specifically articulating the safety requirements found within these Government contract safety specifications. APP shall be made available in other languages as necessary to convey the contents of the plan.
2. Address both the Prime Contractors and the subcontractors work operations.
3. State measures to be taken to control hazards associated with materials, services, oF equipment provided by suppliers.
4. Address all the elements/sub-elements and in order as follows:
    a. SIGNATURE SHEET. Title, signature, and phone number of the following:
        1) Plan preparer (Qualified Person such as corporate safety staff person or contracted Certified Safety Professional with construction safety experience);
        2) Plan approver (company/corporate officers authorized to obligate the company);
        3) Plan concurrence (e.g., Chief of Operations, Corporate Chief of Safety, CorporatE Industrial Hygienist, project manager or superintendent, project safety professional). Provide concurrence of other applicable corporate and project personnel (Contractor).
    b. BACKGROUND INFORMATION. List the following:
        1) Contractor;
        2) Contract number;
        3) Project name;
        4) Brief project description, description of work to be performed, and location; phases of work anticipated (these will require an AHA).
    c. STATEMENT OF SAFETY AND HEALTH POLICY. Provide a copy of current corporate/company Safety and Health Policy Statement, detailing commitment to providing a safe and healthful workplace for all employees. The Contractor's written safety program goals, objectives, and accident experience goals for this contract should be provided.
    d. RESPONSIBILITIES AND LINES OF AUTHORITIES. Provide the following:
        1) A statement of the employer's ultimate responsibility for the implementation of the Safety and Occupational Health (SOH) program;

2) Identification and accountability of personnel responsible for safety at both corporate and project level. Contracts specifically requiring safety or industrial hygiene personnel shall include a copy of their resumes.

3) The names of Competent and/or Qualified Person(s) and proof oF competency/qualification to meet specific OSHA Competent/Qualified Person(s) requirements must be attached.

4) Requirements that no work shall be performed unless a designated competent person is present on the job site;

5) Requirements for pre-task Activity Hazard Analysis (AHAs);

6) Lines of authority;

7) Policies and procedures regarding noncompliance with safety requirements (to include disciplinary actions for violation of safety requirements) should be identified;

e. SUBCONTRACTORS AND SUPPLIERS. If applicable, provide procedures for coordinating SOH activities with other employers on the job site:

1) Identification of subcontractors and suppliers (if known);

2) Safety responsibilities of subcontractors and suppliers.

f. TRAINING.

1) Site-specific SOH orientation training at the time of initial hire or assignment to the project for every employee before working on the project site is required.

2) Mandatory training and certifications that are applicable to this project (e.g., explosive actuated tools, crane operator, rigger, crane signal person, fall protection, electrical lockout/NFPA ?OE, machine/equipment lockout, confined space, etc .. .) and any requirements for periodic retraining/recertification are required.

3) Procedures for ongoing safety and health training for supervisors and employees shall be established to address changes in site hazards/conditions.

4) OSHA 10-hour training is required for all workers on site and the OSHA 30-hour training is required for Trade Competent Persons (CPs)

g. SAFETY AND HEAL TH INSPECTIONS.

1) Specific assignment of responsibilities for a minimum daily job site safety and healtH inspection during periods of work activity: Who will conduct (e.g., "Site Safety and Health CP"), proof of inspector's training/qualifications, when inspections will be conducted, procedures for documentation, deficiency tracking system, and follow-up procedures.

2) Any external inspections/certifications that may be required (e.g., contracted CSP or CSHT)

h. ACCIDENT/INCIDENT INVESTIGATION & REPORTING. The Contractor shall conduct mishap investigations of all Moderate and Major as well as all High Visibility Incidents. The APP shall include accident/incident investigation procedure and identify person(s) responsible to provide the following to the Contracting Officer Representative:

1) Exposure data (man-hours worked);

2) Accident investigation reports;

3) Project site injury and illness logs.

i. PLANS (PROGRAMS, PROCEDURES) REQUIRED. Based on a risk assessment of contracted activities and on mandatory OSHA compliance programs, the Contractor shall address all applicable occupational, patient, and public safety risks in site-

specific compliance and accident prevention plans. These Plans shall include but are not be limited to procedures for addressing the risks associates with the following:

1) Emergency response;
2) Contingency for severe weather;
3) Fire Prevention;
4) Medical Support;
5) Posting of emergency telephone numbers;
6) Prevention of alcohol and drug abuse;
7) Site sanitation (housekeeping, drinking water, toilets);
8) Night operations and lighting;
9) Hazard communication program
10) Welding/Cutting "Hot" work;
11) Electrical Safe Work Practices (Electrical LOTO/((NFPA 70E)));
12) General Electrical Safety;
13) Hazardous energy control (Machine LOTO);
14) Site-Specific Fall Protection & Prevention;
15) Excavation/trenching;
16) Asbestos abatement;
17) Lead abatement;
18) Respiratory protection;
19) Health hazard control program;
20) Heat/Cold Stress Monitoring;
21) Crystalline Silica Monitoring (Assessment);
22) Demolition plan (to include engineering survey);
23) Formwork and shoring erection and removal;
24) PreCast Concrete;
25) Public (Mandatory compliance with ANSI/ASSE A10.34-2012).

C. Submit the APP to the Contracting Officer Representative for review for compliance with contract requirements in accordance with Section 013300 SUBMITTALS 15 calendar days prior tO commencement of on-site work. Work cannot proceed without an accepted APP.

D. Once accepted by the Contracting Officer Representative, the APP and attachments will be enforced as part of the contract. Disregarding the provisions of this contract or the accepted APP will be cause for stopping of work, at the discretion of the Contracting Officer in accordance with FAR Clause 52.236-13, Accident Prevention, until the matter has been rectified.

E. Once work begins, changes to the accepted APP shall be made with the knowledge and concurrence of the Contracting Officer Representative Should any severe hazard exposure, i.e. imminent danger, become evident, stop work in the area, secure the area, and develop a plan to remove the exposure and control the hazard. Notify the Contracting Officer within 24 hours of discovery. Eliminate/remove the hazard. In the interim, take all necessary action to restore and maintain safe working conditions in order to safeguard onsite personnel, visitors, the public and the environment.

1.06 ACTIVITY HAZARD ANALYSES (AHAS):

A. AHAs are also known as Job Hazard Analyses, Job Safety Analyses, and Activity Safety Analyses. Before beginning each work activity involving a type of work presenting hazards not

experienced in previous project operations or where a new work crew or sub-contractor is to perform the work, the Contractor(s) performing that work activity shall prepare an AHA.

B. AHAs shall define the activities being performed and identify the work sequences, the specific anticipated hazards, site conditions, equipment, materials, and the control measures to be implemented to eliminate or reduce each hazard to an acceptable level of risk.

C. Work shall not begin until the AHA for the work activity has been accepted by the Contracting Officer Representative and discussed with all engaged in the activity, including the Contractor, subcontractor(s), and Government on-site representatives at preparatory and initial control phase meetings.

1. The names of the Competent/Qualified Person(s) required for a particular activity (for example, excavations, scaffolding, fall protection, other activities as specified by OSHA and/or other State and Local agencies) shall be identified and included in the AHA. Certification of their competency/qualification shall be submitted to the Contracting Officer Representative for acceptance prior to the start of that work activity.

2. The AHA shall be reviewed and modified as necessary to address changing site conditions, operations, or change of competent/qualified person(s).

   a. If more than one Competent/Qualified Person is used on the AHA activity, a list of names shall be submitted as an attachment to the AHA. Those listed must be Competent/Qualified for the type of work involved in the AHA and familiar with current site safety issues.

   b. If a new Competent/Qualified Person (not on the original list) is added, the list shall be updated (an administrative action not requiring an updated AHA). The new person shall acknowledge in writing that he or she has reviewed the AHA and is familiar with current site safety issues.

3. The AHA list will be reviewed periodically (at least monthly) at the Contractor supervisory safety meeting and updated as necessary when procedures, scheduling, or hazards change.

4. Develop the activity hazard analyses using the project schedule as the basis for the activities performed. All activities listed on the project schedule will require an AHA. The AHAs will be developed by the contractor, supplier, or subcontractor and provided to the prime contractor for review and approval and maintained onsite for review by Contracting Officer Representative.

1.07 PRECONSTRUCTION CONFERENCE:

A. Contractor representatives who have a responsibility or significant role in implementation of the accident prevention program, as required by 29 CFR 1926.20(b)(1), on the project shall attend the preconstruction conference to gain a mutual understanding of its implementation. This includes the project superintendent, subcontractor superintendents, and any other assigned safety and health professionals.

B. Deficiencies in the submitted APP will be brought to the attention of the Contractor within 14 days of submittal, and the Contractor shall revise the plan to correct deficiencies and re-submit it for acceptance. Do not begin work until there is an accepted APP.

1.08 "SITE SAFETY AND HEALTH OFFICER" (SSHO) AND "COMPETENT PERSON" (CP):

A. The Prime Contractor shall designate a minimum of one SSHO at each project site that will be identified as the SSHO to administer the Contractor's safety program and government-accepted Accident Prevention Plan. Each subcontractor shall designate a minimum of one CP in compliance with 29 CFR 1926.20 (b)(2) that will be identified as a CP to administer their individual safety programs

B. Further, all specialized Competent Persons for the work crews will be supplied by the respective contractor as required by 29 CFR 1926 (i.e. Asbestos, Electrical, Cranes, & Derricks, Demolition, Fall Protection, Fire Safety/Life Safety, Ladder, Rigging, Scaffolds, and Trenches/Excavations).

C. These Competent Persons can have collateral duties as the subcontractor's superintendent and/or work crew lead persons as well as fill more than one specialized CP role (i.e. Asbestos, Electrical, Cranes, & Derricks, Demolition, Fall Protection, Fire Safety/Life Safety, Ladder, Rigging, Scaffolds, and Trenches/Excavations).

D. The SSHO or an equally-qualified Designated Representative/alternate will maintain a presence on the site during construction operations in accordance with FAR Clause 52.236-6: Superintendence by the Contractor. CPs will maintain presence during their construction activities in accordance with above mentioned clause. A listing of the designated SSHO and all known CPs shall be submitted prior to the start of work as part of the APP with the training documentation and/or AHA as listed in Section 1.8 below.

E. The repeated presence of uncontrolled hazards during a contractor's work operations will result in the designated CP as being deemed incompetent and result in the required removal of the employee in accordance with FAR Clause 52.236-5: Material and Workmanship, Paragraph (c).

1.09 TRAINING:

A. The designated Prime Contractor SSHO must meet the requirements of all applicable OSHA standards and be capable (through training, experience, and qualifications) of ensuring that the requirements of 29 CFR 1926.16 and other appropriate Federal, State, Tribal, and local requirements are met for the project. As a minimum the SSHO must have completed the OSHA 30-hour Construction Safety class and have five (5) years of construction industry safety experience or three (3) years if he/she possesses a Certified Safety Professional (CSP) or certified Construction Safety and Health Technician (CSHT) certification or have a safety and health degree from an accredited university or college.

B. All designated CPs shall have completed the OSHA 30-hour Construction Safety course within the past 5 years.

C. In addition to the OSHA 30 Hour Construction Safety Course, all CPs with high hazard work operations such as operations involving asbestos, electrical, cranes, demolition, work at heights/fall protection, fire safety/life safety, ladder, rigging, scaffolds, and trenches/excavations shall have a specialized formal course in the hazard recognition & control associated with those high hazard work operations. Documented "repeat" deficiencies in the execution of safety requirements will require retaking the requisite formal course.

D. All other construction workers shall have the OSHA 10-hour Construction Safety Outreach coursE and any necessary safety training to be able to identify hazards within their work environment.

E. Prior to any worker for the contractor or subcontractors beginning work, they shall undergo a safety briefing provided by the SSHO or his/her designated representative. As a minimum, this briefing shall include information on the site-specific hazards, construction limits, Service Unit safety guidelines, means of egress, break areas, work hours, locations of restrooms, use of Government furnished equipment, emergency procedures, accident reporting etc ... Documentation shall be provided to the Contracting Officer Representative that individuals have undergone contractor's safety briefing.

F. Ongoing safety training will be accomplished in the form of weekly documented safety meeting.

1.10 INSPECTIONS:

A. The SSHO shall conduct frequent and regular safety inspections (daily) of the site and each of the subcontractors CPs shall conduct frequent and regular safety inspections (daily) of the their work operations as required by 29 CFR 1926.20(b)(2). Each week, the SSHO shall conduct a formal documented inspection of the entire construction areas with the subcontractors' "Trade Safety and Health CPs" present in their work areas. Coordinate with, and report findings and corrective actions weekly to Contracting Officer Representative.

B. A Certified Safety Professional (CSP) with specialized knowledge in construction safety or a certified Construction Safety and Health Technician (CSHT) shall randomly conduct a monthly site safety inspection. The CSP or CSHT can be a corporate safety professional or

independently contracted. The CSP or CSHT will provide their certificate number on the required report for verification as necessary.

1. Results of the inspection will be documented with tracking of the identified hazards to abatement.
2. The Contracting Officer Representative will be notified immediately prior to start of the inspection and invited to accompany the inspection.
3. Identified hazard and controls will be discussed to come to a mutual understanding to ensure abatement and prevent future reoccurrence.
4. A report of the inspection findings with status of abatement will be provided to the Contracting Officer within one week of the onsite inspection.

1.11 ACCIDENTS, OSHA 300 LOGS, AND MAN-HOURS:

A. prime contractor shall establish and maintain an accident reporting, recordkeeping, and analysis system to track and analyze all injuries and illnesses, high visibility incidents, and accidental property damage (both government and contractor) that occur on site. Notify the~ Contracting Officer Representative as soon as practical, but no more than four hours after any accident meeting the definition of a Moderate or Major incidents, High Visibility Incidents, or any weight handling and hoisting equipment accident. Within notification include contractor name; contract title; type of contract; name of activity, installation, or location where accident occurred; date and time of accident; names of personnel injured; extent of property damage, if any; extent of injury, if known, and brief description of accident (to include type of construction equipment used, PPE used, etc.). Preserve the conditions and evidence on the accident site until the Contracting Officer Representative determine whether a government investigation will be conducted.

B. Conduct an accident investigation for all Minor, Moderate and Major incidents as defined in paragraph DEFINITIONS, and property damage accidents resulting in at least $20,000 inch (508000 mm) damages, to establish the root cause(s) of the accident. Schedule a meeting within five (5) days with the COR and Facility Safety Officer to complete an 1ST AR incident report.

C. A summation of all man-hours worked by the contractor and associated sub-contractors for each month shall be available to the Contracting Officer Representative monthly.

D. A summation of all Minor, Moderate, and Major incidents experienced on site by the contractor and associated sub-contractors for each month will be provided to the Contracting Officer Representative monthly. The contractor and associated sub-contractors' OSHA 300 logs will be made available to the Contracting Officer Representative as requested.

1.12 PERSONAL PROTECTIVE EQUIPMENT (PPE):

A. PPE is governed in all areas by the nature of the work the employee is performing. For example, specific PPE required for performing work on electrical equipment is identified in NFPA 70E, Standard for Electrical Safety in the Workplace.

B. Mandatory PPE shall be defined by the AHAs and the work conditions in the space.

1.13 FIRE SAFETY

A. Fire Safety Plan: Establish and maintain a site-specific fire protection program in accordance with 29 CFR 1926. Prior to start of work, prepare a plan detailing project-specific fire safety measures, including periodic status reports, and submit to Contracting Officer Representative for review for compliance with contract requirements in accordance with 013300 SUBMITTALS. This plan may be an element of the Accident Prevention Plan.

B. Site and Building Access: Maintain free and unobstructed access to facility emergency service and for fire, police and other emergency response forces in accordance with NFPA 241 .

C. Temporary Heating and Electrical: Install, use and maintain installations in accordance with 29 CFR 1926, NFPA 241 and NFPA 70.

D. Means of Egress: Any changes to the Means of Egress shall be coordinated via a meeting with the Facility Safety Officer and Contracting Officer Representative through a preconstruction risk assessment (PCRA).

E. Egress Routes for Construction Workers: Maintain free and unobstructed egress. Inspect daily. Report findings and corrective actions weekly to Contracting Officer Representative

F. Fire Extinguishers: Provide and maintain extinguishers in construction areas and temporary storage areas in accordance with 29 CFR 1926, NFPA 241 and NFPA 10.

G. Existing Fire Protection: Do not impair automatic sprinklers, smoke and heat detection, and fire alarm systems, except for portions immediately under construction, and temporarily for connections. Provide fire watch for impairments more than 4 hours in a 24-hour period. Schedule interruptions in advance through a PCRA meeting. All existing or temporary fire protection systems (fire alarms, sprinklers) located in construction areas shall be tested as coordinated with the medical center. Parameters for the testing and results of any tests performed shall be recorded by the medical center and copies provided to the Facility Manager and Contracting Officer Representative.

H. Smoke Detectors: Prevent accidental operation. Remove temporary covers at end of work operations each day. Coordinate with Contracting Officer Representative.

I. HOT WORK PERMIT

1. Hot work is defined as operations including, but not limited to, cutting, welding, thermal welding, brazing, soldering, grinding, thermal spraying, thawing pipes, or any similar situation. If such work is required, whenever possible, the contractor must notify the CCR/ Project Manager no less than fourteen day in advance of such work. The Facility Safety Officer will inspect the work area and issue a Hot Work Permit, authorizing the performance of such work.

2. All hot work will be performed in compliance with the medical center's policy regarding Hot Work Permits and NFPA 241 and NFPA 518; and applicable OSHA Standards. A Hot Work Permit will only be issued to individuals familiar with these regulations.

3. A Hot Work Permit will be issued only for the period necessary to perform such work. A Hot Work Permit will apply only to the location identified on the permit. If addit ional areas involve hot work, then additional permits must be requested. All fire protection, detection and monitoring systems are to be returned to active status at the end of each work day. If this is not possible, the contractor will provide a continuous fire watch until the system(s) are reactivated.

4. Contractors will not be allowed to perform hot work processes without the appropriate permit.

5. Any work involving the medical center's fire protection system will require reasonable advance notification. Under no circumstance will the contractor or employee attempt to alter or tamper with the existing fire protection system. The Facility Safety Officer will be notified within 30 minutes of the completion of all hot work to perform an inspection of the area to confirm that sparks or drops of hot metal are not present.

6. Fire Hazard Prevention and Safety Inspections: Inspect entire construction areas weekly. Coordinate with, and report findings and corrective actions weekly to Contracting Officer Representative.]

J. Smoking: The use of tobacco products is prohibited on all I HS-operated properties (IHM, Part 5, Chapter 3) The term "tobacco" includes cigarettes, e-cigarettes, cigars, pipes, chewing tobacco, smokeless tobacco, electronic nicotine device system, and any other tobacco products. Security personnel may ask visitors who refuse to comply with the policy to leave the property and may document the incident.

K. Contractor shall remove and dispose of excess materials, debris, or waste generated by this project at an approved off-site location in accordance with applicable Local, Tribal, State and Federal laws and regulations, and pay any related fees. Burning or burial of materials is not

permitted. Contractor shall provide all required waste storage containers and coordinate their location on site with the COR or Facility Manager. Contractor shall remove and dispose of excess materials, debris, or waste generated by this project at an approved off-site location in accordance with applicable Local, Tribal, State and Federal laws and regulations, and pay anD related fees. Burning or burial of materials is not permitted. Contractor shall provide all required waste storage containers and coord inate their location on site with the COR or Facility Manager.

1.14 ELECTRICAL

A. All electrical work shall comply with NFPA 70 (NEC), NFPA 70B, NFPA 70E, 29 CFR Part 1910 Subpart J - General Environmental Controls, 29 CFR Part 1910 Subpart S - Electrical, and 29 CFR 1926 Subpart K in addition to other references required by contract.

B. All qualified persons performing electrical work under this contract shall be licensed journeyman or master electricians. All apprentice electricians performing under this contract shall be deemed unqualified persons unless they are working under the immediate supervision of a licensed electrician or master electrician.

C. All electrical work will be accomplished de-energized and in the Electrically Safe Work Condition (refer to NFPA 70E for Work Involving Electrical Hazards, including Exemptions to Work Permit). Any Contractor, subcontractor or temporary worker who fails to fully comply with this requirement is subject to immediate termination in accordance with FAR clause 52.236-5(c). Only in rare circumstance where achieving an electrically safe work condition prior to beginning work would increase or cause additional hazards, or is infeasible due to equipment design or operational limitations is energized work permitted. The Contracting Officer Representative with approval of the Facility Safety Officer will make the determination if the circumstances would meet th exception outlined above. An AHA specific to energized work activities will be developed, reviewed, and accepted by the Government prior to the start of that activity

   1. Development of a Hazardous Electrical Energy Control Procedure is required prior to deenergization. A single Simple Lockout/Tagout Procedure for multiple work operations can only be used for work involving qualified person(s) de-energizing one set of conductors or circuit part source. Task specific Complex Lockout/Tagout Procedures are required at all other times.

   2. Verification of the absence of voltage after de-energization and lockout/tagout is considered "energized electrical work" (live work) under NFPA 70E, and shall only be performed by qualified persons wearing appropriate shock protective (voltage rated) gloves and arc rate personal protective clothing and equipment, using Underwriters Laboratories (UL) tested and appropriately rated contact electrical testing instruments or equipment appropriate for the environment in which they will be used.

   3. Personal Protective Equipment (PPE) and electrical testing instruments will be readily available for inspection by the Contracting Officer Representative.

D. Before beginning any electrical work, an Activity Hazard Analysis (AHA) will be conducted to include Shock Hazard and Arc Flash Hazard analyses (NFPA Tables can be used only as a last alterative and it is strongly suggested a full Arc Flash Hazard Analyses be conducted). Work shall not begin until the AHA for the work activity for energized work has been reviewed and accepted by the Contracting Officer Representative and discussed with all engaged in the activity, includinG The Contractor, subcontractor(s), and Government on-site representatives at preparatory and initial control phase meetings.

E. Ground-fault circuit interrupters. GFCI protection shall be provided where an employee is operating or using cord- and plug-connected tools related to construction activity supplied by 125- volt, 15-, 20-, or 30- ampere circuits. Where employees operate or use equipment supplied by greater than 125-volt, 15-, 20-, or 30- ampere circuits, GFCI protection or an assured equipment grounding conductor program shall be implemented in accordance with NFPA 70E, Chapter 1, Article 110.4(C)(2)e

1.15 FALL PROTECTION

A. The fall protection (FP) threshold height requirement is 6 feet (182.88 cm) for ALL WORK, unless specified differently or the OSHA 29 CFR 1926 requirements are more stringent, to include steel erection activities, systems-engineered activities (prefabricated) metal buildings, residential (wood) construction and scaffolding work.

1. The use of a Safety Monitoring System (SMS) as a fall protection method is prohibited.
2. The use of Controlled Access Zone (CAZ) as a fall protection method is prohibited.
3. A Warning Line System (WLS) may ONLY be used on floors or flat or low-sloped roofs (between O - 18.4 degrees or 4:12 slope) and shall be erected around all sides of the work area (See 29 CFR 1926.502(f) for construction of WLS requirements). Working within the WLS does not require FP. No worker shall be allowed in the area between the roof or floor edge and the WLS without FP. FP is required when working outside the WLS.
4. Fall protection while using a ladder will be governed by the OSHA requirements.

1.16 SCAFFOLDS AND OTHER WORK PLATFORMS

A. All scaffolds and other work platforms construction activities shall comply with 29 CFR 1926 Subpart L.

B. The fall protection (FP) threshold height requirement is 6 feet (182.88 cm) as stated in Section 1.16.

C. The following hierarchy and prohibitions shall be followed in selecting appropriate work platforms.

1. Scaffolds, platforms, or temporary floors shall be provided for all work except that can bE performed safely from the ground or similar footing.
2. Ladders less than 20 feet (609.6 cm) may be used as work platforms only when use of small hand tools or handling of light material is involved.
3. Ladder jacks, lean-to, and prop-scaffolds are prohibited.
4. Emergency descent devices shall not be used as working platforms.

D. Contractors shall use a scaffold tagging system in which all scaffolds are tagged by the Competent Person. Tags shall be color-coded: green indicates the scaffold has been inspecteD and is safe to use; red indicates the scaffold is unsafe to use. Tags shall be readily visible, made of materials that will withstand the environment in which they are used, be legible and shall include:

1. The Competent Person's name and signature;
2. Dates of initial and last inspections.

1.17 EXCAVATION AND TRENCHES

A. All excavation and trenching work shall comply with 29 CFR 1926 Subpart P. Excavations lesS than 5 feet (152.4 cm) in depth require evaluation by the contractor's "Competent Person" (CP) for determination of the necessity of an excavation protective system where kneeing, laying in, or stooping within the excavation is required.

B. All excavations and trenches 24 inches (609.6 mm) in depth or greater shall require a written trenching andexcavation plan; including a permit (NOTE - some States and other local jurisdictions require separate state/jurisdiction-issued excavation permits). The permit shall have two sections, one section will be completed prior to digging or drilling and the other will be completed prior to personnel entering the excavations greater than 5 feet (152.4 cm) in depth. Each section of the permit shall be provided to the Contracting Officer Representative prior to proceeding with digging or drilling and prior to proceeding with entering the excavation. After completion of the work and prior to opening a new section of an excavation, the permit shall be closed out and provided to the Contracting Officer Representative The permit shall be maintained onsite and the first section of the permit shall include the following:

1. Estimated start time & stop time. Specific location and nature of the work.
2. Indication of the contractor's "Competent Person" (CP) in excavation safety with qualification and signature. Formal course in excavation safety is required by the contractor's CP.
3. Indication of whether soil or concrete removal to an offsite location is necessary.
4. Indication of whether soil samples are required to determined soil contamination.
5. Indication of coordination with local authority (i.e. "One Call") or contractor's effort to determine utility location with search and survey equipment.
6. Indication of review of site drawings for proximity of utilities to digging/drilling.

C. The second section of the permit for excavations greater than five feet in depth shall include the following:
   1. Determination of OSHA classification of soil. Soil samples will be from freshly dug soil with samples taken from different soil type layers as necessary and placed at a safe distance from the excavation by the excavating equipment. A pocket penetrometer will be utilized in determination of the unconfined compression strength of the soil for comparison against OSHA table (Less than 0.5 Tons/FT2 - Type C, 0.5 Tons/FT2 to 1.5 Tons/FT2 - Type B, greater than 1.5 Tons/FT2 - Type A without condition to reduce to Type B).
   2. Indication of selected protective system (sloping/benching, shoring, shielding). When soil classification is identified as "Type A" or "Solid Rock", only shoring or shielding or Professional Engineer designed systems can be used for protection. A Sloping/Benching system may only be used when classifying the soil as Type B or Type C. Refer to Appendix B of 29 CFR 1926, Subpart P for further information on protective systems designs.
   3. Indication of the spoil pile being stored at least 2 feet (60.96 cm) from the edge of the excavation and safe access being provided within 25 feet (762 cm) of the workers.
   4. Indication of assessment for a potential toxic, explosive, or oxygen deficient atmosphere where oxygen deficiency (atmospheres containing less than 19.5 percent oxygen) or a hazardous atmosphere exists or could reasonably be expected to exist. Internal combustion engine equipment is not allowed in an excavation without providing force air ventilation to lower the concentration to below OSHA PELs, providing sufficient oxygen levels, and atmospheric testing as necessary to ensure safe levels are maintained.

D. As required by OSHA 29 CFR 1926.651 (b)(1), the estimated location of utility installations, such as sewer, telephone, fuel, electric, water lines, or any other underground installations that reasonably may be expected to be encountered during excavation work, shall be determined prior to opening an excavation.
   1. The planned dig site will be outlined/marked in white prior to locating the utilities.
   2. Used of the American Public Works Association Uniform Color Code is required for the marking of the proposed excavation and located utilities.
   3. 811 and Tribal Utilities will be called two business days before digging on all local or State lands and public Right-of Ways.
   4. Digging will not commence until all known utilities are marked.
   5. Utility markings will be maintained.

E. Excavations will be hand dug or excavated by other similar safe and acceptable means as excavation operations approach within 5 feet (152.4 cm) of identified underground utilities. Exploratory bar or other detection equipment will be utilized as necessary to further identify the location of underground utilities.

F. Excavations greater than 20 feet (609.6 cm) in depth require a Professional Engineer designed excavation protective system.

1.18 CRANES

A. All crane work shall comply with 29 CFR 1926 Subpart CC.

B. Prior to operating a crane, the operator must be licensed, qualified or certified to operate the crane. Thus, all the provisions contained with Subpart CC are effective and there is no "PhasE In" date.

C. A detailed lift plan for all lifts shall be submitted to the Contracting Officer Representative 14 days prior to the scheduled lift complete with route for truck carrying load, crane load analysis, siting of crane and path of swing and all other elements of a critical lift plan where the lift meets the definition of a critical lift. Critical lifts require a more comprehensive lift plan to minimize the potential of crane failure and/or catastrophic loss. The plan must be reviewed and accepted by the General Contractor before being submitted to the Government for review. The lift will not be allowed to proceed without prior acceptance of this document.

D. Crane operators shall not carry loads

1. over any personnel
2. over any occupied building unless
    a. the top two floors are vacated
    b. or overhead protection with a design live load of 300 psf is provided

1.19 CONTROL OF HAZARDOUS ENERGY (LOCKOUT/TAGOUT.

A. All installation, maintenance, and servicing of equipment or machinery shall comply with 29 CFR 1910.147 except for specifically referenced operations in 29 CFR 1926 such as concrete & masonry equipment 1 926.7020), heavy machinery & equipment 1 926.600(a)(3)(i), and process safety management of highly hazardous chemicals (1926.64). Control of hazardous electrical energy during the installation, maintenance, or servicing of electrical equipment shall comply with Section 1.15 to include NFPA ?OE and other Government specific requirements discussed in the section.

1.20 CONFINED SPACE ENTRY

A. All confined space entry shall comply with 29 CFR 1926, Subpart AA except for specifically referenced operations in 29 CFR 1926 such as excavations/trenches 1926.651(9).

B. A site-specific Confined Space Entry Plan (including permitting process) shall be developed and submitted to the COR.

1.21 WELDING AND CUTTING

A. As specified in section 1.14, Hot Work: Perform and safeguard hot work operations in accordance with NFPA 241 and NFPA 518. Submit plan to Contracting Officer Representative at least 5 working days in advance Designate contractor's responsible project-site fire prevention program manager to plan hot work.

1.22 LADDERS

A. All Ladder use shall comply with 29 CFR 1926 Subpart X.

B. All portable ladders shall be of sufficient length and shall be placed so that workers will not stretch or assume a hazardous position.

C. Manufacturer safety labels shall be in place on ladders

D. Step Ladders shall not be used in the closed position

E. Top steps or cap of step ladders shall not be used as a step

F. Portable ladders, used as temporary access, shall extend at least 3 feet (91.44 cm) above the upper landing surface.

1. When a 3 feet (91.44 cm) extension is not possible, a grasping device (such as a grab rail) shall be provided to assist workers in mounting and dismounting the ladder.

2. In no case shall the length of the ladder be such that ladder deflection under a load would, by itself, cause the ladder to slip from its support.

G. Ladders shall be inspected for visible defects on a daily basis and after any occurrence that could affect their safe use. Broken or damaged ladders shall be immediately tagged "DO NOT USE," or with similar wording, and withdrawn from service until restored to a condition meeting their original design.

1.23 FLOOR & WALL OPENINGS

A. All floor and wall openings shall comply with 29 CFR 1926 Subpart M.

B. Floor and roof holes/openings are any that measure over 2 inch (50.8 mm) in any direction of a walking/working surface which persons may trip or fall into or where objects may fall to the level below. Skylights located in floors or roofs are considered floor or roof hole/openings.

C. All floor, roof openings or hole into which a person can accidentally walk or fall through shall bE guarded either by a railing system with toeboards along all exposed sides or a load-bearing cover. When the cover is not in place, the opening or hole shall be protected by a removable guardrail system or shall be attended when the guarding system has been removed, or other fall protection system.

1. Covers shall be capable of supporting, without failure, at least twice the weight of the worker, equipment and material combined.

2. Covers shall be secured when installed, clearly marked with the word "HOLE", "COVER" or "Danger, Roof Opening-Do Not Remove" or color-coded or equivalent methods (e.g., red or orange "X"). Workers must be made aware of the meaning for color coding and equivalent methods.

3. Roofing material, such as roofing membrane, insulation or felts, covering or partly covering openings or holes, shall be immediately cut out. No hole or opening shall be left unattended unless covered.

4. Non-load-bearing skylights shall be guarded by a load-bearing skylight screen, cover, or railing system along all exposed sides.

5. Workers are prohibited from standing/walking on skylights.

PART 2 - PRODUCTS - (NOT USED.

PART 3 - EXECUTION - (NOT USED.)

END OF SECTION 013526

SECTION 014000
QUALITY REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Submittals.

B. Testing and inspection agencies and services.

C. Contractor's design-related professional design services.

D. Control of installation.

E. Defect Assessment.

1.02 CONTRACTOR'S DESIGN-RELATED PROFESSIONAL DESIGN SERVICES

A. Coordination: Contractor's professional design services are subject to requirements of project's Conditions for Construction Contract.

B. Base design on performance and/or design criteria indicated in individual specification sections.

C. Scope of Contractor's Professional Design Services: Provide for the following items of work:
   1. Concrete Mix Design: As described in Section 033000 - Cast-in-Place Concrete. No specific designer qualifications are required.

1.03 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Design Data: Submit for Engineer's knowledge as contract administrator for the limited purpose of assessing compliance with information given and the design concept expressed in the Contract Documents, or for Owner's information.

C. Test Reports: After each test/inspection, promptly submit two copies of report to Engineer and to Contractor.
   1. Test report submittals are for Engineer's knowledge as contract administrator for the limited purpose of assessing compliance with information given and the design concept expressed in the Contract Documents, or for Owner's information.

1.04 TESTING AND INSPECTION AGENCIES AND SERVICES

A. Owner will employ and pay for services of an independent testing agency to perform other specified testing.

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

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 CONTROL OF INSTALLATION

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

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

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

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

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

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

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

3.02 TESTING AND INSPECTION

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

B. Limits on Testing/Inspection Agency Authority:
   1. Agency may not release, revoke, alter, or enlarge on requirements of Contract Documents.
   2. Agency may not approve or accept any portion of the Work.
   3. Agency may not assume any duties of Contractor.
   4. Agency has no authority to stop the Work.

C. Contractor Responsibilities:
   1. Deliver to agency at designated location, adequate samples of materials proposed to be used that require testing, along with proposed mix designs.
   2. Cooperate with laboratory personnel, and provide access to the Work and to manufacturers' facilities.
   3. Provide incidental labor and facilities:
      a. To provide access to Work to be tested/inspected.
      b. To obtain and handle samples at the site or at source of Products to be tested/inspected.
      c. To facilitate tests/inspections.
      d. To provide storage and curing of test samples.
   4. Notify Engineer and laboratory 24 hours prior to expected time for operations requiring testing/inspection services.
   5. Employ services of an independent qualified testing laboratory and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.
   6. Arrange with Owner's agency and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.

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

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

3.03 DEFECT ASSESSMENT

A. Replace Work or portions of the Work not complying with specified requirements.

END OF SECTION 014000

SECTION 016000
PRODUCT REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. General product requirements.

B. Transportation, handling, storage and protection.

C. Product option requirements.

D. Substitution limitations.

1.02 RELATED REQUIREMENTS

A. Section 012500 - Substitution Procedures: Substitutions made during procurement and/or construction phases.

B. Section 014000 - Quality Requirements: Product quality monitoring.

1.03 SUBMITTALS

A. Product Data Submittals: Submit manufacturer's standard published data. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information specific to this Project.

B. Shop Drawing Submittals: Prepared specifically for this Project; indicate utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.

C. Sample Submittals: Illustrate functional and aesthetic characteristics of the product, with integral parts and attachment devices. Coordinate sample submittals for interfacing work.
   1. For selection from standard finishes, submit samples of the full range of the manufacturer's standard colors, textures, and patterns.

PART 2 PRODUCTS

2.01 NEW PRODUCTS

A. Provide new products unless specifically required or permitted by Contract Documents.

B. See Section 014000 - Quality Requirements, for additional source quality control requirements.

C. Use of products having any of the following characteristics is not permitted:
   1. Made outside the United States, its territories, Canada, or Mexico.
   2. Made using or containing CFC's or HCFC's.

2.02 PRODUCT OPTIONS

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

B. Products Specified by Naming One or More Manufacturers: Use a product of one of the manufacturers named and meeting specifications, no options or substitutions allowed.

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

PART 3 EXECUTION

3.01 SUBSTITUTION LIMITATIONS

A. See Section 012500 - Substitution Procedures.

3.02 TRANSPORTATION AND HANDLING

A. Package products for shipment in manner to prevent damage; for equipment, package to avoid loss of factory calibration.

B. If special precautions are required, attach instructions prominently and legibly on outside of packaging.

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

D. Transport and handle products in accordance with manufacturer's instructions.

E. Transport materials in covered trucks to prevent contamination of product and littering of surrounding areas.

F. Promptly inspect shipments to ensure that products comply with requirements, quantities are correct, and products are undamaged.

G. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage, and to minimize handling.

H. Arrange for the return of packing materials, such as wood pallets, where economically feasible.

3.03 STORAGE AND PROTECTION

A. Designate receiving/storage areas for incoming products so that they are delivered according to installation schedule and placed convenient to work area in order to minimize waste due to excessive materials handling and misapplication.

B. Store and protect products in accordance with manufacturers' instructions.

C. Store with seals and labels intact and legible.

D. Store sensitive products in weathertight, climate-controlled enclosures in an environment favorable to product.

E. For exterior storage of fabricated products, place on sloped supports above ground.

F. Protect products from damage or deterioration due to construction operations, weather, precipitation, humidity, temperature, sunlight and ultraviolet light, dirt, dust, and other contaminants.

G. Comply with manufacturer's warranty conditions, if any.

H. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of products.

I. Prevent contact with material that may cause corrosion, discoloration, or staining.

J. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.

K. Arrange storage of products to permit access for inspection. Periodically inspect to verify products are undamaged and are maintained in acceptable condition.

END OF SECTION 016000

SECTION 017000
EXECUTION AND CLOSEOUT REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Examination, preparation, and general installation procedures.

B. Cutting and patching.

C. Cleaning and protection.

D. Closeout procedures, including Contractor's Correction Punch List, except payment procedures.

1.02 RELATED REQUIREMENTS

A. Section 013000 - Administrative Requirements: Submittals procedures, Electronic document submittal service.

B. Section 014000 - Quality Requirements: Testing and inspection procedures.

1.03 REFERENCE STANDARDS

A. NFPA 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations; 2022, with Errata (2021).

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Cutting and Patching: Submit written request in advance of cutting or alteration that affects:
   1. Structural integrity of any element of Project.
   2. Integrity of weather exposed or moisture resistant element.
   3. Efficiency, maintenance, or safety of any operational element.
   4. Visual qualities of sight exposed elements.
   5. Work of Owner or separate Contractor.

PART 2 PRODUCTS

2.01 PATCHING MATERIALS

A. New Materials: As specified in product sections; match existing products and work for patching and extending work.

B. Type and Quality of Existing Products: Determine by inspecting and testing products where necessary, referring to existing work as a standard.

C. Product Substitution: For any proposed change in materials, submit request for substitution described in Section 016000 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that existing site conditions and substrate surfaces are acceptable for subsequent work. Start of work means acceptance of existing conditions.

B. Verify that existing substrate is capable of structural support or attachment of new work being applied or attached.

C. Examine and verify specific conditions described in individual specification sections.

D. Take field measurements before confirming product orders or beginning fabrication, to minimize waste due to over-ordering or misfabrication.

E. Verify that utility services are available, of the correct characteristics, and in the correct locations.

F. Prior to Cutting: Examine existing conditions prior to commencing work, including elements subject to damage or movement during cutting and patching. After uncovering existing work,

assess conditions affecting performance of work. Beginning of cutting or patching means acceptance of existing conditions.

3.02 PREPARATION

A. Clean substrate surfaces prior to applying next material or substance.

B. Seal cracks or openings of substrate prior to applying next material or substance.

C. Apply manufacturer required or recommended substrate primer, sealer, or conditioner prior to applying any new material or substance in contact or bond.

3.03 GENERAL INSTALLATION REQUIREMENTS

A. Install products as specified in individual sections, in accordance with manufacturer's instructions and recommendations, and so as to avoid waste due to necessity for replacement.

B. Make vertical elements plumb and horizontal elements level, unless otherwise indicated.

C. Install equipment and fittings plumb and level, neatly aligned with adjacent vertical and horizontal lines, unless otherwise indicated.

D. Make consistent texture on surfaces, with seamless transitions, unless otherwise indicated.

E. Make neat transitions between different surfaces, maintaining texture and appearance.

3.04 CUTTING AND PATCHING

A. Whenever possible, execute the work by methods that avoid cutting or patching.

B. Perform whatever cutting and patching is necessary to:
   1. Complete the work.
   2. Fit products together to integrate with other work.
   3. Provide openings for penetration of mechanical, electrical, and other services.
   4. Match work that has been cut to adjacent work.
   5. Repair areas adjacent to cuts to required condition.
   6. Repair new work damaged by subsequent work.
   7. Remove samples of installed work for testing when requested.
   8. Remove and replace defective and non-complying work.

C. Execute work by methods that avoid damage to other work and that will provide appropriate surfaces to receive patching and finishing. In existing work, minimize damage and restore to original condition.

D. Employ original installer to perform cutting for weather exposed and moisture resistant elements, and sight exposed surfaces.

E. Cut rigid materials using masonry saw or core drill. Pneumatic tools not allowed without prior approval.

F. Restore work with new products in accordance with requirements of Contract Documents.

G. Fit work air tight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.

H. At penetrations of fire rated walls, partitions, ceiling, or floor construction, completely seal voids with fire rated material in accordance with Section 078400, to full thickness of the penetrated element.

I. Patching:
   1. Finish patched surfaces to match finish that existed prior to patching. On continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.
   2. Match color, texture, and appearance.
   3. Repair patched surfaces that are damaged, lifted, discolored, or showing other imperfections due to patching work. If defects are due to condition of substrate, repair substrate prior to repairing finish.

3.05 PROGRESS CLEANING

A. Maintain areas free of waste materials, debris, and rubbish. Maintain site in a clean and orderly condition.

B. Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces, and other closed or remote spaces, prior to enclosing the space.

C. Broom and vacuum clean interior areas prior to start of surface finishing, and continue cleaning to eliminate dust.

D. Collect and remove waste materials, debris, and trash/rubbish from site periodically and dispose off-site; do not burn or bury.

3.06 PROTECTION OF INSTALLED WORK

A. Protect installed work from damage by construction operations.

B. Provide special protection where specified in individual specification sections.

C. Provide temporary and removable protection for installed products. Control activity in immediate work area to prevent damage.

D. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings.

E. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials.

F. Prohibit traffic or storage upon waterproofed or roofed surfaces. If traffic or activity is necessary, obtain recommendations for protection from waterproofing or roofing material manufacturer.

G. Remove protective coverings when no longer needed; reuse or recycle coverings if possible.

3.07 ADJUSTING

A. Adjust operating products and equipment to ensure smooth and unhindered operation.

3.08 FINAL CLEANING

A. Use cleaning materials that are nonhazardous.

B. Remove all labels that are not permanent. Do not paint or otherwise cover fire test labels or nameplates on mechanical and electrical equipment.

C. Clean equipment and fixtures to a sanitary condition with cleaning materials appropriate to the surface and material being cleaned.

D. Clean filters of operating equipment.

E. Clean site; sweep paved areas, rake clean landscaped surfaces.

F. Remove waste, surplus materials, trash/rubbish, and construction facilities from the site; dispose of in legal manner; do not burn or bury.

3.09 CLOSEOUT PROCEDURES

A. Make submittals that are required by governing or other authorities.
   1. Provide copies to Owner.

B. Accompany Project Coordinator on preliminary inspection to determine items to be listed for completion or correction in the Contractor's Correction Punch List for Contractor's Notice of Substantial Completion.

C. Notify Engineer when work is considered ready for Engineer's Substantial Completion inspection.

D. Submit written certification containing Contractor's Correction Punch List, that Contract Documents have been reviewed, work has been inspected, and that work is complete in accordance with Contract Documents and ready for Engineer's Substantial Completion inspection.

E. Conduct Substantial Completion inspection and create Final Correction Punch List containing Engineer's and Contractor's comprehensive list of items identified to be completed or corrected and submit to Engineer.

F. Correct items of work listed in Final Correction Punch List and comply with requirements for access to Owner-occupied areas.

G. Notify Engineer when work is considered finally complete and ready for Engineer's Substantial Completion final inspection.

H. Complete items of work determined by Engineer listed in executed Certificate of Substantial Completion.

END OF SECTION 017000

SECTION 017123
FIELD ENGINEERING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Field engineering services by Contractor.

B. Land surveying services by Contractor.

C. Construction surveying by Contractor.

1.02 DESCRIPTION OF SERVICES

A. Specific services listed in this section are in addition to, and do not supersede, general Execution and Closeout Requirements.

B. Sole responsibility for establishing all locations, dimensions and levels of items of work.

C. Sole responsibility for provision of all materials required to establish and maintain benchmarks and control points, including batter boards, grade stakes, structure elevation stakes, and other items.

D. Keeping a transit, theodolite, or TST (total station theodolite with electronic distance measurement device); leveling instrument; and related implements such as survey rods and other measurement devices, at the project site at all times.

E. Provision of facilities and assistance necessary for Owner to check lines and grade points placed by Contractor.
   1. Performance of excavation or embankment work until after all cross-sectioning necessary for determining payment quantities for Unit Price work have been completed and accepted by COR.

F. Preparation and maintenance of daily reports of activity on the work. Submission of reports containing key progress indicators and job conditions to Owner.
   1. Number of employees at the Site.
   2. Number employees at the Site for each of Contractor's subcontractors.
   3. Major equipment and materials installed as part of the work.
   4. Major construction equipment utilized.
   5. Location of areas in which construction was performed.
   6. Materials and equipment received.
   7. Work performed, including field quality control measures and testing.
   8. Weather conditions.
   9. Safety.
   10. Delays encountered, amount of delay incurred, and the reasons for the delay.
   11. Instructions received from Owner, if any.

G. Preparation and maintenance of professional-quality, accurate, well organized, legible notes of all measurements and calculations made while surveying and laying out the work.

1.03 REFERENCE STANDARDS

A. FGDC-STD-007.1 - Geospatial Positioning Accuracy Standards - Part 1: Reporting Methodology; 1998.

B. FGDC-STD-007.2 - Geospatial Positioning Accuracy Standards - Part 2: Standards for Geodetic Networks; 1998.

C. FGDC-STD-007.4 - Geospatial Positioning Accuracy Standards - Part 4: Architecture, Engineering, Construction, and Facilities Measurement; 2002.

D. State Plane Coordinate System: CA83-VF.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 FIELD ENGINEERING

A. Maintain field office files, drawings, specifications, and record documents.

B. Coordinate field engineering services with Contractor's subcontractors, installers, and suppliers as appropriate.

C. Prepare layout and coordination drawings for construction operations.

D. Check and coordinate the work for conflicts and interferences, and immediately advise Owner of all discrepancies of which Contractor is aware.

E. Cooperate as required with Owner in observing the work and performing field inspections.

F. Review and coordinate work on a regular basis with shop drawings and Contractor's other submittals.

G. In general, match existing adjacent grades and maintain existing flow lines.

H. Check the location, line and grade of every major element as the work progresses. Notify the Owner when deviations from required lines or grades exceed allowable tolerances. Include in such notifications a thorough explanation of the problem, and a proposed plan and schedule for remedying the deviation. Do not proceed with remedial work without Owner's concurrence of the remediation plan.

3.02 LAND SURVEYING

A. General: Follow standards for geospatial positioning accuracy.
   1. FGDC-STD-007.1 as amended by Authority Having Jurisdiction.
   2. FGDC-STD-007.2 as amended by Authority Having Jurisdiction.
   3. FGDC-STD-007.4 as amended by Authority Having Jurisdiction.

B. Coordinate survey data with the State Plane Coordinate System of the State in which the Project is located.

C. Contractor is responsible for the restoration of all property corners and control monuments damaged or destroyed by construction-related activities. Any disturbed monuments must be replaced at Contractor's expense by a surveyor licensed in the State in which the Project is located, and approved by the Owner.
   1. Temporarily suspend work at such points and for such reasonable times as the Owner may require for resetting monuments. The Contractor will not be entitled to any additional compensation or extension of time.

3.03 REPORTS

A. Submit two copies of Contractor's daily reports at Owner's field office (or electronically) by 9:00 AM the next working day after the day covered in the associated report. Daily report shall be signed by responsible member of Contractor's staff, such as project manager or superintendent, or foreman designated by Contractor as having authority to sign daily reports.

3.04 RECORDS

A. Maintain at the Site a complete and accurate log of control and survey work as it progresses.
   1. Organize and record survey data in accordance with recognized professional surveying standards, Laws and Regulations, and prevailing standards of practice in the State in which the Project is located. Record Contractor's surveyor's original field notes, computations, and other surveying data in Contractor-furnished hard-bound field books. Contractor is solely responsible for completeness and accuracy of survey work, and completeness and accuracy of survey records, including field books. Survey records,(including field books) may be rejected by Owner due to failure to organize and maintain survey records in a manner that allows reasonable and independent verification of calculations, and/or allows identification of elevations, dimensions, and grades of the work.
   2. Illegible notes or data, and erasures on any page of field books, are unacceptable. Do not submit copied notes or data. Corrections by ruling or lining out errors will be unacceptable

unless initialed by the surveyor. Violation of these requirements may require re-surveying the data questioned by Owner.

B. Submit three copies of final property survey to Owner. Include on the survey a certification, signed by the surveyor, that principal metes, bounds, lines, and levels of the Project are accurately positioned as shown on the survey. Include the following information:
   1. Structure locations from property and/or fence lines, and distances to adjacent buildings.
   2. Dimensions and locations of underground utilities, appurtenances, and major site features.

3.05 CLOSEOUT ACTIVITIES

A. See Section 017800 - Closeout Submittals, for closeout submittals.

END OF SECTION 017123

SECTION 017800
CLOSEOUT SUBMITTALS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Project record documents.

B. Operation and maintenance data.

C. Warranties and bonds.

1.02 RELATED REQUIREMENTS

A. Section 013000 - Administrative Requirements: Submittals procedures, shop drawings, product data, and samples.

B. Individual Product Sections: Specific requirements for operation and maintenance data.

C. Individual Product Sections: Warranties required for specific products or Work.

1.03 SUBMITTALS

A. Project Record Documents: Submit documents to Owner with claim for final Application for Payment.

B. Operation and Maintenance Data:
   1. For equipment, or component parts of equipment put into service during construction and operated by Owner, submit completed documents within ten days after acceptance.
   2. Submit one copy of completed documents 15 days prior to final inspection. This copy will be reviewed and returned after final inspection, with Engineer comments. Revise content of all document sets as required prior to final submission.
   3. Submit two sets of revised final documents in final form within 10 days after final inspection.

C. Warranties and Bonds:
   1. For equipment or component parts of equipment put into service during construction with Owner's permission, submit documents within 10 days after acceptance.
   2. Make other submittals within 10 days after Date of Substantial Completion, prior to final Application for Payment.
   3. For items of Work for which acceptance is delayed beyond Date of Substantial Completion, submit within 10 days after acceptance, listing the date of acceptance as the beginning of the warranty period.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 PROJECT RECORD DOCUMENTS

A. Maintain on site one set of the following record documents; record actual revisions to the Work:
   1. Drawings.
   2. Addenda.
   3. Change Orders and other modifications to the Contract.

B. Ensure entries are complete and accurate, enabling future reference by Owner.

C. Store record documents separate from documents used for construction.

D. Record information concurrent with construction progress.

E. Record Drawings: Legibly mark each item to record actual construction including:
   1. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
   2. Field changes of dimension and detail.
   3. Details not on original Contract drawings.

3.02 OPERATION AND MAINTENANCE DATA

A. Product Data: Mark each sheet to clearly identify specific products and component parts, and data applicable to installation. Delete inapplicable information.

B. Drawings: Supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams. Do not use Project Record Documents as maintenance drawings.

C. Typed Text: As required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions.

3.03 OPERATION AND MAINTENANCE DATA FOR MATERIALS AND FINISHES

A. Instructions for Care and Maintenance: Manufacturer's recommendations for cleaning agents and methods, precautions against detrimental cleaning agents and methods, and recommended schedule for cleaning and maintenance.

B. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.

3.04 OPERATION AND MAINTENANCE DATA FOR EQUIPMENT AND SYSTEMS

A. For Each Item of Equipment and Each System:

B. Description of unit or system, and component parts.

C. Identify function, normal operating characteristics, and limiting conditions.

D. Include performance curves, with engineering data and tests.

E. Complete nomenclature and model number of replaceable parts.

F. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.

G. Operating Procedures: Include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and any special operating instructions.

H. Maintenance Requirements: Include routine procedures and guide for preventative maintenance and trouble shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.

I. Provide servicing and lubrication schedule, and list of lubricants required.

J. Include manufacturer's printed operation and maintenance instructions.

K. Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.

3.05 WARRANTIES AND BONDS

A. Obtain warranties and bonds, executed in duplicate by responsible Subcontractors, suppliers, and manufacturers, within 10 days after completion of the applicable item of work. Except for items put into use with Owner's permission, leave date of beginning of time of warranty until Date of Substantial completion is determined.

B. Verify that documents are in proper form, contain full information, and are notarized.

C. Co-execute submittals when required.

D. Retain warranties and bonds until time specified for submittal.

E. Manual: Bind in commercial quality 8-1/2 by 11 inch (216 by 279 mm) three D side ring binders with durable plastic covers.

F. Cover: Identify each binder with typed or printed title WARRANTIES AND BONDS, with title of Project; name, address and telephone number of Contractor and equipment supplier; and name of responsible company principal.

G. Table of Contents: Neatly typed, in the sequence of the Table of Contents of the Project Manual, with each item identified with the number and title of the specification section in which specified, and the name of product or work item.

H. Separate each warranty or bond with index tab sheets keyed to the Table of Contents listing. Provide full information, using separate typed sheets as necessary. List Subcontractor, supplier, and manufacturer, with name, address, and telephone number of responsible principal.

END OF SECTION 017800

Division 02 Existing Conditions

SECTION 024113
SELECTIVE SITE DEMOLITION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Remove site structural and site utility items and dispose of them off site.

B. Salvage.

1.02 PAYMENT PROCEDURES

A. Payment for structures or obstructions that are not designated for removal and disposal in the Bid documents, that cannot be removed with equipment reasonably expected to be used in the work without cutting, drilling, or blasting, will be paid for by Change Order.

B. Backfilling depressions left because of demolition work will not be measured or paid for separately except as provided in the preceding paragraph.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION

3.01 PREPARATION

A. Review all work procedures with ENGINEER and with representatives of any utility in the work zone.

B. Locate and preserve all active utilities which are to remain in service.

3.02 PROTECTION

A. Protect structures to be removed and their contents from vandalism and theft.

B. Repair or replace damage at no additional cost to OWNER.

3.03 STRUCTURE DEMOLITION

A. Remove structures and incidentals such as foundations, fences, outbuildings, etc.

B. Remove foundation walls at least two (2) feet below finished grade or two (2) feet below natural ground surface. Remove floor slab or break it into pieces no larger than three (3) feet square.

C. Backfilling and compaction of excavations for structures, Section 31 23 23.

3.04 PIPELINE DEMOLITION

A. General:
   1. Abandoned pipelines not to be salvaged are considered as incidental excavation work, Section 31 23 16.
   2. Do not damage pipe or structures that remain in service or are to be salvaged for OWNER.

B. Gravity Pipe Demolition:
   1. Plug abandoned pipe with a permanent, water-tight concrete plug extending into the abandoned pipe at least two (2) feet.
   2. Seal openings in walls of remaining manholes, catch basins, or structures with water-tight plugs.

C. Pressure Pipe Demolition:
   1. Coordinate demolition with ENGINEER and agency owning the utility pipe.
   2. Plug abandoned pipe with a permanent water-tight plug.
   3. Cap and restrain the active pipe with a blind flange or equivalent type of plug.
   4. For service line demolition or abandonment, disconnect the line from the mainline and shut off the corporation stop.

3.05 MISCELLANEOUS DEMOLITION

A. Remove miscellaneous structures and obstructions or cover them with backfill if the result meets the following requirements:
   1. Backfill is stable.
   2. Burial does not interfere with construction.
   3. Permission to do so is obtained from ENGINEER.
   4. No remaining portion is within two (2) feet of the final ground surface contours.

3.06 SALVAGE

A. Salvage designated equipment and materials for OWNER.

B. All other material becomes the property of CONTRACTOR unless such materials are not owned by OWNER.

END OF SECTION 024113

Division 03 Concrete

SECTION 033000
CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. This section includes cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes, for the following:
   1. Footings
   2. Piers
   3. Concrete slabs on grade

1.02 REFERENCE STANDARDS

A. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement; 2022.

B. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete; 2024.

C. PS 1 - Structural Plywood; 2023.

1.03 SUBMITTALS

A. Concrete Mix Design: Submit mix designs for all concrete mixes used on the project, including strength, slump, air content, water/cement ratio, and other relevant properties. The mix design must be approved before concrete delivery.

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

C. Product data for each of the following
   1. Admixtures
   2. Cementitious materials
   3. Concrete curing materials
   4. Steel reinforcement
   5. Curing compounds

D. Aggregate material test reports

1.04 QUALITY ASSURANCE

A. ACI Publications:
   Comply with the following unless modified by requirements in the Contract Documents:
   1. ACI 301, "Specifications for Structural Concrete," Sections 1 through 5.
   2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."

B. Concrete Testing Service: Engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixtures.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Follow ACI 301 and ACI 304R requirements and recommendations. Do not deliver concrete until forms, reinforcement, and embedded items are in place and ready for concrete placement.

B. Store steel reinforcement of different sizes and shapes in separate piles or racks raised above the ground to avoid excessive rusting. Protect from contaminants such as grease, oil, and dirt. Ensure bar sizes can be accurately identified after bundles are broken and tags removed.

PART 2 PRODUCTS

2.01 FORM-FACING MATERIALS

A. Smooth-Formed Finished Concrete:
Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.
1. Plywood, metal, or other approved panel materials.
2. Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1, and as follows:
    a. High-density overlay, Class 1 or better.
    b. Medium-density overlay, Class 1 or better; mill-release agent treated and edge sealed.
    c. Structural 1, B-B or better; mill oiled and edge sealed.
    d. B-B (Concrete Form), Class 1 or better; mill oiled and edge sealed.

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

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

D. Chamfer Strips:
Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch (19.05 mm), minimum.

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

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

2.02 REINFORCEMENT

A. Reinforcing Bars:
ASTM A615/A615M, Grade 60 deformed.

B. Bar Supports:
Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:
1. For concrete surfaces exposed to view where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainless-steel bar supports.

2.03 CONCRETE MIXTURES

A. Footings
Proportion normal-weight concrete mixture as follows:
1. Minimum Compressive Strength: 4500 psi (31026.42 kPa) at 28 days.
2. Maximum Water-Cementitious Materials Ratio: 0.45
3. Slump Limit: 8 inches (203.2 mm) for concrete with verified slump of 2 to 4 inches (101.6 mm) before adding high-range water-reducing admixture or plasticizing admixture, plus or minus 1 inch (25.4 mm).
4. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery for 1-inch or 3/4-inch nominal maximum aggregate size.

B. Slabs on Grade
Proportion normal-weight concrete mixture as follows:
1. Minimum Compressive Strength: 4500 psi (31026.42 kPa) at 28 days.
2. Maximum Water-Cementitious Materials Ratio: 0.45

3. Slump Limit: 8 inches (203.2 mm) for concrete with verified slump of 2 to 4 inches (101.6 mm) before adding high-range water-reducing admixture or plasticizing admixture, plus or minus 1 inch (25.4 mm).
4. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery for 1-inch or 3/4-inch nominal maximum aggregate size.

C. Piers
Proportion normal-weight concrete mixture as follows:
1. Minimum Compressive Strength: 4500 psi (31026.42 kPa) at 28 days.
2. Maximum Water-Cementitious Materials Ratio: 0.45
3. Slump Limit: 8 inches (203.2 mm) for concrete with verified slump of 2 to 4 inches (101.6 mm) before adding high-range water-reducing admixture or plasticizing admixture, plus or minus 1 inch (25.4 mm).
4. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery for 1-inch or 3/4-inch nominal maximum aggregate size.

2.04 READY-MIXED CONCRETE:

A. Measure, batch, mix, and deliver concrete according to ASTM C 94 and ASTM C 1116, and furnish batch ticket information.

PART 3 - EXECUTION

3.01 GENERAL

A. Do not begin installation until substrates have been properly constructed; verify that substrates are level. Check field dimensions before beginning installation. Surfaces against which concrete is to be placed must be free of debris, loose material, standing water, snow, ice, and other deleterious substances before start of concrete placing.

3.02 FORMS

A. General
1. Provide formwork in accordance with ACI 301 Section 5 and construct formwork so concrete surfaces conform to tolerances in ACI 117.
2. Set forms mortar tight and true to line and grade
3. Chamfer above grade exposed joints, edges, and external corners of concrete 0.75 inch (19.05 mm). Place chamfer strips in corners of formwork to produce beveled edges on permanently exposed surfaces.
4. Inspect formwork and remove foreign material before concrete is placed.

B. Coating
1. Cover formwork surfaces with an acceptable material that inhibits bond with concrete.
2. If formwork release agent is used, apply to formwork surfaces in accordance with manufacturer's recommendations before placing reinforcement. Remove excess release agent on formwork prior to concrete placement. Do not allow formwork release agent to contact reinforcement or hardened concrete against which fresh concrete is to be placed.

C. Removal of Form
1. Leave formwork in place to support construction loads and weight of concrete in beams, slabs, and other structural members until in-place required strength of concrete is reached.

3.03 REINFORCEMENT

A. Accurately place embedded items and reinforcement; securely tie at intersections, and hold in position during placing of concrete by spacers, chairs, or other approved supports.
1. Unless otherwise specified, place reinforcement and miscellaneous materials in accordance to ACI 301. Provide bars, welded wire reinforcement, wire ties, supports, and other devices necessary to install and secure reinforcement.
2. Reinforcement must not have rust, scale, oil, grease, clay, or foreign substances that would reduce the bond. Rusting of reinforcement is a basis of rejection if the effective

cross-sectional area or the nominal weight per unit length has been reduced. Remove loose rust prior to placing steel. Tack welding is prohibited.

3. Nonprestressed cast-in-place concrete members must have the minimum concrete cover for reinforcement given in the following table:

CONCRETE EXPOSURE	BAR SIZE	MINIMUM COVER
CAST DIRECTLY AGAINST SOIL	ALL	3 INCHES (76.2 MM)
EXPOSED TO EARTH OR WEATHER	#6 BAR AND LARGER	2 INCHES (50.8 MM)
	#5 BAR AND SMALLER	1 1/2" INCHES

4. Inspection of Reinforcement:
   a. Inspect and verify proper reinforcement grade, shape, cross section and condition. Do not use reinforcement with the following defects:
      1) Bar lengths, depths, and bends beyond specified fabrication tolerances.
      2) Bends or kinks not indicated on drawings or approved shop drawings.
      3) Bars with reduced cross section due to rusting or other cause.

3.04 BATCHING, MEASURING, MIXING, AND TRANSPORTING CONCRETE

A. All concrete shall be vibrated as it is placed except slabs on grade which shall be vibrated at edges, thickened slabs and embedded items.

3.05 PLACING CONCRETE

A. In accordance with ASTM C94/C94M, ACI 301, ACI 302.1R and ACI 304R
   1. Place concrete in accordance with ACI 301 Section 5. All concrete shall be placed within 90 minutes of water being added to the mix unless set retarding admixtures have been tested and approved by the engineer of record .
   2. All concrete shall be vibrated as it is placed per ACI 301, except slabs on grade which shall be vibrated at edges, thickened slabs and embedded items.
   3. Concrete to be placed during hot or cold weather conditions shall follow the requirements specified in ACI305R (hot weather) and ACI 306R (cold weather).

END OF SECTION 033000

Division 09 Finishes

SECTION 099009
PROTECTIVE COATINGS

PART 1 - GENERAL

1.01 DESCRIPTION:

A. Provide protective coatings as indicated and in compliance with Contract Documents.
   1. Provide sizes and capacities as indicated or specified.

1.02 REFERENCE STANDARDS:

A. American National Standards Institute (ANSI):
   1. A13.1: Scheme for the Identification of Piping Systems.
   2. Z53.1: Safety Color Code for Marking Physical Hazards.

B. Society for Protective Coatings (SSPC) Surface Preparation Specifications
   1. SP1: Solvent Cleaning
   2. SP2: Hand Tool Cleaning:
   3. SP3: Power Tool Cleaning
   4. SP5: White Metal Blast Cleaning
   5. SP6: Commercial Blast Cleaning
   6. SP10: Near-White Metal Blast Cleaning
   7. SP11: Power Tool Cleaning to Bare Metal

1.03 SUBMITTALS:

A. Submit the following:
   1. Schedule of products and paint systems to be used. Schedule shall include the following information:
      a. Surfaces for system to be applied.
      b. Surface preparation method and degree of cleanliness.
      c. Product manufacturer, name, and number.
      d. Method of application.
      e. Dry-film mil thickness per coat of coating to be applied.
   2. Color charts for selection and acceptance.
   3. Technical and material safety data sheets.
   4. Certification by coating manufacturer(s) that all coatings are suitable for service intended as stated on each coating system sheet. If manufacturer has an equivalent product that specified, but is not as suitable for the intended purpose, they shall submit the recommended product for approval at no increase in cost, and state reasons for substitution.
   5. Contractor shall certify in writing to the Engineer that applicators have previously applied all the systems in this Specification and have the ability and equipment to prepare the surfaces and apply the coatings correctly.

1.04 QUALITY ASSURANCE:

A. Include on label of container:
   1. Manufacturer’s name, product name, and number.
   2. Type of paint and generic name.
   3. Color name and number.
   4. Storage and temperature limits.
   5. Mixing and application instructions, including requirements for precautions which must be taken.
   6. Drying, recoat, or curing time.

B. Prepainting Conference:

1. Before Project field painting starts, representatives for the Owner, Contractor, coating applicator, and coating manufacturer's technical representative shall meet with the Engineer.
2. Agenda for the meeting will include details of surface preparations and coating systems to ensure understanding and agreement by parties for compliance.

C. In the event a problem occurs with coating system, surface preparation, or application, coating applicator and coating manufacturer's technical representative shall promptly investigate the problem and submit results to Engineer.
D. Stated VOC shall be unthinned maximum VOC certified by manufacturer.
E. A coating report shall be completed daily by Contractor at each phase of the coating system starting with surface preparation. These shall be submitted on the form attached at the end of this Section.

1.05 DELIVERY, STORAGE AND HANDLING:

A. Delivery of Materials:
1. Deliver in original unbroken sealed containers with labels and information legible and intact. Containers shall also have correct labels with required information.
2. Allow sufficient time for testing if required.
3. Open and mix on the premises and in the presence of the Engineer. Any rejected material shall be at once removed from the premises. Colors shall be as selected by Engineer.

B. Storage of Materials:
1. Store only acceptable materials on Project site in enclosed structures to protect them from weather and excessive heat and cold. Store in accordance with County and State Safety Codes.
2. Provide separate area and suitable containers for storage of coatings and related coating equipment.
3. Dispose of used or leftover containers, thinners, rags, brushes, and rollers in accordance with applicable regulations.

1.06 WARRANTY:

A. The coating manufacturers and applicators shall warrant their products and applications respectively against defects for a period of five (5) years under normal use. The warranty shall be in printed form.

1.07 REGULATORY REQUIREMENTS:

A. In addition to requirements specified elsewhere for environmental protection, provide coating materials that conform to the restrictions of the local and regional jurisdiction. Notify Engineer of any coating specified herein that fails to conform to the requirements for the location of the project or location of application.
B. Lead Content: Use only coatings that are totally lead free except for zinc-rich primers which shall not have a lead content over 0.06% by weight of nonvolatile content.
C. Chromate Content: Do not use coatings containing zinc-chromate or strontium chromate.
D. Asbestos Content: Materials shall not contain asbestos.
E. Mercury Content: Materials shall not contain mercury or mercury compounds**.**

1.08 INSPECTION SERVICE:

A. Owner will engage in the services of an independent NACE certified coating inspection service, Level III certification.
B. Inspection service will provide full-time inspection of all field surface preparation and coating applications to ensure full compliance with the requirements of this Specification. The presence of the inspection service shall not relieve Contractor for compliance with Specifications or authorized changes.

C. Inspection service will document all work, including nonconformance, using forms acceptable to Owner and Engineer. All documentation and reports will be prepared and signed by the Inspection service representative and submitted to Engineer on a daily basis. At the completion of all coating applications, Inspection service representative will also submit a conformance report certifying that all Work relative to coatings complies with the Specifications or authorized change.

D. Inspection service will be responsible for field verification and recommendations of the following field coating operations:
   1. Surface preparation methods, equipment.
   2. Substrate conditions, moisture content of concrete, substrate profiles, and surface temperatures.
   3. Temperature, humidity, and wind conditions at times of coating applications.
   4. Specified or approved coating verification.
   5. Application equipment.
   6. Coating wet and dry film thickness.
   7. Proper coating curing.
   8. Coating system failure, causes, and remedy.

E. Inspection service representative will discuss with Engineer, Owner, and Contractor all recommended Specification deviations, changes in products, or application methods

PART 2 - MATERIALS

2.01 MANUFACTURERS

A. Acceptable Manufacturers:
   1. Saureisen.
   2. Carboline.
   3. Raven Lining Systems.
   4. Ameron Protective Coatings Systems Group, Ameron Corp.
   5. Devoe Coating Company, Division of ICI.
   6. Futura Coatings, Inc.
   7. The Glidden Company.
   8. International Protective Coatings.
   9. Keeler & Long, Inc.
   10. Kop-Coat, Inc., Division of Carboline.
   11. Pittsburgh Paints, PPG Industries Inc.
   12. Santile, Division of Carboline Company, Inc.
   13. Tnemec Company, Inc.
   14. Polyken.

2.02 GENERAL

A. Materials furnished for each coating system must be compatible to the substrate

B. When unprimed surfaces are to be coated, entire coating system shall be by the same coating manufacturer to assure compatibility of coatings.

C. When shop-painted surfaces are to be coated, ascertain whether finish materials will be compatible with shop coating. Inform Engineer/ Architect of any unsuitable substrate or coating conditions.

D. Coating system shall be as specified below or to the manufacturer's standard, whichever is more stringent

2.03 AREAS OF APPLICATION

A. Ferrous Metals, Including all Ferrous Piping: Exterior Non-submerged:
   1. Surface Preparation: SSPC-SP6 Commercial Blast Cleaning.

2. Exterior non-submerged applies to areas that are not housed within a building or structure, and that are not located within process and/or water carrying structures or tanks.
3. Product and Manufacturer: Provided one of the following:
    a. Tnemec:
        1) Primer: 66 H.B. Epoxoline – tow coats, 2-3 dry mils per coat.
        2) Intermediate: 69 H.B. Epoxoline II – one coat, 4-5 dry mils.
        3) Finish: 75 Endura-Shield – tow coats, 1.5-2 dry mils per coat.
    b. Or approved equal.

B. Ductile and Cast Iron (Exterior Exposure)
1. Surface Preparation: Solvent scrub with stiff bristle brush followed by brush-off abrasive blast cleaning to a minimum surfaces profile depth of 1.5 mils (0.0381 mm).
2. Prime Coat: Series 69-1255 (beige) H.B. Epoxoline II: one coat 3-5 mils (0.127 mm) DFT.
3. Finish Coat: Series 73 Endura-Shield; one coat 3-4 mils (0.1016 mm) DFT

2.04 SURFACES NOT TO BE COATED:

A. Do not field paint any of the following items unless specifically noted otherwise.
1. Factory finished equipment, except for touch-up.
2. Metal surfaces of aluminum, stainless steel, copper, bronze and similar finished materials.
3. Equipment nameplates, valve stems, moving shafts and linkages.

2.05 COLOR CODING OF PIPING

A. Color Coding of Piping: Exterior and interior by color coding entire pipe.
1. General
    a. Coat piping with solid colors as for entire length of pipe in exposed finished and unfinished areas. Exclude areas in pipe chases and furred areas.
    b. Coat all other piping in colors matching adjacent surfaces. If adjacent area is unfinished, paint in color determined by Engineer/Architect.
    c. Identify piping with letters, arrows and bands as specified below. Apply after completion of finish coating.
    d. Colors: To be selected by the Engineer.

PART 3 - EXECUTION

3.01 SURFACE PREPARATION:

A. Prepare surfaces for each coating system conforming to SSPC surface preparation specifications listed.
1. If grease or oils are present, SSPC-SP 1 must precede any other method specified.
2. Remove surface irregularities such as weld splatter, burrs, or sharp edges prior to specified surface preparations.
3. Undertake specified surface preparation in accordance with the coating manufacturer's recommendations.

B. Depth of profile will be specified or as recommended by the manufacturer for each system, but in no instance shall it exceed one-third of the total dry film thickness of complete system.

C. Prepare only those areas which will receive the first coat of the system on the same day.

D. Abrasives for blasting shall be free of oil, washed and dry, unused silica sand, coal, copper or nickel slag that have sharp and hard cutting surfaces. Abrasives approved by Powertech Laboratories are strongly recommended.

E. Sharp projections and weld splatter shall be ground smooth. All areas ground smooth shall be reblasted prior to the coating application.

F. All welds shall be stripe coated by brush with the primer, prior to the application of the full primer coat. Note that inorganic zinc coatings shall not be applied by brush except to very small areas. Stripe coating shall be by spray.

G. Unless approved by the Paint Manufacturer to the contrary, the blast surface shall be primed prior to the development of rust bloom or other contaminants and not later than 8 hours after surface preparation.

3.02 APPLICATION:

A. Apply coatings in accordance with coating manufacturer's recommendations.

1. All work shall be undertaken by skilled applicators who are qualified to perform the required work and have a minimum of 5 years experience in similar applications. The work shall be done in a manner comparable to the best standards of practice found in that trade. All materials shall be evenly applied so as to be free from sags, runs, crawls, wrinkles, holidays, or any other defects. All coats shall be of the minimum of brush marks. When finished and dried, brush strokes shall appear in one direction only, and there shall be no curved brush marks showing. All coats shall be thoroughly dry before the succeeding coat is applied. All coats that are intended to hide shall be given another coat if the coating does not properly hide the undercoat.
2. Use properly designed brushes, rollers, and spray equipment for all applications.
3. Spraying shall be done in the cross lap method of spraying, streaking first in one direction and shortly later spraying across this section at right angles to the first set of passes.
4. On unprimed surfaces apply first coat of the system the same day as surface preparation.
5. Dry film thickness of each system shall meet the minimum specified. Maximum dry film thickness shall not exceed the minimum more than 20% or coating manufacturer's requirements if less. Where a dry film thickness range is specified, the range shall not be less than or exceeded.
6. Shop and field painting shall remain 3 inches (76.2 mm) away from unprepared surface of any substrate such as areas to be welded or bolted.

B. **ENVIRONMENTAL CONDITIONS:**

1. Do not apply coatings when inclement weather or freezing temperature may occur within coating curing time requirements. Atmospheric temperature must be maintained between 60°F and 85°F for at least 48 hours prior to and during application, unless otherwise approved by coating manufacturer.
2. Wind velocities for exterior applications shall be at a minimum to prevent overspray or fallout and not greater than coating manufacturer's limits.
3. Relative humidity must be less than 85% and the temperature of the surface to be painted must be at least 5°F above the dew point.
4. Provide adequate ventilation in all areas of application to ensure that at no time does the content of air exceed the threshold limit value given on the manufacturer's material safety data sheets for the specific coatings being applied.

C. **RECOAT TIME:**

1. In the event a coating, such as an epoxy, has exceeded its recoat time limit, prepare the applied coating in accordance with manufacturer's recommendations.

D. **PROTECTION:**

1. Cover or otherwise protect surfaces not to be painted. Remove protective materials when appropriate.
2. Provide signs to indicate fresh paint areas.
3. Provide daily cleanup of both storage and working areas and removal of all paint refuse, trash, rags, and thinners. Dispose of leftover containers, thinners, rags, brushes, and rollers which cannot be reused in accordance with applicable regulations.
4. Do not remove or paint over equipment data plates or code stamps on piping.
5. Mask, remove, or otherwise protect finish hardware, machined surfaces, grilles, lighting fixtures, and prefinished units as necessary.

6. Provide cover to prevent paints from entering orifices in electrical or mechanical equipment.

3.03 INSPECTION:

A. Contractor shall provide and use a wet film gauges to check each application approximately every 15 minutes in order to immediately correct film thickness under or over that specified.

B. Contractor shall provide and use a dry film gauge to check each coat mm (mil) thickness when dry, and the total system mm (mil) thickness when completed.

C. Use holiday or pinhole detector on systems over metal substrates to detect and correct voids when indicated on system sheet.

D. Furnish a sling psychrometer and perform periodic checks on both relative humidity and temperature limits.

E. Check temperature of the substrate at regular intervals to be certain surface is 5°F or more above the dew point.

3.04 CLEANING AND REPAIRS:

A. Remove spilled, dripped, or splattered paint from surfaces.

B. Touch up and restore damaged finishes to original condition. This includes surface preparation and application of coatings specified.

3.05 CONTRACT CLOSEOUT:

A. Provide in accordance with other project specifications.

END OF SECTION 099009

Division 13 Special Construction

SECTION 133419
METAL BUILDING SYSTEMS

PART 1 - GENERAL

3.01 REFERENCE STANDARDS

A. AISC 360 - Specification for Structural Steel Buildings; 2022, with Errata (2025).

B. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures; Most Recent Edition Cited by Referring Code or Reference Standard.

C. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength; 2021.

D. ASTM F1554 - Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength; 2020.

E. MBMA (MBSM) - Metal Building Systems Manual; 2024.

3.01 SUMMARY:

A. This section covers the requirements for the premanufactured metal shade structure.

3.01 SUBMITTALS:

A. Shop Drawings: Submit complete shop drawings to engineer of record for review and approval prior to fabrication showing steel members, connections, and hardware. Indicate dimensions, materials, and finishes

B. Design Data and Sealed Calculations: Submit complete design and calculations in compliance with the 2024 International Building Code sealed by an engineer licensed in the state of Arizona to engineer of record for review and approval prior to fabrication showing all analyses preformed.

C. Product Data: Provide manufacturer’s specifications for structural steel, coatings, and fasteners.

D. Welding Certifications: Submit certifications for welding procedures, including qualifications of welders and welding equipment.

E. Test Reports: Provide test reports for steel material strength and certifications of steel grade.

F. Field Welding Procedures: Submit field welding procedures and details of weld locations.

3.01 QUALITY ASSURANCE:

A. Fabrication: all design and construction of structural steel shall conform to the requirements of the 2024 International Building Code and the referenced American Institute for Steel Construction specification for structural steel buildings 2022 edition (((AISC 360))-22). All construction and tolerances shall conform to the AISC code of standard practice for steel buildings and bridges (((AISC 303))-122).

B. Inspection: Inspect all welds and connections in accordance with the American Welding Society (AWS) D1.1 and AISC 360 standards for quality control.

C. Mill Certification: Provide mill certificates for all structural steel materials, confirming compliance with ASTM standards.

D. Welder Qualifications: Ensure all welders are qualified under AWS D1.1 for the applicable weld type and steel grade.

3.01 DELIVERY, STORAGE AND HANDLING:

A. Storage: Store structural steel components in a clean, dry, and secure location to prevent rust and damage. Provide proper supports to prevent warping or distortion of the material.

B. Handling: Handle steel framing materials carefully to avoid damage or deformation. Ensure that materials are moved with proper rigging methods.

PART 2 – PRODUCTS

3.01 MATERIALS

A. All steel shall meet or exceed the following specifications:

Shape	Specification
Angle (L), Channel (C), and Plate	ASTM A36 (Fy = 36 ksi)
Wide Flange (W)	ASTM A992 (Fy = 50 ksi)
Square or Rectangular Tube (HSS)	ASTM A500 Gr B (Fy = 46 ksi)*
Anchor Bolts	ASTM F1554-36
Bolts	ASTM A307

1. *ASTM A1085 or ASTM A500 GR C (Fy = 50 ksi) may be substituted for ASTM A500 GR B

3.01 FABRICATION:

A. Cutting: Steel members shall be cut to required lengths and angles by methods that minimize damage and maintain the integrity of the material.

B. Drilling and Punching: Holes for bolts shall be drilled or punched to the sizes shown on the shop drawings. If punching is used, it should not affect the steel's structural integrity. No holes, notches, or other penetrations through structural steel shall be permitted without prior approval from engineer of record unless noted otherwise.

C. Welding: Perform welding of structural components in accordance with AWS D1.1 or AISC 360 standards. All welds shall be inspected and tested for strength and compliance.

D. Coatings: Steel members shall be hot-dip galvanized per ASTM A123 or painted with epoxy or polyurethane coatings for corrosion protection, as required by the project specifications.

3.01 METAL COATINGS:

A. Cutting: Galvanizing: If required, steel framing shall be hot-dip galvanized according to ASTM A123.

B. Painting: Provide a primed or painted finish on exposed structural members using high-performance paint systems for long-lasting protection, with a minimum of two coats of paint.

C. Surface Preparation: Steel surfaces to be painted or galvanized shall be cleaned of rust, mill scale, dirt, and oil to meet surface preparation standards in SSPC-SP6 or SSPC-SP10, as applicable.

3.01 FASTENERS:

A. Bolts and Nuts: Provide high-strength bolts and nuts for connections, per ASTM A325 or A490, as shown on the shop drawings.

B. Anchor Bolts: Provide anchor bolts as specified in ASTM F1554.

C. Washers: Provide hardened steel washers conforming to the necessary ASTM standards for the size of the bolts.

PART 3 – EXECUTION

3.01 EXAMINATION:

A. Before erection proceeds, examine with the erector present, the concrete foundation dimensions, concrete bearing surfaces, anchor bolt size and placement, survey slab elevation, locations of bearing plates, and other embedments to receive structural framing with the metal building manufacturer's templates and drawings before erecting any steel components for compliance with requirements for installation tolerances and other conditions affecting performance of the work.

B. Examine primary and secondary framing to verify that rafters, purlins, angles, channels, and other structural and metal panel support members and anchorages have been installed within alignment tolerances required by metal building manufacturer, UL, ASTM, ASCE 7-22 and as required by the 2024 International Building Code.

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

3.02 PREPARATION:

A. Provide temporary shoring, guys, braces, and other supports during erection to keep the structural framing secure, plumb, and in alignment against temporary construction loading or loads equal in intensity of the building design loads. Remove temporary support systems when permanent structural framing, connections, and bracing are in place, unless otherwise indicated.

B. Clean substrates of substances harmful to insulation, including removing projections capable of interfering with insulation attachment and performance.

C. Miscellaneous Framing: Install sub-purlins, angles, furring, and other miscellaneous support members or anchorage for the metal roof panels, according to metal building manufacturer's written instructions.

3.03 ERECTION OF STRUCTURAL FRAMING:

A. Erect metal building system according to manufacturer's written erection instructions, approved shop drawings and other erection documents in accordance with MBMA (MBSM)"Metal Building Systems Manual".

B. Do not field cut, drill, or alter structural members without written approval from metal building system manufacturer's professional engineer.

C. Set structural framing accurately in locations and to elevations indicated and according to AISC 325 specifications. Maintain structural stability of frame during erection.

D. Clean and roughen concrete and bearing surfaces prior to setting plates. Clean bottom surface of plates.

E. Align and adjust structural framing before permanent bolt-up and connections. Perform necessary adjustments and alignment to compensate for changes or discrepancies in elevations.

F. Maintain erection tolerances of structural framing in accordance with AISC 360.

3.04 ROOF PANEL INSTALLATION:

A. Provide metal roof panels of full length from eave to ridge or eave to wall as indicated, unless otherwise indicated or restricted by shipping limitations. Anchor metal roof panels and other components of the work securely in place in accordance with NRCA RoofMan and MBMA (MBSM)

B. Erect roofing system in accordance with the approved erection drawings, the printed instructions and safety precautions of the metal building manufacturer.

C. Sheets are not to be subjected to overloading, abuse, or undue impact. Do not install bent, chipped, or defective sheets.

D. Sheets must be erected true and plumb and in exact alignment with the horizontal and vertical edges of the building, securely anchored, and with the indicated rake and eave overhang.

E. Field cutting metal roof panels by torch is not permitted.

F. Roofing sheets must be laid with corrugations in the direction of the roof slope. End laps of exterior roofing must not be less than 8 inch (203.2 mm) 8 inches (203.2 mm); the side laps of standard exterior corrugated sheets must be not less than 2-1/2 corrugations.

G. Do not permit storage, walking, wheeling, or trucking directly on applied roofing materials. Provide temporary walkways, runways, and platforms of smooth clean boards or planks as

necessary to avoid damage to the installed roofing materials, and to distribute weight to conform to the indicated live load limits of roof construction.

H. Anchor metal panels securely in place, using manufacturer's approved fasteners according to manufacturers' written instructions.

3.05 PROTECTION AND CLEANING:

A. Protect installed steel framing components from damage during subsequent construction activities.

B. Clean all exposed surfaces of the steel framing to remove debris, dirt, or other contaminants, particularly before the application of coatings or other finishes.

END OF SECTION 133419

Division 22 Plumbing

SECTION 220519
METERS AND GAUGES FOR PLUMBING PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Flow meters.

B. Pressure gauges.

1.02 REFERENCE STANDARDS

A. ASME MFC-3M - Measurement of Fluid Flow in Pipes Using Orifice, Nozzle, and Venturi; 2004 (Reaffirmed 2017).

1.03 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data on valves including manufacturers catalog information. Submit performance ratings, rough-in details, weights, support requirements, and piping connections.

C. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

D. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, maintenance and repair data, and parts listings.

E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 016000 - Product Requirements. for additional provisions.

PART 2 PRODUCTS

2.01 FLOWMETERS

A. Manufacturers:
   1. Rosemount 8700 Series Magnetic Flow Meter.
   2. Substitutions: See Section 016000 - Product Requirements.

2.02 PRESSURE GAUGES

A. Manufacturers:
   1. Ashcroft 8008S.
   2. Substitutions: See Section 016000 - Product Requirements.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install metering products in accordance with manufacturer's instructions for intended fluid type and service.

B. Install pressure gauges in accordance with manufacturer’s instructions
   1. Adjust gauges to selected viewing angle, clean thoroughly, and calibrate to zero

END OF SECTION 220519

SECTION 220523
GENERAL-DUTY VALVES FOR PLUMBING PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Check valves.

B. Gate valves.

1.02 RELATED REQUIREMENTS

A. Section 221005 - Plumbing Piping.

1.03 REFERENCE STANDARDS

A. API STD 594 - Check Valves: Flanged, Lug, Wafer, and Butt-Welding; 2022.

B. ASME B16.1 - Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250; 2020.

C. ASME B16.5 - Pipe Flanges and Flanged Fittings: NPS 1/2 through NPS 24 Metric/Inch Standard; 2020.

D. ASME B16.10 - Face-to-Face and End-to-End Dimensions of Valves; 2022, with Errata (2023).

E. ASME B16.34 - Valves — Flanged, Threaded, and Welding End; 2020.

F. ASTM A126 - Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings; 2004 (Reapproved 2023).

G. MSS SP-71 - Gray Iron Swing Check Valves, Flanged and Threaded Ends; 2018.

H. MSS SP-125 - Check Valves: Gray Iron and Ductile Iron, In-Line, Spring-Loaded, Center-Guided; 2018.

I. NSF 61 - Drinking Water System Components - Health Effects; 2024.

J. NSF 372 - Drinking Water System Components - Lead Content; 2024.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data on valves including manufacturers catalog information. Submit performance ratings, rough-in details, weights, support requirements, and piping connections.

C. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

D. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, maintenance and repair data, and parts listings.

1.05 QUALITY ASSURANCE

A. Manufacturer:
   1. Obtain valves for each valve type from single manufacturer.

PART 2 PRODUCTS

2.01 APPLICATIONS

A. See drawings for specific valve locations.

B. Listed pipe sizes shown using nominal pipe sizes (NPS) and nominal diameter (DN).

C. Provide the following valves for the applications if not indicated on drawings:
   1. Shutoff: Ball, butterfly, gate or plug.
   2. Swing Check (Pump Outlet):
      a. 2-1/2 inch (65 mm, DN) and Larger for Domestic Water: Iron swing check valves with closure control, metal or resilient seat check valves.

2.02 GENERAL REQUIREMENTS

A. Valve Pressure and Temperature Ratings: No less than rating indicated; as required for system pressures and temperatures.

B. Valve Sizes: Match upstream piping unless otherwise indicated.

C. Valve Actuator Types:
   1. Handwheel: Valves other than quarter-turn types.
   2. Hand Lever: Quarter-turn valves 6 inch (150 mm, DN) and smaller except plug valves.

D. Valve-End Connections:
   1. Flanges on Iron Valves: ASME B16.1 for flanges on iron valves.
   2. Pipe Flanges and Flanged Fittings 1/2 inch (15 mm, DN) through 24 inch (600 mm, DN): ASME B16.5.

E. General ASME Compliance:
   1. Ferrous Valve Dimensions and Design Criteria: ASME B16.10 and ASME B16.34.

F. Potable Water Use:
   1. Certified: Approved for use in compliance with NSF 61 and NSF 372.
   2. Lead-Free Certified: Wetted surface material includes less than 0.25 percent lead content.

G. Source Limitations: Obtain each valve type from a single manufacturer.

2.03 IRON, SWING CHECK VALVES WITH CLOSURE CONTROL

A. Class 125 with Lever and Spring-Closure Control.
   1. Comply with MSS SP-71, Type I.
   2. Description:
      a. CWP Rating: 200 psi (1380 kPa).
      b. Design: Clear or full waterway.
      c. Body: ASTM A126, gray iron with bolted bonnet.
      d. Ends: Flanged as indicated.
      e. Trim: Bronze.
      f. Gasket: Asbestos free.
      g. Closer Control: Factory installed, exterior lever, and weight.

PART 3 EXECUTION

3.01 INSTALLATION

A. Provide unions or flanges with valves to facilitate equipment removal and maintenance while maintaining system operation and full accessibility for servicing.

B. Provide separate valve support as required and locate valve with stem at or above center of piping, maintaining unimpeded stem movement.

END OF SECTION 220523

SECTION 221005
PLUMBING PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Domestic water piping, above grade.

B. Pipe flanges, unions, and couplings.

C. Pressure reducing valves.

D. Pressure relief valves.

1.02 RELATED REQUIREMENTS

A. Section 099009 – Protective Coatings.

B. Section 312316 - Excavation.

C. Section 312323 - Fill.

D. Section 330110.58 - Disinfection of Water Utility Piping Systems.

1.03 REFERENCE STANDARDS

A. ANSI Z21.22 - American National Standard for Relief Valves for Hot Water Supply Systems; 2015 (Reaffirmed 2020).

B. ASSE 1003 - Water Pressure Reducing Valves for Potable Water Distribution Systems; 2023.

C. ASTM A536 - Standard Specification for Ductile Iron Castings; 1984, with Editorial Revision (2019).

D. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.

E. AWWA C111/A21.11 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings; 2023.

F. AWWA C550 - Protective Interior Coatings for Valves and Hydrants; 2024.

G. NSF 61 - Drinking Water System Components - Health Effects; 2024.

H. NSF 372 - Drinking Water System Components - Lead Content; 2024.

I. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data on pipe materials, pipe fittings, valves, and accessories. Provide manufacturers catalog information. Indicate valve data and ratings.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Potable Water Supply Systems: Provide piping, pipe fittings, and solder and flux (if used), that comply with NSF 61 and NSF 372 for maximum lead content; label pipe and fittings.

B. Plenum-Installed Acid Waste Piping: Flame-spread index equal or below 25 and smoke-spread index equal or below 50 according to ASTM E84 or UL 723 tests.

2.02 DOMESTIC WATER PIPING, ABOVE GRADE

A. Ductile Iron Pipe: AWWA C151/A21.51

1. Fittings: Ductile or gray iron, standard thickness

2. Joints: AWWA C111/A21.11, styrene butadiene rubber (SBR) or vulcanized SBR gasket with ¾ inch diameter rods

2.03 PRESSURE REDUCING VALVES

A. 2 inch (50 mm, DN) and Larger:
   1. ASSE 1003, cast iron body with interior lining complying with AWWA C550, bronze fitted, elastomeric diaphragm and seat disc, flanged.
   2. Pressure Reducing Pilot-Operator:
      a. Operating Range: 5 to 50 psi (0.35 to 35 Bar).
      b. Connected into brass or bronze pilot piping and fittings.
      c. Fixed flow restrictor, strainer, pressure gauges, and isolation valves.

2.04 PRESSURE RELIEF VALVES

A. ANSI Z21.22, AGA certified, bronze body, teflon seat, steel stem and springs, automatic, direct pressure actuated.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that excavations are to required grade, dry, and not over-excavated.

3.02 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Remove scale and dirt, on inside and outside, before assembly.

C. Prepare piping connections to equipment with flanges or unions.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Excavate in accordance with Section 312316.

C. Backfill in accordance with Section 312323.

D. Install bell and spigot pipe with bell end upstream.

3.04 SCHEDULES

A. Pipe Hanger Spacing:
   1. Metal Piping:
      a. Pipe Size: 8 inch (200 mm, DN) to 12 inch (300 mm, DN):
         1) Maximum hanger spacing: 14 ft (4.25 m).
         2) Hanger Rod Diameter: 7/8 inch (22 mm).

END OF SECTION 221005

SECTION 223000
PLUMBING EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Domestic Water Treatment Systems.

1.02 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittals procedures.

B. Product Data:
   1. Provide dimension drawings of chlorinators indicating components and connections to other equipment and piping.
   2. Provide electrical characteristics and connection requirements.

C. Shop Drawings:
   1. Indicate dimensions of tanks, tank lining methods, anchors, attachments, lifting points, tappings, and drains.

D. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.03 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Provide temporary inlet and outlet caps. Maintain caps in place until installation.

1.05 WARRANTY

A. See Section 017800 - Closeout Submittals for additional warranty requirements.

PART 2 PRODUCTS

2.01 DOMESTIC WATER TREATMENT SYSTEMS

A. Manufacturers:
   1. Hammonds HTS-10-P2 Vortex Tablet Chlorination System.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install plumbing equipment in accordance with manufacturer's instructions, as required by code, and complying with conditions required for applicable certifications.

B. Coordinate system, equipment, and piping work with applicable electrical, fuel, gas, vent, drain, and waste support interconnections as included or provided by other trades.

END OF SECTION 223000

Division 26 Electrical

SECTION 260500
BASIC ELECTRICAL REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Requirements applicable to all Division 26 Sections. Also refer to Division 1 - General Requirements.

B. All materials and installation methods shall conform to the applicable standards, guidelines and codes referenced herein and within each specification section.

1.02 REFERENCE STANDARDS

A. ASTM D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)); 2012 (Reapproved 2021).

B. SCAQMD 1113 - Architectural Coatings; 1977, with Amendment (2016).

1.03 REFERENCES

A. CEC California Electrical Code

B. OSHPD - Office of State Wide Health Planning and Development (California)

C. CCR California Code of Regulation

D. CBC California Building Code

E. CFC California Fire Code

F. CMC California Mechanical Code

G. CPC California Plumbing Code

H. California Title 24 - Building Energy Efficiency Standards

I. SCAQMD South Coast Air Quality Management District

1.04 SCOPE OF WORK

A. This Specification and the associated drawings govern furnishing, installing, testing and placing into satisfactory operation the Electrical Systems.

B. The Contractor shall furnish and install all new materials as indicated on the drawings, and/or in these specifications, and all items required to make the portion of the Electrical Work a finished and working system.

C. Separate contracts will be awarded for the following work. The division of work listed below is for the contractors' convenience and lists a normal breakdown of the work. Please refer to the Construction Manager's scope statements for complete scope of work description.

D. Description of Systems shall be as follows:
   1. Electrical power system to equipment, motors, devices, etc.
   2. Grounding system.
   3. Wiring of equipment furnished by others.
   4. Removal work and/or relocation and reuse of existing systems and equipment.

E. Work Not Included:
   1. Telecommunications cabling will be by others, in raceways and conduits furnished and installed as part of the Electrical work.
   2. Temperature control wiring for plumbing and HVAC equipment (unless otherwise indicated) will be by other Contractors.

1.05 WORK SEQUENCE

A. All work that will produce excessive noise or interference with normal building operations, as determined by the Owner, shall be scheduled with the Owner. It may be necessary to schedule such work during unoccupied hours. The Owner reserves the right to determine when restricted construction hours are required.

B. Itemize all work and list associated hours and pay scale for each item.

1.06 DIVISION OF WORK BETWEEN MECHANICAL, ELECTRICAL, AND CONTROL CONTRACTORS

A. Division of work is the responsibility of the Prime Contractor. Any scope of work described at any location on the contract document shall be sufficient for including said requirement in the project. The Prime Contractor shall be solely responsible for determining the appropriate subcontractor for the described scope. In no case shall the project be assessed an additional cost for scope that is described on the contract documents on bid day. The following division of responsibility is a guideline based on typical industry practice.

B. Definitions:
   1. "Mechanical Contractors" refers to the Contractors listed in Division 21/22/23 of this Specification.
   2. "Technology Contractors" refers to the Contractors furnishing and installing systems listed in Division 27/28 of this Specification.
   3. Motor Power Wiring: The single phase or 3 phase wiring extending from the power source (transformer, panelboard, feeder circuits, etc.) through disconnect switches and motor controllers to, and including the connections to the terminals of the motor.
   4. Motor Control Wiring: The wiring associated with the remote operation of the magnetic coils of magnetic motor starters or relays, or the wiring that permits direct cycling of motors by means of devices in series with the motor power wiring. In the latter case, the devices are usually single phase, have "Manual-Off-Auto" provisions, and are usually connected into the motor power wiring through a manual motor starter.
   5. Control devices such as start-stop push buttons, thermostats, pressure switches, flow switches, relays, etc., generally represent the types of equipment associated with motor control wiring.
   6. Motor control wiring is single phase and usually 120 volts. In some instances, the voltage will be the same as the motor power wiring. When the motor power wiring exceeds 120 volts, a control transformer is usually used to give a control voltage of 120 volts.
   7. Temperature Control Wiring: The wiring associated with the operation of a motorized damper, solenoid valve or motorized valve, etc., either modulating or two-position, as opposed to wiring that directly powers or controls a motor used to drive equipment such as fans, pumps, etc. This wiring will be from a 120-volt source and may continue as 120 volt, or be reduced in voltage (24 volt), in which case a control transformer shall be furnished as part of the temperature control wiring.
   8. Control Motor: An electric device used to operate dampers, valves, etc. It may be two-position or modulating. Conventional characteristics of such a motor are 24 volts, 60 cycles, 1 phase, although other voltages may be encountered.
   9. Low Voltage Technology Wiring: The wiring associated with the technology systems, used for analog or digital signals between equipment.
   10. Telecommunications/Technology Rough-in: Relates specifically to the backboxes, necessary plaster rings and other miscellaneous hardware required for the installation or mounting of telecommunications/technology information outlets.

C. General:
   1. The purpose of these Specifications is to outline the Electrical and Mechanical Contractors' responsibilities related to electrical work required for items such as temperature controls, mechanical equipment, fans, chillers, compressors, etc. The exact wiring requirements for much of the equipment cannot be determined until the systems have been selected and submittals approved. Therefore, the electrical drawings show only

known wiring related to such items. All wiring not shown on the electrical drawings, but required for mechanical systems, is the responsibility of the Mechanical Contractor.

2. Where the drawings require the Electrical Contractor to wire between equipment furnished by the Mechanical Contractor, such wiring shall terminate at terminals provided in the equipment. The Mechanical Contractor shall furnish complete wiring diagrams and supervision to the Electrical Contractor and designate the terminal numbers for correct wiring.
3. Control low (24V) and control line (120V) voltage wiring, conduit, and related switches and relays required for the automatic control and/or interlock of motors and equipment, including final connection, are to be furnished and installed under Divisions 21, 22 and 23. Materials and installation to conform to Class 1 or 2 requirements, California Electrical Code Article 725.
4. The Electrical Contractor shall establish electrical utility elevations prior to fabrication and installation. The Electrical Contractor shall coordinate utility elevations with other trades. When a conflict arises, priority shall be as follows:
   a. Gravity flow piping, including steam and condensate.
   b. Other piping.
   c. Conduits and wireway.

D. Mechanical Contractor's Responsibility:
1. Assumes responsibility for internal wiring of all equipment furnished by the Mechanical Contractor.
2. Assumes all responsibility for miscellaneous items furnished by the Mechanical Contractor that require wiring but are not shown on the electrical drawings or specified in the Electrical Specification. If items such as relays, flow switches, or interlocks are required to make the mechanical system function correctly or are required by the manufacturer, they are the responsibility of the Mechanical Contractor.
3. Assumes all responsibility for Temperature Control wiring, if the Temperature Control Contractor is a Subcontractor to the Mechanical Contractor.
4. This Contractor is responsible for coordination of utilities with all other Contractors. If any field coordination conflicts are found, the Contractor shall coordinate with other Contractors to determine a viable layout.

E. Temperature Control Contractor's or Subcontractor's Responsibility:
1. Wiring of all devices needed to make the Temperature Control System functional.
2. Verifying any control wiring on the electrical drawings as being by the Electrical Contractor. All wiring required for the Control System, but not shown on the electrical drawings, is the responsibility of the Temperature Control Contractor or Subcontractor.
3. Coordinating equipment locations (such as PE's, EP's, relays, transformers, etc.) with the Electrical Contractor, where wiring of the equipment is by the Electrical Contractor.

F. Electrical Contractor's Responsibility:
1. Furnishes and installs all combination starters, manual starters and disconnect devices shown on the Electrical Drawings or indicated to be by the Electrical Contractor in the Mechanical Drawings or Specifications.
2. Installs and wires all remote-control devices furnished by the Mechanical Contractor or Temperature Control Contractor when so noted on the Electrical Drawings.
3. Furnishes and installs motor control and temperature control wiring, when noted on the drawings.
4. This Contractor is responsible for coordination of utilities with all other Contractors. If any field coordination conflicts are found, the Contractor shall coordinate with other Contractors to determine a viable layout.

1.07 COORDINATION DRAWINGS

A. Definitions:
   1. Coordination Drawings: A compilation of the pertinent layout and system drawings that show the sizes and locations, including elevations, of system components and required access areas to ensure that no two objects will occupy the same space.
      a. Mechanical trades shall include, but are not limited to, mechanical equipment, ductwork, fire protection systems, plumbing piping, medical gas systems, hydronic piping, steam and steam condensate piping, and any item that may impact coordination with other disciplines.
      b. Electrical trades shall include, but are not limited to, electrical equipment, conduit 1.5" and larger, conduit racks, cable trays, pull boxes, transformers, raceway, busway, lighting, ceiling-mounted devices, and any item that may impact coordination with other disciplines.
      c. Technology trades shall include, but are not limited to, technology equipment, racks, conduit 1.5" and larger, conduit racks, cable trays, ladder rack, pull boxes, raceway, ceiling-mounted devices, and any item that may impact coordination with other disciplines.
      d. Maintenance clearances and code-required dedicated space shall be included.
      e. The coordination drawings shall include all underground, underfloor, in-floor, in chase, and vertical trade items.
   2. Spaces with open/cloud ceiling architecture shall indicate the overhead utilities and locate equipment as required to maintain clearance above lights. The intent for the installation is to maintain a maximum allowable vertical clearance and an organized/clean manner in the horizontal. Notify Engineer of the maximum clearance which can be maintained. Failure to comply will result in modifications with no cost to Owner.
      a. In cloud ceiling architecture, when open cabling/wire and/or cable tray crosses gaps between ceiling clouds and/or walls, cabling is to transition to conduits to span the gaps in order to conceal cabling from below.
   3. The contractors shall use the coordination process to identify the proper sequence of installation of all utilities above ceilings and in other congested areas, to ensure an orderly and coordinated end result, and to provide adequate access for service and maintenance.

B. Participation:
   1. The contractors and subcontractors responsible for work defined above shall participate in the coordination drawing process.
   2. One contractor shall be designated as the Coordinating Contractor for purposes of preparing a complete set of composite electronic CAD coordination drawings that include all applicable trades, and for coordinating the activities related to this process. The Coordinating Contractor for this project shall be the Civil Contractor.
      a. The Coordinating Contractor shall utilize personnel familiar with requirements of this project and skilled as draftspersons/CAD operators, competent to prepare the required coordination drawings.
   3. Electronic CAD drawings shall be submitted to the Coordinating Contractor for addition of work by other trades. IMEG will provide electronic file copies of ventilation drawings for contractor's use if the contractor signs and returns an "Electronic File Transfer" waiver provided by IMEG. IMEG will not consider blatant reproductions of original file copies an acceptable alternative for coordination drawings.

C. Drawing Requirements:
   1. The file format and file naming convention shall be coordinated with and agreed to by all contractors participating in the coordination process and the Owner.
      a. Scale of drawings:
         1) General plans: 1/4 Inch = 1 feet (30.48 cm)-0" (minimum).
         2) Mechanical, electrical, communication rooms, and including the surrounding areas within 10 feet (304.8 cm): 1/2 Inch = 1'-0" (minimum).
         3) Shafts and risers: 1/2 Inch = 1'-0" (minimum).

4) Sections of shafts and mechanical and electrical equipment rooms: 1/4 Inch = 1 feet (30.48 cm)-0" (minimum).
5) Sections of congested areas: 1/2 Inch = 1'-0" (minimum).

2. Ductwork layout drawings shall be the baseline system for other components. Ductwork layout drawings shall be modified to accommodate other components as the coordination process progresses.
3. There may be more drawings required for risers, top and bottom levels of mechanical rooms, and shafts.
4. The minimum quantity of drawings will be established at the first coordination meeting and sent to the Engineer for review. Additional drawings may be required if other areas of congestion are discovered during the coordination process.

D. General:
1. Coordination drawing files shall be made available to the Engineer and Owner's Representative. The Engineer will only review identified conflicts and give an opinion, but will not perform as a coordinator.
2. A plotted set of coordination drawings shall be available at the project site.
3. Coordination drawings are not shop drawings and shall not be submitted as such.
4. The contract drawings are schematic in nature and do not show every fitting and appurtenance for each utility. Each contractor is expected to have included in the bid sufficient fittings, material, and labor to allow for adjustments in routing of utilities made necessary by the coordination process and to provide a complete and functional system.
5. The contractors will not be allowed additional costs or time extensions due to participation in the coordination process.
6. The contractors will not be allowed additional costs or time extensions for additional fittings, reroutings or changes of duct size, that are essentially equivalent sizes to those shown on the drawings and determined necessary through the coordination process.
7. The Engineer reserves the right to determine space priority of equipment in the event of spatial conflicts or interference between equipment, piping, conduit, ducts, and equipment provided by the trades.
8. Changes to the contract documents that are necessary for systems installation and coordination shall be brought to the attention of the Engineer.
9. Access panels shall preferably occur only in gypsum board walls or plaster ceilings where indicated on the drawings.
   a. Access to mechanical, electrical, technology, and other items located above the ceiling shall be through accessible lay-in ceiling tile areas.
   b. Potential layout changes shall be made to avoid additional access panels.
   c. Additional access panels shall not be allowed without written approval from the Engineer at the coordination drawing stage.
   d. Providing additional access panels shall be considered after other alternatives are reviewed and discarded by the Engineer and the Owner's Representative.
   e. When additional access panels are required, they shall be provided without additional cost to the Owner.
10. Complete the coordination drawing process and obtain sign-off of the drawings by all contractors prior to installing any of the components.
11. Conflicts that result after the coordination drawings are signed off shall be the responsibility of the contractor or subcontractor who did not properly identify their work requirements, or installed their work without proper coordination.
12. Updated coordination drawings that reflect as-built conditions may be used as record documents.

1.08 QUALITY ASSURANCE

A. Contractor's Responsibility Prior to Submitting Pricing/Bid Data:
1. The Contractor is responsible for constructing complete and operating systems. The Contractor acknowledges and understands that the Contract Documents are a two-

dimensional representation of a three-dimensional object, subject to human interpretation. This representation may include imperfect data, interpreted codes, utility guides, three-dimensional conflicts, and required field coordination items. Such deficiencies can be corrected when identified prior to ordering material and starting installation. The Contractor agrees to carefully study and compare the individual Contract Documents and report at once in writing to the Engineer any deficiencies the Contractor may discover. The Contractor further agrees to require each subcontractor to likewise study the documents and report at once any deficiencies discovered.

2. The Contractor shall resolve all reported deficiencies with the Engineer prior to awarding any subcontracts, ordering material, or starting any work with the Contractor's own employees. Any work performed prior to receipt of instructions from the Engineer will be done at the Contractor's risk.

B. Qualifications:
   1. Only products of reputable manufacturers as determined by the Engineer are acceptable.
   2. All Contractors and subcontractors shall employ only workmen who are skilled in their trades. At all times, the number of apprentices at the job site shall be less than or equal to the number of journeymen at the job site.

C. Compliance with Codes, Laws, Ordinances:
   1. Conform to all requirements of the Havasu Lake, California current Codes, Laws, Ordinances and other regulations having jurisdiction.
   2. Conform to all published standards of Chemehuevi Indian Tribe and IHS.
   3. If there is a discrepancy between the codes and regulations and these specifications, the Engineer shall determine the method or equipment used.
   4. If the Contractor notes, at the time of bidding, that any parts of the drawings or specifications do not comply with the codes or regulations, Contractor shall inform the Engineer in writing, requesting a clarification. If there is insufficient time for this procedure, Contractor shall submit with the proposal a separate price to make the system comply with the codes and regulations.
   5. All changes to the system made after the letting of the contract to comply with codes or the requirements of the Inspector, shall be made by the Contractor without cost to the Owner.
   6. If there is a discrepancy between manufacturer's recommendations and these specifications, the manufacturer's recommendations shall govern.
   7. If there are no local codes having jurisdiction, the current issue of the National Electrical Code shall be followed.

D. Permits, Fees, Taxes, Inspections:
   1. Procure all applicable permits and licenses.
   2. Abide by all laws, regulations, ordinances, and other rules of the State or Political Subdivision where the work is done, or as required by any duly constituted public authority.
   3. Pay all charges for permits or licenses.
   4. Pay all fees and taxes imposed by State, Municipal, and other regulatory bodies.
   5. Pay all charges arising out of required inspections by an authorized body.
   6. Pay all charges arising out of required contract document reviews associated with the project and as initiated by the Owner or authorized agency/consultant.
   7. Where applicable, all fixtures, equipment and materials shall be listed by Underwriter's Laboratories, Inc. or a nationally recognized testing organization.
   8. Pay all telephone company charges related to the service or change in service.

E. Examination of Drawings:
   1. The drawings for the electrical work are completely diagrammatic, intended to convey the scope of the work and to indicate the general arrangements and locations of equipment, outlets, etc., and the approximate sizes of equipment.

2. Contractor shall determine the exact locations of equipment and rough-ins, and the exact routing of raceways to best fit the layout of the job. Conduit entry points for electrical equipment including, but not limited to, panelboards, switchboards, switchgear and unit substations, shall be determined by the Contractor unless noted in the contract documents.
3. Scaling of the drawings will not be sufficient or accurate for determining these locations.
4. Where job conditions require reasonable changes in arrangements and locations, such changes shall be made by the Contractor at no additional cost to the Owner.
5. Because of the scale of the drawings, certain basic items, such as junction boxes, pull boxes, conduit fittings, etc., may not be shown, but where required by other sections of the specifications or required for proper installation of the work, such items shall be furnished and installed.
6. If an item is either shown on the drawings or called for in the specifications, it shall be included in this contract.
7. The Contractor shall determine quantities and quality of material and equipment required from the documents. Where discrepancies arise between drawings, schedules and/or specifications, the greater and better-quality number shall govern.
8. Where used in electrical documents the word "furnish" shall mean supply for use, the word "install" shall mean connect up complete and ready for operation, and the word "provide" shall mean to supply for use and connect up complete and ready for operation.
9. Any item listed as furnished shall also be installed unless otherwise noted.
10. Any item listed as installed shall also be furnished unless otherwise noted.

F. Electronic Media/Files:
1. Construction drawings for this project have been prepared utilizing Revit.
2. Contractors and Subcontractors may request electronic media files of the contract drawings and/or copies of the specifications. Specifications will be provided in PDF format.
3. Upon request for electronic media, the Contractor shall complete and return a signed "Electronic File Transmittal" form provided by IMEG.
4. If the information requested includes floor plans prepared by others, the Contractor will be responsible for obtaining approval from the appropriate Design Professional for use of that part of the document.
5. The electronic contract documents can be used for preparation of shop drawings and as-built drawings only. The information may not be used in whole or in part for any other project.
6. The drawings prepared by IMEG for bidding purposes may not be used directly for ductwork layout drawings or coordination drawings.
7. The use of these CAD documents by the Contractor does not relieve them from their responsibility for coordination of work with other trades and verification of space available for the installation.
8. The information is provided to expedite the project and assist the Contractor with no guarantee by IMEG as to the accuracy or correctness of the information provided. IMEG accepts no responsibility or liability for the Contractor's use of these documents.

G. Field Measurements:
1. Verify all pertinent dimensions at the job site before ordering any conduit, conductors, wireways, bus duct, fittings, etc.

1.09 WEB-BASED PROJECT SOFTWARE

A. The General Contractor shall provide a web-based project software site for the purpose of hosting and managing project communication and documentation until completion of the warranty phase.

B. The web-based project software shall include, at a minimum, the following features: construction schedule, submittals, RFIs, ASIs, construction change directives, change orders, drawing management, specification management, payment applications, contract modifications, meeting minutes, construction progress photos.

C. Provide web-based project software user licenses for use by the Engineer. Access will be provided from the start of the project through the completion of the warranty phase.

D. At project completion, provide digital archive of entire project in format that is readable by common desktop software applications in format acceptable to Engineer. Provide data in locked format to prevent further changes.

1.10 SUBMITTALS

A. Submittals shall be required for the following items, and for additional items where required elsewhere in the specifications or on the drawings.

1. Submittals list:

Referenced Specification Section	Submittal Item
26 05 13	Wire and Cable
26 05 26	Grounding and Bonding
26 05 33	Conduit and Boxes
26 05 48	Seismic Requirements for Equipment and Supports
26 05 53	Electrical Identification
26 24 16	Panelboards
26 28 13	Fuses
26 28 16	Disconnect Switches
26 32 13	Packaged Engine Generator Systems
26 36 00	Transfer Switch
26 43 00	Surge Protection Devices

B. General Submittal Procedures: In addition to the provisions of Division 1, the following are required:

1. Transmittal: Each transmittal shall include the following:
   a. Date
   b. Project title and number
   c. Contractor's name and address
   d. Division of work (e.g., electrical, plumbing, heating, ventilating, etc.)
   e. Description of items submitted and relevant specification number
   f. Notations of deviations from the contract documents
   g. Other pertinent data
2. Submittal Cover Sheet: Each submittal shall include a cover sheet containing:
   a. Date
   b. Project title and number
   c. Engineer
   d. Contractor and subcontractors' names and addresses
   e. Supplier and manufacturer's names and addresses
   f. Division of work (e.g., electrical, plumbing, heating, ventilating, etc.)
   g. Description of item submitted (using project nomenclature) and relevant specification number
   h. Notations of deviations from the contract documents
   i. Other pertinent data
   j. Provide space for Contractor's review stamps
3. Composition:
   a. Submittals shall be submitted using specification sections and the project nomenclature for each item.

b. Individual submittal packages shall be prepared for items in each specification section. All items within a single specification section shall be packaged together where possible. An individual submittal may contain items from multiple specifications sections if the items are intimately linked (e.g., pumps and motors).
c. All sets shall contain an index of the items enclosed with a general topic description on the cover.

4. Content: Submittals shall include all fabrication, erection, layout, and setting drawings; manufacturers' standard drawings; schedules; descriptive literature, catalogs and brochures; performance and test data; wiring and control diagrams; dimensions; shipping and operating weights; shipping splits; service clearances; and all other drawings and descriptive data of materials of construction as may be required to show that the materials, equipment or systems and the location thereof conform to the requirements of the contract documents.
5. Contractor's Approval Stamp:
   a. The Contractor shall thoroughly review and approve all shop drawings before submitting them to the Engineer. The Contractor shall stamp, date and sign each submittal certifying it has been reviewed.
   b. Unstamped submittals will be rejected.
   c. The Contractor's review shall include, but not be limited to, verification of the following:
      1) Only approved manufacturers are used.
      2) Addenda items have been incorporated.
      3) Catalog numbers and options match those specified.
      4) Performance data matches that specified.
      5) Electrical characteristics and loads match those specified.
      6) Equipment connection locations, sizes, capacities, etc. have been coordinated with other affected trades.
      7) Dimensions and service clearances are suitable for the intended location.
      8) Equipment dimensions are coordinated with support steel, housekeeping pads, openings, etc.
      9) Constructability issues are resolved (e.g., weights and dimensions are suitable for getting the item into the building and into place, sinks fit into countertops, etc.).
   d. The Contractor shall review, stamp and approve all subcontractors' submittals as described above.
   e. The Contractor's approval stamp is required on all submittals. Approval will indicate the Contractor's review of all material and a complete understanding of exactly what is to be furnished. Contractor shall clearly mark all deviations from the contract documents on all submittals. If deviations are not marked by the Contractor, then the item shall be required to meet all drawing and specification requirements.
6. Submittal Identification and Markings:
   a. The Contractor shall clearly mark each item with the same nomenclature applied on the drawings or in the specifications.
   b. The Contractor shall clearly indicate the size, finish, material, etc.
   c. Where more than one model is shown on a manufacturer's sheet, the Contractor shall clearly indicate exactly which item and which data is intended.
   d. All marks and identifications on the submittals shall be unambiguous.
7. Schedule submittals to expedite the project. Coordinate submission of related items.
8. Identify variations from the contract documents and product or system limitations that may be detrimental to the successful performance of the completed work.
9. Reproduction of contract documents alone is not acceptable for submittals.
10. Incomplete submittals will be rejected without review. Partial submittals will only be reviewed with prior approval from the Engineer.
11. Submittals not required by the contract documents may be returned without review.

12. The Engineer's responsibility shall be to review one set of shop drawing submittals for each product. If the first submittal is incomplete or does not comply with the drawings and/or specifications, the Contractor shall be responsible to bear the cost for the Engineer to recheck and handle the additional shop drawing submittals.
13. Submittals shall be reviewed and approved by the Engineer before releasing any equipment for manufacture or shipment.
14. Contractor's responsibility for errors, omissions or deviation from the contract documents in submittals is not relieved by the Engineer's approval.
15. Schedule shall allow for adequate time to perform orderly and proper review of submittals, including time for consultants and Owner if required, and resubmittals by Contractor if necessary, and to cause no delay in Work or in activities of Owner or other contractors.
    a. Allow at least two weeks for Engineer's review and processing of each submittal, excluding mailing.
16. Engineer reserves the right to withhold action on a submittal which, in the Engineer¢¢s opinion, requires coordination with other submittals until related submittals are received. The Engineer will notify the Contractor, in writing, when they exercise this right.

C. Electronic Submittal Procedures:
1. Distribution: Email submittals as attachments to all parties designated by the Engineer, unless a web-based submittal program is used.
2. Transmittals: Each submittal shall include an individual electronic letter of transmittal.
3. Format: Electronic submittals shall be in PDF format only. Scanned copies, in PDF format, of paper originals are acceptable. Submittals that are not legible will be rejected. Do not set any permission restrictions on files; protected, locked, or secured documents will be rejected.
4. File Names: Electronic submittal file names shall include the relevant specification section number followed by a description of the item submitted, as follows. Where possible, include the transmittal as the first page of the PDF instead of using multiple electronic files.
    a. Submittal file name: 26 XX XX.description.YYYYMMDD
    b. Transmittal file name: 26 XX XX.description.YYYYMMDD
5. File Size: Files shall be transmitted via a pre-approved method. Larger files may require an alternative transfer method, which shall also be pre-approved.

1.11 SCHEDULE OF VALUES

A. The requirements herein are in addition to the provisions of Division 1.

B. Format:
1. Use AIA Document Continuation Sheets G703 or another similar form approved by the Owner and Engineer.
2. Submit in Excel format.
3. Support values given with substantiating data.

C. Preparation:
1. Itemize work required by each specification section and list all providers. All work provided by subcontractors and major suppliers shall be listed on the Schedule of Values. List each subcontractor and supplier by company name.
2. Break down all costs into:
    a. Material: Delivered cost of product with taxes paid.
    b. Labor: Labor cost, excluding overhead and profit.

D. Update Schedule of Values when:
1. Indicated by Engineer.
2. Change of subcontractor or supplier occurs.
3. Change of product or equipment occurs.

1.12 CHANGE ORDERS

A. A detailed material and labor takeoff shall be prepared for each change order, along with labor rates and markup percentages. Change orders shall be broken down by sheet or associated individual line item indicated in the change associated narrative, whichever provides the most detailed breakdown. Change orders with inadequate breakdown will be rejected.

B. Itemized pricing with unit cost shall be provided from all distributors and associated subcontractors.

C. Change order work shall not proceed until authorized.

1.13 PRODUCT DELIVERY, STORAGE, HANDLING AND MAINTENANCE

A. Exercise care in transporting and handling to avoid damage to materials. Store materials on the site to prevent damage.

B. Protect equipment, components, and openings with airtight covers and exercise care at every stage of storage, handling, and installation of equipment to prevent airborne dust and dirt from entering or fouling equipment to include, but not limited to:
   1. Distribution equipment - branch panels, distribution panels, switchboards, motor control centers, etc.
   2. Variable frequency drives.
   3. Transformers, ventilated.
   4. Electronic equipment, UPS, harmonic filters, power factor correction.
   5. Lighting luminaires and lighting control systems.

C. Equipment and components that are visibly damaged or have been subject to environmental conditions prior to building turnover to Owner that could shorten the life of the component (for example, water damage, humidity, dust and debris, excessive hot or cold storage location, etc.) shall be repaired or replaced with new equipment or components without additional cost to the building owner.

D. Keep all materials clean, dry and free from damaging environments.

E. Coordinate the installation of heavy and large equipment with the General Contractor and/or Owner. If the Electrical Contractor does not have prior documented experience in rigging and lifting similar equipment, he/she shall contract with a qualified lifting and rigging service that has similar documented experience. Follow all equipment lifting and support guidelines for handling and moving.

F. Contractor is responsible for moving equipment into the building and/or site. Contractor shall review site prior to bid for path locations and any required building modifications to allow movement of equipment. Contractor shall coordinate the work with other trades.

1.14 NETWORK / INTERNET CONNECTED EQUIPMENT

A. These specifications may require certain equipment or systems to have network, Internet and/or remote access capability ("Network Capability"). Any requirement for Network Capability shall be interpreted only as a functional capability and is not to be construed as authority to connect or enable any Network Capability. Network Capability may only be connected or enabled with the express written consent of the Owner.

B. The following network connected equipment shall be equipped with restricted access protocols:
   1. Adjustable trip overcurrent protection devices
   2. Electrical controls
   3. Variable frequency drives
   4. Package engine generator and remote annunciator
   5. Transfer switch and remote annunciator

1.15 WARRANTY

A. Provide one-year warranty for all fixtures, equipment, materials, and workmanship.

B. The warranty period for all work in this specification Division shall commence on the date of Substantial Completion or successful system performance whichever occurs later. The warranty may also commence if a whole or partial system or any separate piece of equipment or component is put into use for the benefit of any party other than the installing contractor with prior written authorization of the Owner. In this instance, the warranty period shall commence on the date when such whole system, partial system or separate piece of equipment or component is placed in operation and accepted in writing by the Owner.

C. Warranty requirements extend to correction, without cost to the Owner, of all work found to be defective or nonconforming to the contract documents. The Contractor shall bear the cost of correcting all damage due to defects or nonconformance with contract documents excluding repairs required as a result of improper maintenance or operation, or of normal wear as determined by the Engineer.

1.16 INSURANCE

A. This Contractor shall maintain insurance coverage as set forth in Division 1 of these specifications.

1.17 MATERIAL SUBSTITUTION

A. Where several manufacturers' names are given, the manufacturer for which a catalog number is given is the basis for job design and establishes the quality.

B. Equivalent equipment manufactured by the other listed manufacturers may be used. Contractor shall ensure that all items submitted by these other manufacturers meet all requirements of the drawings and specifications and fits in the allocated space. When using other listed manufacturers, the Contractor shall assume responsibility for any and all modifications necessary (including, but not limited to structural supports, electrical connections and rough-in, and regulatory agency approval, etc.) and coordinate such with other contractors. The Engineer shall make the final determination of whether a product is equivalent.

C. Any material, article or equipment of other unnamed manufacturers which will adequately perform the services and duties imposed by the design and is of a quality equal to or better than the material, article or equipment identified by the drawings and specifications may be used if approval is secured in writing from the Engineer via addendum. The Contractor assumes all costs incurred as a result of using the offered material, article or equipment, on the Contractors part or on the part of other Contractors whose work is affected.

D. Voluntary add or deduct prices for alternate materials may be listed on the bid form. These items will not be used in determining the low bidder. This Contractor assumes all costs incurred as a result of using the offered material or equipment on the Contractors part or on the part of other Contractors whose work is affected.

E. All material substitutions requested after the final addendum must be listed as voluntary changes on the bid form.

PART 2 PRODUCTS

2.01 GENERAL

A. All items of material having a similar function (e.g., safety switches, panelboards, switchboards, contactors, motor starters, dry type transformers) shall be of the same manufacturer unless specifically stated otherwise on drawings or elsewhere in specifications.

PART 3 EXECUTION

3.01 JOBSITE SAFETY

A. Neither the professional activities of the Engineer, nor the presence of the Engineer or the employees and subconsultants at a construction site, shall relieve the Contractor and any other entity of their obligations, duties and responsibilities including, but not limited to, construction means, methods, sequence, techniques or procedures necessary for performing, superintending or coordinating all portions of the work of construction in accordance with the contract documents and any health or safety precautions required by any regulatory agencies.

The Engineer and personnel have no authority to exercise any control over any construction contractor or other entity or their employees in connection with their work or any health or safety precautions. The Contractor is solely responsible for jobsite safety. The Engineer and the Engineer's consultants shall be indemnified and shall be made additional insureds under the Contractor's general liability insurance policy.

3.02 EXCAVATION, FILL, BACKFILL, COMPACTION

A. General:
   1. Prior to the commencement of any excavation or digging, the Contractor shall verify all underground utilities with the regional utility locator. Provide prior notice to the locator before excavations. Contact information for most regional utility locaters can be found by calling 811.
   2. The Contractor shall do all excavating, filling, backfilling, compacting, and restoration in connection with the work.

B. Excavation:
   1. Make all excavations to accurate, solid, undisturbed earth, and to proper dimensions.
   2. If excavations are carried in error below indicated levels, concrete of same strength as specified for the foundations or thoroughly compacted sand-gravel fill, as determined by the Engineer shall be placed in such excess excavations under the foundation. Place thoroughly compacted, clean, stable fill in excess excavations under slabs on grade, at the Contractor's expense.
   3. Trim bottom and sides of excavations to grades required for foundations.
   4. Protect excavations against frost and freezing.
   5. Take care in excavating not to damage surrounding structures, equipment or buried pipe. Do not undermine footing or foundation.
   6. Perform all trenching in a manner to prevent cave-ins and risk to workmen.
   7. Where original surface is pavement or concrete, the surface shall be saw cut to provide clean edges and assist in the surface restoration.
   8. If satisfactory bearing soil is not found at the indicated levels, immediately notify the Engineer or their representative, and do no further work until the Engineer or their representative gives further instructions.
   9. Excavation shall be performed in all ground conditions, including rock, if encountered. Bidders shall visit the premises and determine the soil conditions by actual observations, borings, or other means. The cost of all such inspections, borings, etc., shall be borne by the bidder.
   10. If a trench is excavated in rock, a compacted bed with a depth of 3" (minimum) of sand and gravel shall be used to support the conduit unless masonry cradles or encasements are used.
   11. Mechanical excavation of the trench to line and grade of the conduit or to the bottom level of masonry cradles or encasements is permitted, unless otherwise indicated on the electrical drawings.
   12. Mechanical excavation of the trench to line and grade where direct burial cables are to be installed is permitted provided the excavation is made to a depth to permit installation of the cable on a fine sand bed at least 3 inches (76.2 mm) deep.

C. Dewatering:
   1. Furnish, install, operate and remove all dewatering pumps and pipes needed to keep trenches and pits free of water.

D. Underground Obstructions:
   1. Known underground piping, conduit, feeders, foundations, and other obstructions in the vicinity of construction are shown on the drawings. Review all Bid Documents for all trades on the project to determine obstructions indicated. Take great care in making installations near underground obstructions.
   2. If objects not shown on the drawings are encountered, remove, relocate, or perform extra work as directed by the Engineer.

E. Fill and Backfilling:
   1. No rubbish or waste material is permitted for fill or backfill.
   2. Provide all necessary sand and/or CA6 for backfilling.
   3. Native soil materials may be used as backfill if approved by the Geotechnical Engineer.
   4. Dispose of the excess excavated earth as directed.
   5. Backfill materials (native soil material, sand, and/or CA6) shall be suitable for required compaction, clean and free of perishable materials, frozen earth, debris, earth with a high void content, and stones greater than 4 inches (101.6 mm) in diameter. Water is not permitted to rise in unbackfilled trenches.
   6. Backfill all trenches and excavations immediately after installing of conduit, or removing forms, unless other protection is directed.
   7. Around piers and isolated foundations and structures, backfill and fill shall be placed and consolidated simultaneously on all sides to prevent wedge action and displacement. Spread fill and backfill materials in 6" uniform horizontal layers with each layer compacted separately to required density.
   8. For conduits that are not concrete encased, lay all conduits on a compacted bed of sand at least 3" deep. Backfill around conduits with sand, in 6" layers and compact each layer.
   9. Conduits that are concrete encased or in a ductbank, conduit spacers, and cradles shall be installed on a bed of compacted CA-6 gravel. Refer to conduit section for backfilling and ductbank requirements.
   10. Backfill with native soil material (if approved) or sand up to grade for all conduits under slabs or paved areas. All other conduits shall have sand backfill to 6" above the top of the conduit.
   11. Place all backfill above the sand in uniform layers not exceeding 6" deep. Place then carefully and uniformly tamp each layer to eliminate lateral or vertical displacement.
   12. Where the fill and backfill will ultimately be under a building, floor or paving, each layer of fill shall be compacted to 95% of the maximum density as determined by AASHTO Designation T-99 or ASTM Designation D-698. Moisture content of soil at time of compaction shall not exceed plus or minus 2% of optimum moisture content as determined by AASHTO T-99 or ASTM D698 test.
   13. After backfilling of trenches, no superficial loads shall be placed on the exposed surface of the backfill until a period of 48 hours has elapsed.

F. Surface Restoration:
   1. Where trenches are cut through graded, planted or landscaped areas, the areas shall be restored to the original condition. Replace all planting and landscaping features removed or damaged to its original condition. At least 6" of topsoil shall be applied where disturbed areas are to be seeded or sodded. All lawn areas shall be sodded unless seeding is called out in the drawings or specifications.
   2. Concrete or asphalt type pavement, seal coat, rock, gravel or earth surfaces removed or damaged shall be replaced with comparable materials and restored to original condition. Broken edges shall be saw cut and repaired as directed by Engineer.

3.03 ENGINEER OBSERVATION OF WORK

A. The contractor shall provide seven (7) calendar days' notice to the Engineer prior to:
   1. Placing fill over underground and underslab utilities.
   2. Covering exterior walls, interior partitions and chases.
   3. Installing hard or suspended ceilings and soffits.

B. The Engineer will review the installation and provide a written report noting deficiencies requiring correction. The contractor's schedule shall account for these reviews and show them as line items in the approved schedule.

C. Above-Ceiling Final Observation:
   1. All work above the ceilings must be complete prior to the Engineer's review. This includes, but is not limited to:

a. All junction boxes are closed and identified in accordance with Section 26 0553 Electrical Identification.
b. Luminaires, including ceiling-mounted exit and emergency lights, are installed and operational.
c. Luminaire whips are supported above the ceiling.
d. Conduit identification is installed in accordance with Section 26 0553 Electrical Identification.
e. Luminaires are suspended independently of the ceiling system when required by these contract documents.
f. All wall penetrations have been sealed.

2. To prevent the Above-Ceiling Final Observation from occurring too early, the Contractor shall review the status of the work and certify, in writing, that the work is ready for the Above-Ceiling Final Observation.
3. It is understood that if the Engineer finds the ceilings have been installed prior to this review and prior to seven days elapsing, the Engineer may not recommend further payments to the contractor until full access has been provided.

3.04 PROJECT CLOSEOUT

A. The following paragraphs supplement the requirements of Division 1.

B. Final Jobsite Observation:
1. To prevent the Final Jobsite Observation from occurring too early, the Contractor shall review the completion status of the project and certify that the job is ready for the final jobsite observation.
2. Attached to the end of this section is a typical list of items that represent the degree of job completeness expected prior to requesting a review. The Contractor shall sign the attached certification and return it to the Engineer so that the final observation can be scheduled.
3. It is understood that if the Engineer finds the job not ready for the final observation and additional trips and observations are required to bring the project to completion, the cost of the additional time and expenses incurred by the Engineer will be deducted from the Contractor's final payment.

C. The following must be submitted before Engineer recommends final payment:
1. Operation and maintenance manuals with copies of approved shop drawings.
2. Record documents including marked-up drawings and specifications.
3. A report documenting the instructions given to the Owner's representatives complete with the number of hours spent in the instruction. The report shall bear the signature of an authorized agent of this Contractor and shall be signed by the Owner's representatives.
4. Provide spare parts, maintenance, and extra materials in quantities specified in individual specification sections. Deliver to project site and place in location as directed and submit receipt to Engineer.
5. Inspection and testing report by the fire alarm system manufacturer.
6. Start-up reports on all equipment requiring a factory installation or start-up.

D. Circuit Directories:
1. Provide custom typed circuit directory for each branch circuit panelboard. Provide updated custom typed circuit directory for each existing branch circuit panelboard with new or revised circuits per the scope of work. Label shall include equipment name or final approved room name, room number, and load type for each circuit (examples: SUMP SP-1 or ROOM 101 RECEPT). Revise directory to reflect circuit changes required to balance phase loads. Printed copies of the bid document panel schedules are not acceptable as circuit directories.

3.05 OPERATION AND MAINTENANCE MANUALS

A. General:

1. Provide an electronic copy of the O&M manuals as described below for Engineer's review and approval. The electronic copy shall be corrected as required to address the Engineer's comments. Once corrected, electronic copies and paper copies shall be distributed as directed by the Engineer.
2. Approved O&M manuals shall be completed and in the Owner's possession prior to Owner's acceptance and at least 10 days prior to instruction of operating personnel.

B. Electronic Submittal Procedures:
1. Distribution: Email the O&M manual as attachments to all parties designated by the Engineer.
2. Transmittals: Each submittal shall include an individual electronic letter of transmittal.
3. Format: Electronic submittals shall be in PDF format only. Scanned copies, in PDF format, of paper originals are acceptable. Submittals that are not legible will be rejected. Do not set any permission restrictions on files; protected, locked, or secured documents will be rejected.
4. File Names: Electronic submittal file names shall include the relevant specification section number followed by a description of the item submitted, as follows. Where possible, include the transmittal as the first page of the PDF instead of using multiple electronic files.
    a. O&M file name: O&M.div26.contractor.YYYYMMDD
    b. Transmittal file name: O&Mtransmittal.div26.contractor.YYYYMMDD
5. File Size: Files shall be transmitted via a pre-approved method. Larger files may require an alternative transfer method, which shall also be pre-approved.
6. Provide the Owner with an approved copy of the O&M manual on compact discs (CD), digital video discs (DVD), or flash drives with a permanently affixed label, printed with the title "Operation and Maintenance Instructions", title of the project and subject matter of disc/flash drive when multiple disc/flash drives are required.
7. All text shall be searchable.
8. Bookmarks shall be used, dividing information first by specification section, then systems, major equipment and finally individual items. All bookmark titles shall include the nomenclature used in the construction documents and shall be an active link to the first page of the section being referenced.

C. Paper Copy Submittal Procedures:
1. Once the electronic version of the manuals has been approved by the Engineer, three (3) paper copies of the O&M manual shall be provided to the Owner. The content of the paper copies shall be identical to the corrected electronic copy.
2. Binder Requirements: The Contractor shall submit O&M manuals in heavy duty, locking three ring binders. Incorporate clear vinyl sheet sleeves on the front cover and spine for slip-in labeling. "Peel and stick" labels are not acceptable. Sheet lifters shall be supplied at the front of each notebook. The three-ring binders shall be 1/2" thicker than initial material to allow for future inserts. If more than one notebook is required, label in consecutive order. For example; 1 of 2, 2 of 2. No other form of binding is acceptable.
3. Binder Labels: Label the front and spine of each binder with "Operation and Maintenance Instructions", title of project, and subject matter.
4. Index Tabs: Divide information by specification section, major equipment, or systems using index tabs. All tab titling shall be clearly printed under reinforced plastic tabs. All equipment shall be labeled to match the identification in the construction documents.

D. Operation and Maintenance Instructions shall include:
1. Title Page: Include title page with project title, Engineer, Contractor, all subcontractors, and major equipment suppliers, with addresses, telephone numbers, website addresses, email addresses and point of contacts. Website URLs and email addresses shall be active links in the electronic submittal.
2. Table of Contents: Include a table of contents describing specification section, systems, major equipment, and individual items.

3. Copies of all final approved shop drawings and submittals. Include Engineer's shop drawing review comments. Insert the individual shop drawing directly after the Operation and Maintenance information for the item(s) in the review form.
4. Copies of all factory inspections and/or equipment startup reports.
5. Copies of warranties.
6. Schematic wiring diagrams of the equipment that have been updated for field conditions. Field wiring shall have label numbers to match drawings.
7. Dimensional drawings of equipment.
8. Detailed parts lists with lists of suppliers.
9. Operating procedures for each system.
10. Maintenance schedule and procedures. Include a chart listing maintenance requirements and frequency.
11. Repair procedures for major components.
12. Replacement parts and service material requirements for each system and the frequency of service required.
13. Instruction books, cards, and manuals furnished with the equipment.
14. Include record drawings of the one-line diagrams for each major system. The graphic for each piece of equipment shown on the one-line diagram shall be an active link to its associated Operation & Maintenance data.
15. Copies of all panel schedules in electronic Microsoft Excel spreadsheet (.xlsx) file. Each panelboard shall be a separate tab in the workbook.

3.06 INSTRUCTING THE OWNER'S REPRESENTATIVE

A. Adequately instruct the Owner's designated representatives in the maintenance, care, and operation of the complete systems installed under this contract.

B. Provide verbal and written instructions to the Owner's representatives by FACTORY PERSONNEL in the care, maintenance, and operation of the equipment and systems.

C. The Owner has the option to make a video recording of all instructions. Coordinate schedule of instructions to facilitate this recording.

D. The instructions shall include:
   1. Maintenance of equipment.
   2. Start-up procedures for all major equipment.
   3. Description of emergency system operation.

E. Notify the Engineer of the time and place for the verbal instructions to be given to the Owner's representative so a representative can be present if desired.

F. Minimum hours of instruction time for each item and/or system shall be as indicated in each individual specification section.

G. Operating Instructions:
   1. Contractor is responsible for all instructions to the Owner's representatives for the electrical and specialized systems.
   2. If the Contractor does not have staff that can adequately provide the required instructions, the Contractor shall include in the bid an adequate amount to reimburse the Owner for the Engineer to perform these services.

3.07 RECORD DOCUMENTS

A. The following paragraphs supplement Division 1 requirements.

B. Maintain at the job site a separate and complete set of electrical drawings and specifications with all changes made to the systems clearly and permanently marked in complete detail.

C. Mark drawings and specifications to indicate approved substitutions; Change Orders, and actual equipment and materials used. All Change Orders, RFI responses, Clarifications and other supplemental instructions shall be marked on the documents. Record documents that merely reference the existence of the above items are not acceptable. Should this Contractor

fail to complete Record Documents as required by this contract, this Contractor shall reimburse Engineer for all costs to develop record documents that comply with this requirement. Reimbursement shall be made at the Engineer's hourly rates in effect at the time of work.

D. Record changes daily and keep the marked drawings available for the Engineer's examination at any normal work time.

E. Upon completing the job, and before final payment is made, give the marked-up drawings to the Engineer.

F. Record actual routing of conduits exceeding 2 inches (50.8 mm).

3.08 PAINTING

A. Paint all equipment that is marred or damaged prior to the Owner's acceptance. Paint and color shall match original equipment paint and shall be obtained from the equipment supplier if available. All equipment shall have a finished coat of paint applied unless specifically allowed to be provided with a prime coat only.

B. Equipment cabinets, casings, covers, metal jackets, etc., located in equipment rooms or concealed spaces, shall be furnished in standard finish, free from scratches, abrasions, chippings, etc.

C. Equipment in occupied spaces, or if standard to the unit, shall have a baked primer with baked enamel finish coat free from scratches, abrasions, chipping, etc. If color option is specified or is standard to the unit, verify with the Engineer the color preference before ordering.

D. Equipment furnished with a suitable factory finish need not be painted; provided the factory applied finish is not marred or spattered. If so, equipment shall be refinished with the same paint as was factory applied.

E. All electrical conduit and equipment, fittings, hangers, structural supports, etc., in unfinished areas, such as equipment and storage room area, shall be painted two (2) coats of oil paint of colors selected by the Engineer.

F. After surfaces have been thoroughly cleaned and are free of oil, dirt or other foreign matter, paint all raceway and equipment with the following:
   1. Bare Metal Surfaces - Apply one coat of metal primer suitable for the metal being painted. Finish with two coats of Alkyd base enamel paint.
   2. Plastic Surfaces - Paint plastic surfaces with two coats of semi-gloss acrylic latex paint.

3.09 ADJUST AND CLEAN

A. Thoroughly clean all equipment and systems prior to the Owner's final acceptance of the project.

B. Clean all foreign paint, grease, oil, dirt, labels, stickers, etc. from all equipment.

C. Remove all rubbish, debris, etc., accumulated during construction from the premises.

3.10 SPECIAL REQUIREMENTS

A. Coordinate the installation of all equipment, controls, devices, etc., with other trades to maintain clear access area for servicing.

B. Install all equipment to maximize access to parts needing service or maintenance. Review the final location, placement, and orientation of equipment with the Owner's representative prior to setting equipment.

C. Installation of equipment or devices without regard to coordination of access requirements and confirmation with the Owner's representative will result in removal and reinstallation of the equipment at the Contractor's expense.

D. Adhesives and Sealants: All sealers, adhesives, and sealants shall comply with the low emitting material limits of the following standards:

1. CDPH Standard Method V1.1-2010 - Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions VOC from Indoor Sources Using Environmental Chambers Version 1.1.
2. South Coast Air Quality Management District Rule 1168 - Adhesive and Sealant Applications. All adhesives and sealants wet-applied on site shall comply with the applicable chemical content requirements of SCAQMD Rule 1168.
3. South Coast Air Quality Management District Rule SCAQMD 1113 - Wet Applied Paints and Coatings. All paints and coatings wet-applied on site must meet the applicable VOC limits of SCAQMD Rule 1113.

3.11 SYSTEM STARTING AND ADJUSTING

A. The electrical systems shall be complete and operating. System startup, testing, adjusting, and balancing to obtain satisfactory system performance is the responsibility of the Contractor. This includes all calibration and adjustment of electrical controls, balancing of loads, troubleshooting and verification of software, and final adjustments that may be needed.

B. Complete all manufacturer-recommended startup procedures and checklists to verify proper equipment operation and does not pose a danger to personnel or property.

C. All operating conditions and control sequences shall be tested during the start-up period. Testing all interlocks, safety shut-downs, controls, and alarms.

D. The Contractor, subcontractors, and equipment suppliers shall have skilled technicians to ensure that all systems perform properly. If the Engineer is requested to visit the job site for trouble shooting, assisting in start-up, obtaining satisfactory equipment operation, resolving installation and/or workmanship problems, equipment substitution issues or unsatisfactory system performance, including call backs during the warranty period, through no fault of the design; the Contractor shall reimburse the Owner on a time and materials basis for services rendered at the Engineer's standard hourly rates in effect when the services are requested. The Contractor shall pay the Owner for services required that are product, installation or workmanship related. Payment is due within 30 days after services are rendered.

3.12 FIELD QUALITY CONTROL

A. General:
   1. Conduct all tests required during and after construction. Submit test results in NETA format, or equivalent form, that shows the test equipment used, calibration date, tester's name, ambient test conditions, humidity, conductor length, and results corrected to 40°C.
   2. Supply necessary instruments, meters, etc., for the tests. Supply competent technicians with training in the proper testing techniques.
   3. All cables and wires shall be tested for shorts and grounds following installation and connection to devices. Replace shorted or grounded wires and cables.
   4. Any wiring device, electrical apparatus or luminaire, if grounded or shorted on any integral "live" part, shall have all defective parts or materials replaced.
   5. Test cable insulation of service and panel feeder conductors for proper insulation values. Tests shall include the cable, all splices, and all terminations. Each conductor shall be tested and shall test free of short circuits and grounds and have an insulation value not less than Electrical Code Standards. Take readings between conductors, and between conductors and ground.
   6. If the results obtained in the tests are not satisfactory, make adjustments, replacements, and changes as needed. Then repeat the tests, and make additional tests, as the Engineer or authority having jurisdiction deems necessary.

B. Ground Resistance:
   1. Conduct service ground resistance tests using an approved manufactured ground resistance meter. Submit to the Engineer a proposed test procedure including type of equipment to be used. (The conventional ohmmeter is not an acceptable device.)
   2. Make ground resistance measurements during normal dry weather and not less than 48 hours after a rain.

3. If the ground resistance value obtained is more than the value set forth in Section 26 0526, the following shall be done to obtain the value given:
    a. Verify that all connections in the service ground system are secure.
    b. Increase the depth to which ground rods are driven by adding section lengths to the rods and retest. If the resistance is still excessive increase the depth by adding an additional rod section and retest.
    c. If the resistance is still excessive, furnish and install additional ground rods, spaced not less than 20 feet (609.6 cm) from other ground rods unless otherwise noted on plans, and connect into the ground electrode system. Retest.
    d. Review results with the Engineer.
4. Before final payment is made to the Contractor submit a written report to the Engineer including the following:
    a. Date of test.
    b. Number of hours since the last rain.
    c. Soil condition at the time of the test in the ground electrode location. That is: dry, wet, moist, sand, clay, etc.
    d. Diagram of the test set-up showing distances between test equipment, ground electrode, auxiliary electrodes, etc.
    e. Make, model, and calibration date of test equipment.
    f. Tabulation of measurements taken and calculations made.

C. Ground-Fault Equipment Performance Testing:
1. Test: Perform ground-fault performance testing when system is installed. The test process shall use primary current injection per manufacturer instruction and procedures. Perform test for the following:
    a. Service disconnects
    b. Solid state molded case circuit breakers and solid-state insulated case circuit breakers equipped with ground fault protection.
    c. Fusible switches with ground fault relay protection.
    d. Outside branch circuits and feeders.
    e. Code required.
2. Report: Provide copy of test result report with Operation and Maintenance manuals. Provide report to Authority Having Jurisdiction when requested.

D. Arc Energy Reduction Equipment Performance Testing:
1. Test: Perform arc energy protection performance testing when system is installed. The test process shall use primary current injection or approved method per manufacturer instructions and procedures. Perform test for the following:
    a. All arc energy reduction systems installed.
2. Report: Provide copy of test result report with Operation and Maintenance manuals. Provide report to Authority Having Jurisdiction when requested.

E. Other Equipment:
1. Give other equipment furnished and installed by the Contractor all standard tests normally made to assure that the equipment is electrically sound, all connections properly made, phase rotation correct, fuses and thermal elements suitable for protection against overloads, voltage complies with equipment nameplate rating, and full load amperes are within equipment rating.

F. If any test results are not satisfactory, make adjustments, replacements and changes as needed and repeat the tests and make additional tests as the Engineer or authority having jurisdiction deem necessary.

G. Report shall include color printouts, in binder, of pictures taken to use as a baseline reading after building is occupied.

H. Upon completion of the project, the Contractor shall provide amperage readings for all panelboards and switchboards and turn the results over to the Owner for "benchmark" amperages.

3.13 READINESS CERTIFICATION PRIOR TO FINAL JOBSITE OBSERVATION

A. To prevent the final job observation from occurring too early, we require that the Contractor review the completion status of the project and, by copy of this document, certify that the job is indeed ready for the final job observation. The following is a typical list of items that represent the degree of job completeness expected prior to your requesting a final job observation.

1. Penetrations of fire-rated construction fire sealed in accordance with specifications.
2. Electrical panels have typed circuit identification.
3. Smoke and fire/smoke dampers are wired and have been tested.
4. Per Section 26 0500, cable insulation test results have been submitted.
5. Per Section 26 0500, medium voltage testing report has been submitted.
6. Per Section 26 0500, ground resistance test results have been submitted.
7. Operation and Maintenance manuals have been submitted as per Section 26 0500.
8. Bound copies of approved shop drawings have been submitted as per Section 26 0500.
9. Report of instruction of Owner's representative has been submitted as per Section 26 0500.
10. Start-up reports from factory representative have been submitted as per Section 26 0500.

a. **ACCEPTED BY:**

PRIME CONTRACTOR _____

BY _____ DATE _____

UPON CONTRACTOR CERTIFICATION THAT THE PROJECT IS COMPLETE AND READY FOR A FINAL JOB OBSERVATION, WE REQUIRE THE CONTRACTOR TO SIGN THIS AGREEMENT AND RETURN IT TO THE ENGINEER SO THAT THE FINAL OBSERVATION CAN BE SCHEDULED.

IT IS UNDERSTOOD THAT IF THE ENGINEER FINDS THE JOB NOT READY FOR THE FINAL OBSERVATION AND THAT ADDITIONAL TRIPS AND OBSERVATIONS ARE REQUIRED TO BRING THE PROJECT TO COMPLETION, THE COSTS INCURRED BY THE ENGINEERS FOR ADDITIONAL TIME AND EXPENSES WILL BE DEDUCTED FROM THE CONTRACTOR'S CONTRACT RETAINAGE PRIOR TO FINAL PAYMENT AT THE COMPLETION OF THE JOB.

END OF SECTION 260500

SECTION 260513
WIRE AND CABLE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Building wire

B. Cabling for remote control, signal, and power limited circuits

C. Metal-clad cable (MC)

1.02 REFERENCE STANDARDS

A. ASTM B800 - Standard Specification for 8000 Series Aluminum Alloy Wire for Electrical Purposes - Annealed and Intermediate Tempers; 2005 (Reapproved 2021).

B. ASTM B801 - Standard Specification for Concentric-Lay-Stranded Conductors of 8000 Series Aluminum Alloy for Subsequent Covering or Insulation; 2018 (Reapproved 2023).

C. NEMA WC 70 - Power Cables Rated 2000 Volts or Less for the Distribution of Electrical Energy; 2021.

D. UL 44 - Thermoset-Insulated Wires and Cables; Current Edition, Including All Revisions.

E. UL 83 - Thermoplastic-Insulated Wires and Cables; Current Edition, Including All Revisions.

F. UL 854 - Service-Entrance Cables; Current Edition, Including All Revisions.

G. UL 1581 - Reference Standard for Electrical Wires, Cables, and Flexible Cords; Current Edition, Including All Revisions.

1.03 RELATED WORK

A. Section 26 0553 - Electrical Identification: Refer to electrical identification for color and identification labeling requirements.

1.04 REFERENCES

A. ASTM B800-05 - Standard Specification for 8000 Series Aluminum Alloy Wire Electrical Purposes-Annealed and Intermediate Tempered.

B. ASTM B801-07 - Standard Specification for Concentric-Lay-Stranded Conductors of 8000 Series Aluminum Alloy for Subsequent Covering or Insulation

C. NEMA WC 70 - Power Cables Rated 2,000V or Less for the Distribution of Electrical Energy

D. CEC California Electrical Code

E. UL 44 - Thermoset-Insulated Wires and Cables

F. UL 83 - Thermoplastic-Insulated Wires and Cables

G. UL 854 - Service-Entrance Cables

H. UL 1581 - Standard for Electrical Wires, Cables, and Flexible Cords

I. UL 2196 - Fire Resistive, Fire Resistant and Circuit Integrity Cables

J. California Division of State Architect (DSA) Interpretation of Regulations

1.05 SUBMITTALS

A. Submit shop drawings and product data under the provisions of Section 26 0500.

B. Submit manufacturer's installation instructions.

PART 2 PRODUCTS

2.01 BUILDING WIRE

A. Feeders and Branch Circuits 8 AWG and larger: Copper, stranded conductor, 600-volt insulation, THHN/THWN or XHHW-2.

B. Feeders and Branch Circuits 8 AWG and larger in Underground Conduit: Copper, stranded conductor, 600-volt insulation, THWN or XHHW-2.

C. Feeders and Branch Circuits 10 AWG and Smaller: Copper, solid or stranded conductor, 600-volt insulation, THHN/THWN, unless otherwise noted on the drawings.

D. Motor Feeder from Variable Frequency Drives: Copper conductor, 600-volt XHHW-2 insulation, stranded conductor, unless otherwise noted on the drawings.

E. Control Circuits: Copper, stranded conductor 600-volt insulation, THHN/THWN.

F. Aluminum conductors are not to be used for feeds to motor loads.

G. Each 120 and 277-volt branch circuit shall have a dedicated neutral conductor. Neutral conductors shall be considered current-carrying conductors for wire derating.

PART 3 EXECUTION

3.01 WIRE AND CABLE INSTALLATION SCHEDULE

A. All Other Locations: Building wire in raceway.

B. Above Grade: All conductors installed above grade shall be type "THHN".

C. Underground or In Slab: All conductors shall be type "THWN".

D. Low Voltage Cable (less than 100 volts): Low voltage cable shall be installed in raceway.

E. Fire-Rated 2-Hour Feeders and Circuit Requiring Continuous Operation (CI): Refer to Part 2 of this section for acceptable products and assemblies. Installation shall meet UL 2196.

3.02 CONTRACTOR CHANGES

A. The basis of design is copper conductors installed in raceway based on ambient temperature of 30°C, CEC California Electrical Code edition Table 310.15(B)(16). Service entrance conductors are based on copper conductor installed in underground electrical ducts, CEC California Electrical Code Table B310.15(B)(2)(7).

B. The Contractor shall be responsible for derating and sizing conductors and conduits to equal or exceed the ampacity of the basis of design circuits, if he/she chooses to use methods or materials other than the basis of design.

C. Underground electrical duct ampacity rating shall be in accordance with CEC California Electrical Code Table B310.15(B)(2)(7). The calculations and a sketch of the proposed installation shall be submitted prior to any conduit being installed.

D. Conductor length(s) listed on plans and schedules. The drawings are diagrammatic with intent to convey the components of the electrical distribution system. Conductor length(s) when listed on plans and schedules are for engineering calculation purposes. Conductor length(s) shall NOT be used for bidding purposes.

E. Record drawing shall include the calculations and sketches.

3.03 GENERAL WIRING METHODS

A. Use no wire smaller than 12 AWG for power and lighting circuits, and no smaller than 14 AWG for control wiring.

B. Use no wire smaller than 18 AWG for low voltage control wiring below 100 volts.

C. Use 10 AWG conductor for 20 ampere, 120-volt branch circuit home runs longer than 75 feet (2286 cm), and for 20 ampere, 277-volt branch circuit home runs longer than 200 feet (6096 cm).

D. Use no wire smaller than 8 AWG for outdoor lighting circuits.

E. The ampacity of multiple conductors in one conduit shall be derated per the Electrical Code. In no case shall more than 4 conductors be installed in one conduit to such loads as motors larger than 1/4 HP, panelboards, motor control centers, etc.

F. Where installing parallel feeders, place an equal number of conductors for each phase of a circuit in same raceway or cable.

G. Splice only in junction or outlet boxes.

H. Neatly train and lace wiring inside boxes, equipment, and panelboards.

I. Make conductor lengths for parallel circuits equal.

J. All conductors shall be continuous in conduit from last outlet to their termination.

K. Terminate all spare conductors on terminal blocks, and label the spare conductors.

L. Cables or wires shall not be laid out on the ground before pulling.

M. Cables or wires shall not be dragged over earth or paving.

N. Care shall be taken so as not to subject the cable or wire to high mechanical stresses that would cause damage to the wire and cable.

O. At least six (6)-inch loops or ends shall be left at each outlet for installation connection of luminaires or other devices.

P. All wires in outlet boxes not connected to fixtures or other devices shall be rolled up, spliced if continuity of circuit is required, and insulated.

3.04 WIRING INSTALLATION IN RACEWAYS

A. Pull all conductors into a raceway at the same time. Use UL listed wire pulling lubricant for pulling 4 AWG and larger wires.

B. Install wire in raceway after interior of building has been physically protected from the weather and all mechanical work likely to injure conductors has been completed.

C. Pulling shall be continuous without unnecessary stops and starts with wire or cable only partially through raceway.

D. Where reels of cable or wire are used, they shall be set up on jacks close to the point where the wire or cable enters the conduit or duct so that the cable or wire may be unreeled and run into the conduit or duct with a minimum of change in the direction of the bend.

E. Conductors shall not be pulled through conduits until plastering or masonry work is completed and conduits are free from moisture. Care shall be taken so that long pulls of wire or pulls around several bends are not made where the wire may be permanently stretched and the insulation damaged.

F. Only nylon rope shall be permitted to pull cables into conduit and ducts.

G. Completely and thoroughly swab raceway system before installing conductors.

H. Conductor Supports in Vertical Raceways:
   1. Support conductors in vertical raceways in accordance with the Electrical Code Spacing of Conductors Supports.
   2. Supports shall be of insulated wedge type (OZ Gedney Type S, or equal) and installed in a tapered insulated bushing fitting or a metal woven mesh with a support ring that fits inside conduit fitting installed in an accessible junction box (Hubbell Kellems support grip or equal).

3.05 CABLE INSTALLATION

A. Provide protection for exposed cables where subject to damage.

B. Use suitable cable fittings and connectors.

C. Run all open cable parallel or perpendicular to walls, ceilings, and exposed structural members. Follow the routing as illustrated on the drawings as closely as possible. Cable routing on drawings scaled 1/4"=1'-0" or less shall be considered diagrammatical, unless noted otherwise. The correct routing, when shown diagrammatically, shall be chosen by the Contractor based on information in the contract documents; in accordance with the manufacturer's written instructions, applicable codes, the NECA's "Standard of Installation", recognized industry standards; and coordinated with other contractors.

D. Open cable shall be supported by the appropriate size J-hooks or other means if called for on the drawings. Wire and cable from different systems shall not be installed in the same J-hook. J-hooks shall be sized with 20% spare capacity. J-hooks shall provide proper bend radius support for data cable and fiber cables.

E. Open cable installed above suspended ceilings shall not rest on the suspended ceiling construction, nor utilize the ceiling support system for wire and cable support.

F. J-hook support spans shall be based on the smaller of the manufacturer's load ratings and code requirements. In no case shall horizontal spans exceed 5 feet (152.4 cm) and vertical spans exceed 4 feet (121.92 cm). All J-hooks shall be installed where completely accessible and not blocked by piping, ductwork, inaccessible ceilings, etc. J-hooks shall be independently rigidly attached to a structural element. J-hooks shall be installed to provide 2" horizontal separation and 6" vertical separation between systems.

G. Open cable shall only be installed where specifically shown on the drawings, or permitted in these specifications.

3.06 WIRING CONNECTIONS AND TERMINATIONS

A. Splice and tap only in accessible junction boxes.

B. Use solderless, tin-plated copper, compression terminals (lugs) applied with circumferential crimp for conductor terminations, 8 AWG and larger.

C. Use solderless, tin-plated, compression terminals (lugs) applied with indenter crimp for copper conductor terminations, 10 AWG and smaller.

D. Use solderless pressure connectors with insulating covers for copper wire splices and taps, 8 AWG and smaller. For 10 AWG and smaller, use insulated spring wire connectors with plastic caps.

E. Use compression connectors applied with circumferential crimp for conductor splices and taps, 6 AWG and larger. Tape uninsulated conductors and connectors with electrical tape to 150 percent of the insulation value of conductor. Cold shrink connector insulator with 1kV rating shall be used in damp and wet locations.

F. Thoroughly clean wires before installing lugs and connectors.

G. Make splices, taps and terminations to carry full ampacity of conductors without perceptible temperature rise.

H. Phase Sequence: All apparatus shall be connected to operate in the phase sequence A-B-C representing the time sequence in which the phase conductors so identified reach positive maximum voltage.

I. As a general rule, applicable to switches, circuit breakers, starters, panelboards, switchgear and the like, the connections to phase conductors are intended thus:
   1. Facing the front and operating side of the equipment, the phase identification shall be:
      a. Left to Right - A-B-C
      b. Top to Bottom - A-B-C

J. Connection revisions as required to achieve correct rotation of motors shall be made at the load terminals of the starters or disconnect switches.

K. Use antioxidant joint compound on all aluminum conductor terminations. Apply antioxidant joint compound per manufacturer's recommendations.

3.07 FIELD QUALITY CONTROL

A. Field inspection and testing will be performed under provisions of Division 1.

B. Building Wire and Power Cable Testing: Perform an insulation-resistance test on each conductor with respect to ground and adjacent conductors. Test shall be made by means of a low-resistance ohmmeter, such as a "Megger". The applied potential shall be 500 volts dc for 300 volt rated cable and 1000 volts dc for 600 volt rated cable. The test duration shall be one minute. Insulation resistance must be greater than 100 mega-ohm for 600 volt and 25 mega-

ohm for 300 volt rated cables per NETA Acceptance Testing Standard. Verify uniform resistance of parallel conductors.

C. MI cable shall have the insulation resistance of each cable tested with a 500-volt dc megohmeter prior to energizing the cables. Tabulate resistance values and submit to Engineer for acceptance.

D. Inspect wire and cable for physical damage and proper connection.

E. Torque test conductor connections and terminations to manufacturer's recommended values.

F. Perform continuity test on all power and equipment branch circuit conductors. Verify proper phasing connections.

G. Provide documentation of the manufacturer's recommended lug torque value for copper conductors, the date the lugs were torqued, and installed torque readings. Documentation indicating that the torque wrench has been calibrated not more than 30 days prior to tightening of lugs shall be provided.

H. Protection of wire and cable from foreign materials:
   1. It is the Contractor's responsibility to provide adequate physical protection to prevent foreign material application or contact with any wire or cable type. Foreign material is defined as any material that would negatively impact the validity of the manufacturer's performance warranty. This includes, but is not limited to, overspray of paint (accidental or otherwise), drywall compound, or any other surface chemical, liquid, or compound that could come in contact with the cable, cable jacket, or cable termination components.

I. Overspray of paint on any wire or cable will not be accepted. It shall be the Contractor's responsibility to replace any component containing overspray, in its entirety, at no additional cost to the project. Cleaning of the cables with harsh chemicals is not allowed.

END OF SECTION 260513

SECTION 260526
GROUNDING AND BONDING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Equipment grounding system

B. Bonding system

C. Grounding of systems over 1kV

D. Substation grounding

1.02 REFERENCE STANDARDS

A. 29 CFR 1910 - Occupational Safety and Health Standards; Current Edition.

B. IEEE 81 - IEEE Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Grounding System; 2012.

C. NFPA 99 - Health Care Facilities Code; 2024, with Errata.

D. NFPA 780 - Standard for the Installation of Lightning Protection Systems; 2023.

E. UL 96 - Lightning Protection Components; Current Edition, Including All Revisions.

F. UL 467 - Grounding and Bonding Equipment; Current Edition, Including All Revisions.

1.03 QUALITY ASSURANCE

A. Testing Agency Qualifications: Testing agency as defined by OSHA in 29 CFR 1910.7 or a member company of the International Electrical Testing Association and that is acceptable to authorities having jurisdiction.

B. Testing Agency's Field Supervisor: Person currently certified by the International Electrical Testing Association to supervise on-site testing specified in Part 3.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in Electrical Code, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

D. Comply with UL 467 Grounding and Bonding Equipment.

E. Comply with NFPA 780 and UL 96 when interconnecting with lightning protection system.

F. Comply with Electrical Code; for overhead-line construction and medium-voltage underground construction, comply with IEEE/ANSI C2 National Electrical Safety Code (NESC).

1.04 REFERENCES

A. CEC California Electrical Code

B. NFPA 99 - Standard for Healthcare Facilities

1.05 SUBMITTALS

A. Submit shop drawings under provisions of Section 26 0500.

B. Product Data: For the following:
   1. Ground rods.

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

D. Field Test Reports: Submit written test reports to include the following:
   1. Test procedures used.
   2. Test results that comply with requirements.
   3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

E. Indicate layout of ground field, location of system grounding electrode connections, and routing of grounding electrode conductor and ground ring.

1.06 SUMMARY

A. This section includes grounding of electrical systems and equipment. Grounding requirements specified in this Section may be supplemented by special requirements of systems described in other Sections.

PART 2 PRODUCTS

2.01 GROUNDING CONDUCTORS

A. For insulated conductors, comply with Division 26 Section 26 0513 "Wire and Cable".

B. Material: Copper.

C. Equipment Grounding Conductors: Insulated. Refer to Section 26 0553 for insulation color.

D. Grounding Electrode Conductors: Stranded cable.

E. Underground Conductors: Bare, tinned, stranded, unless otherwise indicated.

F. Copper Bonding Conductors: As follows:
   1. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG copper conductor, 1/4 inch (6.35 mm) in diameter.
   2. Bonding Conductor: No. 4 or No. 6 AWG, stranded copper conductor.
   3. Bonding Jumper: Bare copper tape, braided bare copper conductors, terminated with copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.59 mm) thick.
   4. Tinned Bonding Jumper: Tinned-copper tape, braided copper conductors, terminated with copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.59 mm) thick.

G. GB; Grounding Bar:
   1. Bare, annealed copper bars of rectangular cross section, with insulators. 1/4" x 2", length of technology or applicable room.

2.02 CONNECTOR PRODUCTS

A. Comply with UL 467; listed for use for specific types, sizes, and combinations of conductors and connected items.

B. Connectors: Hydraulic compression type, in kit form, and selected per manufacturer's written instructions.

C. Bolted Connectors: Bolted-pressure-type connectors.

D. Substation connectors shall comply with IEEE 837 listed for use for specific types, sizes, and combinations of conductors and connected items.

2.03 GROUNDING ELECTRODES

A. Ground Rods Copper-clad steel.

B. Concrete-Encased Grounding Electrode (Ufer): Fabricate according to Electrical Code, using a minimum of 20 feet (609.6 cm) of bare copper conductor not smaller than No. 4 AWG or 20 feet of 1/2"steel reinforcing bar.

PART 3 EXECUTION

3.01 CONNECTIONS

A. General: 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.

B. 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.

C. 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.

D. 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 non-continuous conduits at entrances and exits with grounding bushings and bare grounding conductors, unless otherwise indicated.

E. Underground Connections: Use for underground connections, except those at test wells.

F. Connections at back boxes, junction boxes, pull boxes, and equipment terminations: The equipment grounding conductor(s) associated with all circuits in the box shall be connected together and to the box using a suitable grounding screw. The removal of the respective receptacle, or other device served by the box shall not interrupt the grounding continuity.

G. 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.

H. 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.

3.02 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. 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. Each grounding conductor that passes through a below grade wall must be provided with a waterstop.

C. Grounding electrode conductor (GEC) shall be protected from physical damage by rigid polyvinyl chloride conduit (PVC) in exposed locations.

D. Bonding Straps and Jumpers: Install so vibration by equipment mounted on vibration isolation hangers and 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.

E. In raceways, use insulated equipment grounding conductors.

F. Underground Grounding Conductors: Use tinned copper conductor, No. 2/0 AWG minimum. Bury at least 24 inches (609.6 mm) below grade or bury 12 inches (304.8 mm) above duct bank when installed as part of the duct bank.

3.03 EQUIPMENT GROUNDING SYSTEM

A. Comply with Electrical Code, for types, sizes, and quantities of equipment grounding conductors, unless specific types, larger sizes, or more conductors than required by Electrical Code are indicated.

B. Install equipment grounding conductors in all feeders and circuits. Terminate each end on a grounding lug or bus.

3.04 BONDING SYSTEM

A. Exterior Metallic Pull and Junction Box Covers, Metallic Hand Rails: Bond to grounding system using flexible grounding conductors.

B. Heat-Tracing, Metal Well Casing, and Heating Cables: Install a separate equipment grounding conductor to each electric water heater, heat-tracing, and anti-frost heating cable. Bond conductor to heater units, piping, well casing, connected equipment, and components.

C. Connect bonding conductors to metal water pipe using a suitable ground clamp. Make connections to flanged piping at street side of flange. Provide bonding jumper around water meter.

D. Industrial Control Panels, Terminal Cabinets, and Similar Installation: Terminate bonding conductor on cabinet grounding terminal. Provide an equipment grounding conductor and bond adjacent and associated control panels together.

E. Equipment Ground Conductor Continuity: All spliced equipment grounding conductors in junction boxes, cabinets, and distribution equipment shall be connected together and bonded to the metal enclosure.

3.05 GROUNDING ELECTRODE SYSTEM

A. Supplementary Grounding Electrode: Use driven ground rod on exterior of building.

B. Metal Water Service Pipe: Provide insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes by grounding clamp connectors. Where a dielectric main water fitting is installed, connect grounding conductor to street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.

C. Concrete-Encased Grounding Electrode (Ufer):Install concrete-encased grounding electrode encased in at least 2 inches (50.8 mm) of concrete horizontally within the foundation that is in contact with the earth. If concrete foundation is less than 20 feet (609.6 cm) long, coil excess conductor within the base of the foundation. Bond grounding conductor to reinforcing steel in at least four locations and to anchor bolts. Extend grounding conductor below grade and connect to building grounding grid or to a grounding electrode external to concrete.

3.06 FIELD QUALITY CONTROL

A. Inspect grounding and bonding system conductors and connections for tightness and proper installation.
   1. Measure ground resistance from system neutral connection at service entrance to convenient ground reference points using suitable ground testing equipment. Resistance shall not exceed 5 ohms.
   2. Testing: Owner will engage a qualified testing agency to perform the following field quality-control testing:
   3. Testing: Engage a qualified testing agency to perform the following field quality-control testing:
   4. Testing: Perform the following field quality-control testing:
      a. After installing grounding system but before permanent electrical circuitry has been energized, test for compliance with requirements.
      b. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, and at ground test wells. Measure ground resistance not less than 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.
      c. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Engineer promptly and include recommendations to reduce ground resistance.

3.07 GRADING AND PLANTING

A. Restore surface features, including vegetation, at areas disturbed by Work of this Section. Reestablish original grades, unless otherwise indicated. Restore areas disturbed by trenching, storing of dirt, cable laying, and other activities to their original condition. Include application of topsoil, fertilizer, lime, seed, sod, sprig, and mulch. Comply with Division 2. Maintain restored surfaces. Restore disturbed paving.

END OF SECTION 260526

SECTION 260533
CONDUIT AND BOXES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Rigid metallic conduit and fittings (RMC)
B. Intermediate metallic conduit and fittings (IMC)
C. Electrical metallic tubing and fittings (EMT)
D. Liquidtight flexible metallic conduit and fittings (LFMC)
E. Rigid polyvinyl chloride conduit and fittings (PVC)
F. Electrical connection
G. Pull and junction boxes
H. Handholes
I. Raceway Seals and Sealant
J. Accessories

1.02 REFERENCE STANDARDS

A. ANSI C80.1 - American National Standard for Electrical Rigid Steel Conduit (ERSC); 2020.
B. ANSI C80.3 - American National Standard for Electrical Metallic Tubing -- Steel (EMT-S); 2020.
C. ANSI C80.6 - American National Standard for Electrical Intermediate Metal Conduit; 2018.
D. ASTM D570 - Standard Test Method for Water Absorption of Plastics; 2022.
E. ASTM D638 - Standard Test Method for Tensile Properties of Plastics; 2022.
F. ASTM D648 - Standard Test Method for Deflection Temperature of Plastics Under Flexural Load in the Edgewise Position; 2018.
G. ASTM D3350 - Standard Specification for Polyethylene Plastics Pipe and Fittings Materials; 2021.
H. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2020.
I. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable; 2014.
J. NEMA OS 1 - Sheet-Steel Outlet Boxes, Device Boxes, Covers, and Box Supports; 2013 (Reaffirmed 2020).
K. NEMA OS 2 - Nonmetallic Outlet Boxes, Device Boxes, Covers and Box Supports; 2013 (Reaffirmed 2020).
L. NEMA TC 3 - Polyvinyl Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing; 2021.
M. UL 1 - Flexible Metal Conduit; Current Edition, Including All Revisions.
N. UL 6 - Electrical Rigid Metal Conduit-Steel; Current Edition, Including All Revisions.
O. UL 360 - Liquid-Tight Flexible Metal Conduit; Current Edition, Including All Revisions.
P. UL 514B - Conduit, Tubing, and Cable Fittings; Current Edition, Including All Revisions.
Q. UL 651A - Schedule 40 and 80 High Density Polyethylene (HDPE) Conduit; Current Edition, Including All Revisions.
R. UL 797 - Electrical Metallic Tubing-Steel; Current Edition, Including All Revisions.
S. UL 1242 - Electrical Intermediate Metal Conduit-Steel; Current Edition, Including All Revisions.

1.03 RELATED WORK

A. Section 26 0553 - Electrical Identification: Refer to electrical identification for color and identification labeling requirements.

1.04 REFERENCES

A. American National Standards Institute (ANSI):
   1. ANSI C80.1 - Rigid Steel Conduit, Zinc-Coated
   2. ANSI C80.3 - Electrical Metallic Tubing, Zinc-Coated and Fittings
   3. ANSI C80.4 - Fittings for Rigid Metal Conduit and Electrical Metallic Tubing
   4. ANSI C80.6 - Intermediate Metal Conduit, Zinc Coated
   5. ANSI/NEMA OS 1 - Sheet-Steel Outlet Boxes, Device Boxes, Covers and Box Supports
   6. ANSI/NEMA OS 2 - Nonmetallic Outlet Boxes, Device Boxes, Covers and Box Supports

B. Federal Specifications (FS):
   1. A-A-50553A - Fittings for Conduit, Metal, Rigid, (Thick-Wall and Thin-Wall (EMT) Type
   2. A-A-55810 - Specification for Flexible Metal Conduit

C. NECA "Standards of Installation"

D. National Electrical Manufacturers Association (NEMA):
   1. ANSI/NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing and Cable
   2. RN 1 - Polyvinyl chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit, Rigid Aluminum Conduit, and Intermediate Metal Conduit
   3. TC 2 - Electrical Polyvinyl Chloride (PVC) Conduit
   4. TC 9 - Fittings for PVC Plastic Utilities Duct for Underground Installation

E. CEC California Electrical Code

F. Underwriters Laboratories (UL): Applicable Listings
   1. UL 1 - Flexible Metal Conduit
   2. UL 6 - Rigid Metal Conduit
   3. UL 360 - Liquid Tight Flexible Steel Conduit
   4. UL 514B - Conduit Tubing and Cable Fittings
   5. UL 651A - Type EB and a PVC Conduit and HDPE Conduit
   6. UL746A - Standard for Polymeric Materials - Short Term Property Evaluations
   7. UL 797 - Electrical Metal Tubing
   8. UL 1242 - Intermediate Metal Conduit

G. American Standard of Testing and Materials (ASTM):
   1. ASTM D570 - Standard Test Method for Water Absorption of Plastics
   2. ASTM D638 - Standard Test Method for Tensile Properties of Plastics
   3. ASTM D648 - Standard Test Method for Deflection Temperature of Plastics under Flexural Load in the Edge Wise Position
   4. ASTM D 2412 - Standard Test Method for Determination of External Loading Characteristics of Plastic Pipe by Parallel-Plate Loading
   5. ASTM D 2447 - Standard Specification for Polyethylene (PE) Plastic Pipe, Schedules 40 and 80, Based on Outside Diameter
   6. ASTM D3350 - Standard Specification for Polyethylene Plastic Pipe and Fittings Material

H. Definitions:
   1. Fittings: Conduit connection or coupling.
   2. Body: Enlarged fittings with opening allowing access to the conductors for pulling purposes only.
   3. Mechanical Spaces: Enclosed areas, usually kept separated from the general public, where the primary use is to house service equipment and to route services. These spaces generally have exposed structures, bare concrete and non-architecturally emphasized finishes.

4. Finished Spaces: Enclosed areas where the primary use is to house personnel and the general public. These spaces generally have architecturally emphasized finishes, ceilings and/or floors.
5. Concealed: Not visible by the general public. Often indicates a location either above the ceiling, in the walls, in or beneath the floor slab, in column coverings, or in the ceiling construction.
6. Above Grade: Not directly in contact with the earth. For example, an interior wall located at an elevation below the finished grade shall be considered above grade but a wall retaining earth shall be considered below grade.
7. Slab: Horizontal pour of concrete used for a floor or sub-floor.

1.05 SUBMITTALS

A. Include fittings and conduits 1.5" and larger in coordination files. Include all in--floor and underfloor conduit in coordination files. Refer to Section 26 0500 for coordination drawing requirements.

PART 2 PRODUCTS

2.01 RIGID METALLIC CONDUIT (RMC) AND FITTINGS

A. Manufacturers:
1. Atkore Allied Tube & Conduit
2. Nucor
3. Electroline
4. Western Tube
5. Wheatland Tube Co
6. or approved equal.

B. Manufacturers of RMC Conduit Fittings:
1. ABB/Thomas & Betts
2. Eaton/Crouse-Hinds
3. Electroline
4. Emerson Appleton & OZ Gedney
5. Hubbell Raco and Killark
6. NSI Bridgeport
7. Orbit Industries
8. Wesco Regal
9. or approved equal.

C. Minimum Size Galvanized Steel: 3/4 inch (19.05 mm), unless otherwise noted.

D. Fittings and Conduit Bodies:
1. End Bell Fittings: Malleable iron, hot dip galvanized, threaded flare type with provisions for mounting to form.
2. Expansion Joints: Malleable iron and hot dip galvanized providing a minimum of 4 inches (101.6 mm) of movement. Fitting shall be watertight with an insulating bushing and a bonding jumper.
3. Expansion Joint for Concrete Encased Conduit: Neoprene sleeve with bronze end coupling, stainless steel bands and tinned copper braid bonding jumper. Fittings shall be watertight and concrete-tight.
4. Conduit End Bushings: Malleable iron type with molded-on high impact phenolic thermosetting insulation. Where required elsewhere in the contract documents, bushing shall be complete with ground conductor saddle and clamp. High impact phenolic threaded type bushings are not acceptable.
5. All other fittings and conduit bodies shall be of malleable iron construction and hot dip galvanized.

E. PVC Externally Coated Conduit: Compliant with UL 6, ANSI C80.1 and NEMA RN 1; rigid galvanized steel conduit with external 40 mil (1.016 mm) PVC coating and internal 2 mil (0.0508

mm) urethane coating surface. All fittings and conduit bodies shall be complete with coating. Threads shall be hot galvanized and coated with a clear coat of urethane. The PVC coated system shall include necessary PVC coated fittings, boxes and covers to form a complete encapsulated system.

1. Acceptable Manufacturers:
    a. Atkore Calbond Calpipe
    b. Robroy Perma-cote and Plati-Bond
    c. ABB Ocal
    d. or approved equal.

2.02 INTERMEDIATE METALLIC CONDUIT (IMC) AND FITTINGS

A. Minimum Size Galvanized Steel: 3/4 inch (19.05 mm), unless otherwise noted.

B. Manufacturers:
1. Atkore Allied Tube & Conduit
2. Nucor
3. Electroline
4. Western Tube
5. Wheatland Tube Co
6. or approved equal.

C. Fittings and Conduit Bodies:
1. End Bell Fittings: Malleable iron, hot dip galvanized, threaded flare type with provisions for mounting to form.
2. Expansion Joints: Malleable iron and hot dip galvanized providing a minimum of 4 inches (101.6 mm) of movement. Fitting shall be watertight with an insulating bushing and a bonding jumper.
3. Expansion Joint for Concrete Encased Conduit: Neoprene sleeve with bronze end coupling, stainless steel bands and tinned copper braid bonding jumper. Fittings shall be watertight and concrete-tight.
4. Conduit End Bushings: Malleable iron type with molded-on high impact phenolic thermosetting insulation. Where required elsewhere in the contract documents, bushing shall be complete with ground conductor saddle and clamp. High impact phenolic threaded type bushings are not acceptable.
5. All other fittings and conduit bodies shall be of malleable iron construction and hot dip galvanized.

D. Manufacturers of IMC Conduit Fittings:
1. ABB/Thomas & Betts
2. Easton/Crouse-Hinds
3. Electroline
4. Emerson Appleton & OZ Gedney
5. Hubbell Raco and Killark
6. NSI Bridgeport
7. Orbit Industries
8. Wesco Regal
9. or approved equal.

2.03 ELECTRICAL METALLIC TUBING (EMT) AND FITTINGS

A. Minimum Size Electrical Metallic Tubing: 3/4 inch (19.05 mm), unless otherwise noted.

B. Manufacturers of EMT Conduit:
1. Allied Tube & Conduit
2. Calbond Calpipe
3. Nucor
4. Electroline
5. Western Tube

6. Wheatland Tube Co
7. or approved equal.

C. Fittings and Conduit Bodies:
1. 2" Diameter or Smaller: steel set screw type of steel designed for their specific application.
2. Larger than 2": Compression type of steel designed for their specific application.
3. Manufacturers of EMT Conduit Fittings:
a. ABB/Thomas & Betts
b. Eaton/Crouse-Hinds
c. Electroline
d. Emerson Appleton & OZ Gedney
e. Hubbell Raco and Killark
f. NSI Bridgeport
g. Orbit Industries
h. Wesco Regal
i. or approved equal.

2.04 LIQUIDTIGHT FLEXIBLE METALLIC CONDUIT (LFMC) AND FITTINGS

A. Manufacturers:
1. ABB/Thomas & Betts
2. Anamet Electrical
3. Atkore American Flex AFC and Flexicon
4. Electri-Flex Co
5. Electroline
6. Southwire Alflex
7. or approved equal.

B. Construction: Flexible steel, approved for conduit ground, zinc coated, threadless type formed from a continuous length of spirally wound, interlocked zinc coated strip steel and an extruded PVC cover.

C. Fittings and Conduit Bodies:
1. Watertight, compression type, galvanized zinc coated cadmium plated malleable cast iron, UL listed.
2. Fittings and conduit bodies shall include plastic or cast metal inserts supplied by the manufacturer to protect conductors from sharp edges.
3. Manufacturers:
a. ABB/Thomas & Betts
b. Eaton/Crouse-Hinds
c. Electroline
d. Emerson Appleton & OZ Gedney
e. Hubbell Raco and Killark
f. NSI Bridgeport
g. Orbit Industries
h. Wesco Regal
i. or approved equal.

2.05 RIGID NON-METALLIC CONDUIT (PVC) AND FITTINGS

A. Minimum Size Rigid Smooth-Wall Nonmetallic Conduit: 3/4 inch (19.05 mm), unless otherwise noted.

B. Acceptable Manufacturers:
1. ABB/Carlon
2. Chevron Phillips Chemical Company
3. Cantex, J.M. Mfg.
4. Atkore Heritage Plastics

5. or approved equal.

C. Construction: Schedule 40 and Schedule 80 rigid polyvinyl chloride (PVC), UL labeled for 90°C.

D. Fittings and Conduit Bodies: NEMA TC 3; sleeve type suitable for and manufactured especially for use with the conduit by the conduit manufacturer.

E. Plastic cement for joining conduit and fittings shall be provided as recommended by the manufacturer.

2.06 OUTLET BOXES

A. Sheet Metal Outlet Boxes: ANSI/NEMA OS 1; galvanized steel, 16 gauge (approximately 0.0625 inches (1.59 mm)), with 1/2-inch male fixture studs where required.

B. Cast Boxes: Nema FB1, Type FD, Aluminum, cast feralloy, or stainless steel deep type, gasketed cover, threaded hubs.

2.07 ECONN; ELECTRICAL CONNECTION

A. Electrical connection to equipment and motors, sized per Electrical Code. Coordinate requirements with contractor furnishing equipment or motor. Refer to specifications and general installation notes for terminations to motors.

2.08 JB; PULL AND JUNCTION BOXES

A. Sheet Metal Boxes: ANSI/NEMA OS 1; galvanized steel.

B. Cast Metal Boxes for Outdoor and Wet Location Installations: NEMA 250; Type 4 and Type 6, flat-flanged, surface-mounted junction box, UL listed as raintight. Galvanized cast iron box and cover with ground flange, neoprene gasket, and stainless steel cover screws.

2.09 HANDHOLES

A. HH-#; Handhole, composite polymer concrete body and cover. Stainless steel hardware. Bolted non-skid cover rated for 5,000 pounds. Design load occasional non-deliberate vehicular traffic. Stack units to achieve depth shown on plans. Units in landscaped areas shall be green in color. 11"W, 18"L, 18"D or dimensions as shown on plans.
   1. Manufacturers:
      a. Hubbell/Quazite PG####BB18, PG####HA00
      b. Carson Industries H Series
      c. Armorcast
      d. Highline Products
      e. Synertech

PART 3 EXECUTION

3.01 CONDUIT INSTALLATION SCHEDULE AND SIZING

A. In the event the location of conduit installation represents conflicting installation requirements as specified in the following schedule, a clarification shall be obtained from the Engineer. If this Contractor is unable to obtain a clarification as outlined above, concealed rigid galvanized steel conduit installed per these specifications and the Electrical Code shall be required.

B. Installation Schedule: Refer to drawings.

C. Size conduit as shown on the drawings and specifications. Where not indicated in the contract documents, conduit size shall be according to the Electrical Code. Conduit and conductor sizing shall be coordinated to limit conductor fill to less than 40%, maintain conductor ampere capacity as required by the Electrical Code (to include enlarged conductors due to temperature and quantity derating values) and to prevent excessive voltage drop and pulling tension due to long conduit/conductor lengths.

D. Minimum Conduit Size (Unless Noted Otherwise):
   1. Above Grade: 3/4 inch (19.05 mm). (The use of 1/2 inch (12.7 mm) would be allowed for installation conduit to individual light switches, individual receptacles and individual fixture whips from junction box.)

E. Conduit sizes shall change only at the entrance or exit to a junction box, unless specifically noted on the drawings.

3.02 CONDUIT ARRANGEMENT

A. In general, conduit shall be installed concealed in walls, in finished spaces and where possible or practical, or as noted otherwise. Conduit shall be installed parallel or perpendicular to walls, ceilings, and exposed structural members. In unfinished spaces, mechanical and utility areas, conduit may run either concealed or exposed as conditions dictate and as practical unless noted otherwise on drawings. Installation shall maintain headroom in exposed vicinities of pedestrian or vehicular traffic.

B. Exposed conduit on exterior walls or above roof will not be allowed without prior written approval of Engineer. A drawing of the proposed routing and a photo of the location shall be submitted 14 days prior to start of conduit rough-in. Routing shall be shown on coordination drawings.

C. Conduit arrangement in elevated slabs (restricted to applications specifically noted or shown on drawings):
   1. Conduit size shall not exceed one-third of the structural slab thickness. Place conduit between the top and bottom reinforcing with a minimum of 3" concrete cover.
   2. Parallel conduits shall be spaced at least 8 inches (203.2 mm) apart. Exception: Within 18 inches of commonly served floor boxes, junction boxes, or similar floor devices. Arrange conduits parallel or perpendicular to building lines and walls.

D. Conduit shall not share the same cell as structural reinforcement in masonry walls.

E. Conduit runs shall be routed as shown on large scale drawings. Conduit routing on drawings scaled 1/4"=1'-0" or less shall be considered diagrammatic, unless noted otherwise. The correct routing, when shown diagrammatically shall be chosen by the Contractor based on information in the contract documents, in accordance with manufacturer's written instructions, applicable codes, the NECA's "Standard of Installation", in accordance with recognized industry standards, and coordinated with other contractors.

F. Contractor shall adapt Contractor's work to the job conditions and make such changes as required and permitted by the Engineer, such as moving to clear beams and joists, adjusting at columns, avoiding interference with windows, etc., to permit the proper installation of other mechanical and/or electrical equipment.

G. Contractor shall cooperate with all contractors on the project. Contractor shall obtain details of other contractor's work to ensure fit and avoid conflict. Any expense due to the failure of This Contractor to do so shall be paid for in full by Contractor. The other trades involved as directed by the Engineer shall perform the repair of work damaged as a result of neglect or error by This Contractor. The resultant costs shall be borne by This Contractor.

3.03 CONDUIT SUPPORT

A. Conduit shall not be supported from water, or other non-structural members, unless approved by the Engineer. All supports shall be from structural slabs, walls, structural members, and coordinated with all other applicable contractors, unless noted otherwise.

B. Conduit shall be held in place by the correct size of galvanized one-hole conduit clamps, two-hole conduit straps, patented support devices, clamp back conduit hangers, or by other means if called for on the drawings.

C. Supports for metallic conduit shall be no greater than 10 feet (304.8 cm). A smaller interval may be used if necessitated by building construction, but in no event shall support spans exceed the Electrical Code requirements. Conduit shall be securely fastened within 3 feet (91.44 cm) of each outlet box, junction box, device box, cabinet, or fitting.

D. Supports of flexible conduit shall be within 12 inches (304.8 mm) of each outlet box, junction box, device box, cabinet, or fitting and at intervals not to exceed 4.5 feet (137.16 cm).

E. Supports for non-metallic conduit shall be at sufficiently close intervals to eliminate any sag in the conduit. The manufacturer's recommendations shall be followed, but in no event shall support spans exceed the Electrical Code requirements.

F. Where conduit is to be installed in poured concrete floors or walls, provide concrete-tight conduit inserts securely fastened to forms to prevent conduit misplacement.

G. Finish:
   1. Prime coat exposed steel hangers and supports. Hangers and supports in crawl spaces, pipe shafts, and above suspended ceiling spaces are not considered exposed.
   2. Trim all ends of exposed field fabricated steel hangers, slotted channel and threaded rod to within 1" of support or fastener to eliminate potential injury to personnel unless shown otherwise on the drawings. Smooth ends and install elastomeric insulation with two coats of latex paint if exposed steel is within 6'-6" of finish floor and presents potential injury to personnel.

3.04 CONDUIT INSTALLATION

A. Conduit Connections:
   1. Shorter than standard conduit lengths shall be cut square using industry standards. The ends of all conduits cut shall be reamed or otherwise finished to remove all rough edges.
   2. Metallic conduit connections in slab on grade installation shall be sealed and one coat of rust inhibitor primer applied after the connection is made.
   3. Where conduits with tapered threads cannot be coupled with standard couplings, then approved split or Erickson couplings shall be used. Running threads will not be permitted.
   4. Install expansion/deflection joints where conduit crosses structure expansion/seismic joints.

B. Conduit terminations for all low voltage wiring shall have nylon bushings installed on each end of every conduit run.

C. Conduit Bends:
   1. Use a hydraulic one-shot conduit bender or factory elbows for bends in conduit 2" in size or larger. All steel conduit bending shall be done cold; no heating of steel conduit shall be permitted.
   2. All bends of rigid polyvinyl chloride conduit (PVC) shall be made with the manufacturer's approved bending equipment. The use of spot heating devices will not be permitted (i.e. blow torches).
   3. A run of conduit shall not contain more than the equivalent of four (4) quarter bends (360°), including those bends located immediately at the outlet or body.
   4. Rigid polyvinyl chloride conduit (PVC) runs longer than 100 feet (3048 cm) or runs which have more than two 90° equivalent bends (regardless of length) shall use rigid metal or RTRC factory elbows for bends.
   5. Use conduit bodies to make sharp changes in direction (i.e. around beams).

D. Conduit Placement:
   1. Conduit shall be mechanically continuous from source of current to all outlets. Conduit shall be electrically continuous from source of current to all outlets, unless a properly sized grounding conductor is routed within the conduit. All metallic conduits shall be bonded per the Electrical Code.
   2. Route exposed conduit and conduit above suspended ceilings (accessible or not) parallel/perpendicular to the building structural lines, and as close to building structure as possible. Wherever possible, route horizontal conduit runs above water and steam piping.
   3. Route conduit through roof openings provided for piping and ductwork where possible. If not provided or routing through provided openings is not possible, route through roof jack with pitch pocket. Coordinate roof penetrations with other trades.
   4. Conduits, raceway, and boxes shall not be installed in concealed locations in metal deck roofing or less than 1.5" below bottom of roof decking.

5. Avoid moisture traps where possible. Where unavoidable, provide a junction box with drain fitting at conduit low point.
6. Do not route conduits across each other in slabs on grade.
7. Rigid polyvinyl chloride conduit (PVC) shall be installed when material surface temperatures and ambient temperature are greater than 40°F.
8. Where rigid polyvinyl chloride conduit (PVC) is used below grade, in a slab, below a slab, etc., a transition to rigid galvanized steel conduit shall be installed before conduit exits earth. The conduit shall extend a minimum of 6" into the surface concealing the non-metallic conduit.
9. Contractor shall provide suitable mechanical protection around all conduits stubbed out from floors, walls or ceilings during construction to prevent bending or damaging of stubs due to carelessness with construction equipment.
10. Contractor shall provide a polypropylene pull cord with 2000 lbs. tensile strength in each empty conduit (indoor and outdoor), except in sleeves and nipples.

3.05 CONDUIT TERMINATIONS

A. Where conduit bonding is indicated or required in the contract documents, the bushings shall be a grounding type sized for the conduit and ground bonding conductor as manufactured by O-Z/Gedney, Appleton, Thomas & Betts, Burndy, Regal, Orbit Industries or approved equal.

B. Conduits with termination fittings shall be threaded for one (1) lock nut on the outside and one (1) lock nut and bushing on the inside of each box.

C. Where conduits terminate in boxes with knockouts, they shall be secured to the boxes with lock nuts and provided with approved screw type tinned iron bushings or fittings with plastic inserts.

D. Where conduits terminate in boxes, fittings, or bodies with threaded openings, they shall be tightly screwed against the shoulder portion of the threaded openings.

E. Conduit terminations to all motors shall be made with flexible metallic conduit (FMC), unless noted otherwise. Final connections to exterior motors and motors in damp or wet locations shall be made with liquidtight flexible metallic conduit (LFMC). Flexible conduit shall not exceed 6' in length. Route equipment ground conductors from circuit ground to motor ground terminal through flexible conduit.

F. Rigid polyvinyl chloride conduit (PVC) shall be terminated using fittings and bodies produced by the manufacturer of the conduit, unless noted otherwise. Prepare conduit as per manufacturer's recommendations before joining. All joints shall be solvent welded by applying full even coat of plastic cement to the entire areas that will be joined. Turn the conduit at least a quarter to one half turn in the fitting and let the joint cure for 1-hour minimum or as per the manufacturer's recommendations.

G. All conduit ends shall be sealed with plastic immediately after installation to prevent the entrance of any foreign matter during construction. The seals shall be removed and the conduits blown clear of all foreign matter prior to any wires or pull cords being installed.

3.06 UNDERGROUND CONDUIT INSTALLATION

A. Conduit Connections:
   1. Conduit joints in a multiple conduit run shall be staggered at least one foot apart.

B. Conduit Bends (Lateral):
   1. Conduits shall have long sweep radius elbows instead of standard elbows wherever special bends are indicated and noted on the drawings, or as required by the manufacturer of the equipment or system being served.
   2. Telecommunications conduit bend radius shall be six times the diameter for conduits under 2" and ten times the diameter for conduits over 2". Where long cable runs are involved, sidewall pressures may require larger radius bends. Coordinate with Engineer prior to conduit installation to determine bend radius.

C. Conduit Elbows (vertical):

1. Minimum metal or RTRC elbow radiuses shall be 30 inches (762 mm) for primary conduits (greater than 600V) and 18 inches (457.2 mm) for secondary conduits (less than 600V). Increase radius, as required, based on pulling tension calculation requirements.

D. Expansion Fittings at Finished Grade: Provide underground raceways with an expansion fitting after emerging from finished grade and exterior equipment pads. Field locate the expansion fitting above and within 24 inches (609.6 mm) of finished grade. Raceways extending less than 12 inches (304.8 mm) above finished grade, transitioning to LFMC within 12 inches of finished grade, and interior concrete building slabs do not require an expansion fitting unless required by code.

E. Conduit Placement:
1. Conduit runs shall be pitched a minimum of 4" per 100 feet (3048 cm) to drain toward the terminations. Duct runs shall be installed deeper than the minimum wherever required to avoid any conflicts with existing or new piping, tunnels, etc.
2. For parallel runs, use suitable separators and chairs installed not greater than 4' on centers. Band conduit together with suitable banding devices. Securely anchor conduit to prevent movement during concrete placement or backfilling.
3. Where concrete is required, the materials for concreting shall be thoroughly mixed to a minimum f'c = 2500 and immediately placed in the trench around the conduits. No concrete that has been allowed to partially set shall be used.
4. Before the Contractor pulls any cables into the conduit, Contractor shall have a mandrel 1/4" smaller than the conduit inside diameter pulled through each conduit and if any concrete or obstructions are found, the Contractor shall remove them and clear the conduit. Spare conduit shall also be cleared of all obstructions.
5. Conduit terminations in manholes, masonry pull boxes, or masonry walls shall be with malleable iron end bell fittings.
6. All spare conduits not terminated in a covered enclosure shall have its terminations plugged as described above.
7. Ductbanks and conduit shall be installed a minimum of 24" below finished grade, unless otherwise noted on the drawings or elsewhere in these specifications.
8. All non-metallic conduit installed underground outside of a slab shall be rigid.

3.07 BOX INSTALLATION SCHEDULE

A. Galvanized steel boxes may be used in:
1. Concealed interior locations above ceilings and in hollow studded partitions.
2. Exposed interior locations in mechanical rooms and in rooms without ceilings; higher than 8' above the highest platform level.
3. Direct contact with concrete except slab on grade.

B. Cast boxes shall be used in:
1. Exterior locations.
2. Direct contact with earth.
3. Direct contact with concrete in slab on grade.
4. Wet locations.

3.08 COORDINATION OF BOX LOCATIONS

A. Provide electrical boxes as shown on the drawings, and as required for splices, taps, wire pulling, equipment connections, and code compliance.

B. Electrical box locations shown on the Contract Drawings are approximate, unless dimensioned. Verify location of floor boxes and outlets in offices and work areas prior to rough-in.

C. Locate and install boxes to allow access. Avoid interferences with ductwork, piping, structure, equipment, etc. Recessed luminaires shall not be used as access to outlet, pull, and junction boxes. Where installation is inaccessible, provide access doors. Coordinate locations and sizes of required access doors with the Engineer and General Contractor.

D. Locate and install to maintain headroom and to present a neat appearance.

E. Coordinate locations with Heating Contractor to avoid baseboard radiation cabinets.

3.09 OUTLET BOX INSTALLATION

A. Mount at heights shown or noted on the drawings or as generally accepted if not specifically noted.

B. Provide knockout closures for unused openings.

C. Support boxes independently of conduit.

D. Use multiple-gang boxes where more than one device is mounted together; do not use sectional boxes. Provide barriers to separate wiring of different voltage systems.

E. Provide cast outlet boxes in exterior locations and wet locations, and where exposed rigid or intermediate conduit is used.

3.10 EXPOSED BOX INSTALLATION

A. Boxes shall be secured to the building structure with proper size screws, bolts, hanger rods, or structural steel elements.

B. On brick, block and concrete walls or ceilings, exposed boxes shall be supported with no less than two (2) Ackerman-Johnson, Paine, Phillips, or approved equal screw anchors or expansion shields and round head machine screws. Cast boxes shall not be drilled.

C. On steel structures, exposed boxes shall be supported to the steel member by drilling and tapping the member and fastening the boxes by means of round head machine screws.

D. Boxes may be supported on steel members by APPROVED beam clamps if conduit is supported by beam clamps.

E. Boxes shall be fastened to wood structures by means of a minimum of two (2) wood screws adequately large and long to properly support. (Quantity depends on size of box.)

F. Wood, plastic, or fiber plugs shall not be used for fastenings.

G. Explosive devices shall not be used unless specifically allowed.

END OF SECTION 260533

SECTION 260553
ELECTRICAL IDENTIFICATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Nameplates and Signs

B. Product Colors

1.02 REFERENCE STANDARDS

A. ANSI Z535.4 - American National Standard for Product Safety Signs and Labels; 2023.

B. NFPA 70E - Standard for Electrical Safety in the Workplace; 2024.

1.03 RELATED SECTIONS AND WORK

A. Section 26 0500 - Basic Electrical Requirements

1.04 REFERENCES

A. NFPA 70E - National Electrical Safety Code

B. CEC California Electrical Code

C. ANSI A13.1 - Standard for Pipe Identification

D. ANSI Z535.4 - Standard for Product Safety Signs and Labels

1.05 QUALITY ASSURANCE

A. Electrical identification products shall be suitable for the environment installed. Identification labels damaged by the environment due to ultraviolet light fading, damp or wet conditions, physical damage, corrosion, or other conditions shall be replaced with labels suitable for the environment.

PART 2 PRODUCTS

2.01 NAMEPLATES AND SIGNS

A. Exterior, Metal-Backed, Butyrate Signs: Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs with 0.0396 inch (1.01 mm) galvanized-steel backing: and with colors, legend, and size required for application. Mounting 1/4" grommets in corners.

PART 3 EXECUTION

3.01 INSTALLATION

A. Lettering and Graphics: Coordinate names, abbreviations, colors, and other designations used in electrical identification work with corresponding designations specified or indicated. Install numbers, lettering, and colors as required by code.

B. Install identification devices in accordance with manufacturer's written instruction and requirements of Electrical Code.

C. Sequence of Work: Where identification is to be applied to surfaces that require finish, install identification after completion of finish work. All mounting surfaces shall be cleaned and degreased prior to identification installation.

D. Circuit Identification: Tag or label conductors as follows:

1. Multiple Power or Lighting Circuits in Same Enclosure: Where multiple branch circuits are terminated or spliced in a box or enclosure, label each conductor with source and circuit number.
2. Multiple Control Wiring and Communication/Signal Circuits in Same Enclosure: For control and communications/signal wiring, use wire/cable marking tape at terminations in wiring boxes, troughs, and control cabinets. Use consistent letter/number conductor designations throughout on wire/cable marking tape.

3. Match identification markings with designations used in panelboards shop drawings, Contract Documents, and similar previously established identification schemes for the facility's electrical installations.

E. Apply Danger, Warning, Caution and instruction signs as follows:
   1. Install Danger, Warning, Caution or instruction signs where required by Electrical Code, where indicated, or where reasonably required to assure safe operation and maintenance of electrical systems and of the items to which they connect. Install engraved plastic-laminated instruction signs with approved legend where instructions or explanations are needed for system or equipment operation. Install metal-backed butyrate signs for outdoor items.
   2. 'Danger' indicates a hazardous situation which, if not avoided, will result in death or serious injury. ANSI standard red background, white letters.
   3. 'Warning' indicates a hazardous situation which, if not avoided, could result in death or serious injury. ANSI standard orange background, black letters.
   4. 'Caution' indicates a hazardous situation which, if not avoided, may result in minor or moderate injury. ANSI standard yellow background, black letters.
   5. Emergency Operating Signs: Install, where required by Electrical Code, where indicated, or where reasonably required to assure safe operation and maintenance of electrical systems and of the items to which they connect, engraved laminate signs with white legend on red background with minimum 3/8-inch high lettering for emergency instructions on power transfer, load shedding, or other emergency operations.

F. Apply circuit/control/item designation labels of engraved plastic laminate for pushbuttons, pilot lights, alarm/signal components, and similar items, except where labeling is specified elsewhere.

G. Install labels parallel to equipment lines at locations as required and at locations for best convenience of viewing without interference with operation and maintenance of equipment.

H. Install ARC FLASH WARNING signs on all switchboards, switchgear, distribution panels, branch panelboards, industrial control panels, and motor control centers.
   1. Sample Label:

      ! WARNING

      ARC FLASH AND SHOCK HAZARD

      APPROPRIATE PPE REQUIRED

      FAILURE TO COMPLY CAN RESULT IN DEATH OR INJURY

      REFER TO NFPA 70E

I. Circuits with more than 600V: Identify raceway and cable with "DANGER-HIGH VOLTAGE" in black letters 2 (50mm) inches high on orange background at 10'-0 foot (0 cm) intervals.
   1. Entire floor area directly above conduits running beneath and within 12 inches (304.8 mm) of a basement or ground floor that is in contact with earth or is framed above unexcavated space.
   2. Wall surfaces directly external to conduits concealed within wall.
   3. All accessible surfaces of concrete envelope around conduits in vertical shafts, exposed in building, or concealed above suspended ceilings.

J. Selective Coordination Label: Install caution signs on all switchboards, distribution panels, panelboards, disconnects, and other equipment with selectively coordinated overcurrent protection devices. Sign at a minimum shall contain:
   1. CAUTION: OVERCURRENT DEVICES IN THIS ENCLOSURE ARE SELECTIVELY COORDINATED. EQUIVALENT REPLACEMENTS AND TRIP SETTINGS ARE REQUIRED.

K. Underground Electrical Lines: For exterior underground power, control, signal, and communication lines, install continuous underground plastic line marker located directly above line at 6 (150mm) to 8 (205mm) inches below grade. A single plastic line marker is permitted

when the width of the common trench does not exceed 16 inches (406.4 mm); provide a second plastic line marker to mark each edge of the trench when 16 inches of width is exceeded. Install line marker for underground wiring, both direct-buried cables and cables in raceway.

3.02 FEEDER AND BRANCH CIRCUIT DIRECTORIES

A. Product:
   1. Adhesive labels and field markings
   2. Nameplates and signs

B. Feeder Directories Branch: Provide each feeder, branch circuit, feeder modification, and branch circuit modification with a typed circuit directory label. Refer to technical equipment specification sections for additional requirements. Include the following with each label:
   1. Load Description: Lighting, receptacles, specific equipment, spare, space, or similar description.
   2. Location: Room name, number, location.

C. Provide a factory or custom clear plastic sleeve for each branch panel directory and secure to inside panel cover.

3.03 BOX LABELING

A. Identify Junction, Pull and Connection Boxes: Labeling shall be 3/8-inch Kroy tape OR Brother self-laminating vinyl label, letters/numbers.

B. All junction, pull, and connection boxes shall be identified as follows:
   1. For power and lighting circuits, indicate system voltage and identity of contained circuits ("120V, 1LA1-3,5,7").

3.04 CONDUCTOR COLOR CODING

A. Products:
   1. All wire and cables shall be color coded by the manufacturer.

B. Color coding shall be applied at all panels, switches, junction boxes, pull boxes, vaults, manholes etc., where the wires and cables are visible and terminations are made. The same color coding shall be used throughout the entire electrical system, therefore maintaining proper phasing throughout the entire project.

C. Where more than one nominal voltage system exists in a building or facility, each ungrounded conductor of a multi-wire branch circuit, where accessible, shall be identified by phase and system.

D. Conductors shall be color coded as follows:
   1. 208Y/120 Volt, 4-Wire:
      a. A-Phase - Black
      b. B-Phase - Red
      c. C-Phase - Blue
      d. Neutral - White
      e. Ground Bond - Green
   2. 480Y/277 Volt, 4-Wire:
      a. A-Phase - Brown
      b. B-Phase - Orange
      c. C-Phase - Yellow
      d. Neutral - Gray
      e. Ground Bond - Green
   3. 120/208 Volt, 3-Wire, Isolated (Ungrounded) Power System:
      a. A-Phase - Orange with distinctive colored stripe other than white, green or gray along the entire length of the conductor
      b. B-Phase - Brown with distinctive colored stripe other than white, green or gray along the entire length of the conductor

c. C-Phase - Yellow with distinctive colored stripe other than white, green or gray along the entire length of the conductor
d. Ground Reference - Green

4. Grounding Conductors:
   a. Equipment grounding conductors, main/system/supply-side bonding jumpers: Green.
   b. Isolated Equipment Ground Conductors: Green with colored distinctive yellow stripe along the entire length of the conductor. Isolated ground for feeders, use colored tape with alternating bands of green and yellow to provide a minimum of three bands of green and two bands of yellow.

3.05 EQUIPMENT CONNECTION IDENTIFICATION

A. Products:
   1. Nameplates and signs

B. Provide identification for hard wired electrical connections to equipment such as disconnects switches, starters, etc. Plug and cord type connections do not require this specific label.

C. Identification shall be provided for all connections to equipment furnished by this Contractor, other contractors, or the Owner.
   1. Mechanical equipment; pumps, and similar equipment
   2. Plumbing equipment

D. Labeling shall include:
   1. Equipment type and contract documents designation of equipment being served
   2. Location of equipment being served if it is not located within sight.
   3. Voltage and rating of the equipment.
   4. Panel and circuit numbers(s) serving the equipment
   5. Available fault current; refer to one-line diagram or panel schedule of panel serving equipment.
   6. Date of fault current study; refer to one-line diagram
   7. Sample Label:

      UNIT HEATER UH-1 ("LOCATED IN STORAGE ROOM 200")
      480V: 3-PHASE
      FED FROM "1HA1-1"
      22,000 AMPS AVAILABLE FAULT CURRENT
      DATE OF STUDY: 1 JAN 2017

3.06 POWER DISTRIBUTION EQUIPMENT IDENTIFICATION

A. Products:
   1. Nameplates and signs

B. Provide identification on the front of all power distribution equipment such as panelboards, generators, transfer switches, etc. Labels shall be visible on the exterior of the gear, correspond to the one-line diagram nomenclature, and identify each cubicle of multi-section gear.
   1. Interior Equipment: The identification material shall be engraved plastic-laminated labels.
   2. Exterior Equipment: The identification material shall be engraved vinyl labels.
   3. Labeling shall include:
      a. Equipment type and contract documents designation of equipment.
      b. Voltage of the equipment.
      c. Name of the upstream equipment and location of the upstream equipment if it is not located within sight.
      d. Sample Label:

         DISTRIBUTION PANEL DP-H1
         480Y/277V
         FED FROM SWITCHBOARD "SB-1" (LOCATED IN MAIN ELEC ROOM)

4. Provide the following on a separate label, installed below the label above:
    a. Available fault current; refer to one-line diagram or panel schedules
    b. Date of fault current study; refer to one-line diagram
    c. Sample Label:

        22,000 AMPS AVAILABLE FAULT CURRENT
        DATE OF STUDY: 1 JAN 2017

C. Service Equipment Label: A separate nameplate for the service entrance equipment and include:
    1. Nominal system voltage, service wire size, quantity, material, distance
    2. Maximum available fault current; refer to one-line diagram for values
    3. Clearing time of overcurrent protection devices based on available fault current. Refer to calculations and report from Section 26 0573 for value.
    4. Date of fault current study; refer to one-line diagram
    5. Date of label
    6. Sample Label:

        480Y/277V, 6 SETS 4#750KCM CU, 75FT
        39,800 AMPS AVAILABLE FAULT CURRENT
        0.07 SECOND CLEARING TIME
        DATE OF STUDY: 1 JAN 2017
        DATE OF LABEL: 4 JUL 2017

D. Adjustable-Trip Over Current Protection Label:
    1. Provide a separate engraved plastic laminate label adjacent to each overcurrent projection device with adjustable trip settings. Provide label separate from load identification label.
        a. Label:
            1) Long-time delay:
            2) Long-time pickup:
            3) Short-time delay:
            4) Short-time pickup:
            5) Instantaneous:
            6) Ground fault delay:
            7) Ground fault:
        b. Sample Label:

            Long-time delay: 10.0
            Long-time pickup: 1.0
            Short-time delay: 0.15
            Short-time pickup: 5.0
            Instantaneous: 2.0
            Ground fault delay: 0.25
            Ground fault: 50.0

E. Nominal System Voltage Label:
    1. Where more than one nominal voltage system exists in a building or facility, the identification of color coding used in the panelboard or equipment shall be permanently posted on the interior of the door or cover.

F. Distribution panelboards and switchboards shall have each overcurrent protection device identified with name and location of the load being served ("AHU-1 LOCATED IN PENTHOUSE 1"). Provide a separate engraved plastic laminate label adjacent to each overcurrent projection device with feeder wire size, feeder wire quantity, conductor material and distance in feet. Provide label separate from load identification label and adjustable trip settings label.
    1. Sample Labels for Feeders:

4#3/0 CU & 1#6 CU GND, 125FT
4#250KCM AL & 1#6 GND CU, 125FT
2 SETS 4#400KCM CU & 1#1 GND CU, 125FT

G. Branch panelboards shall be provided with typed panel schedules upon completion of the project. Existing panelboards shall have their existing panel schedules typed, with all circuit changes, additions or deletions also typed on the panel schedules. A copy of all panel schedules for the project shall be turned over as part of the O&M Manuals. Refer to Section 26 0500 for other requirements.

END OF SECTION 260553

SECTION 262416
PANELBOARDS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Lighting and appliance branch circuit panelboards: Panel '###'

1.02 REFERENCE STANDARDS

A. NEMA BS 31047 - Heavy Duty Enclosed and Dead-Front Switches (600 Volts Maximum); 2013 (Reaffirmed 2023).

B. NEMA PB 1 - Panelboards; 2011.

C. NEMA PB 1.1 - General Instructions for Proper Installation, Operation and Maintenance of Panelboards Rated 1000V or Less; 2023.

D. UL 67 - Panelboards; Current Edition, Including All Revisions.

1.03 RELATED SECTIONS AND WORK

A. Refer to the Electrical Distribution Diagram and Electrical Schedules for size, rating, and configuration.

1.04 REFERENCES

A. NEMA AB 1 - Molded Case Circuit Breakers

B. NEMA FU 1 - Low voltage cartridge fuses

C. NEMA BS 31047 - Enclosed Switches

D. NEMA PB 1 - Panelboards

E. NEMA PB 1.1 - Instructions for Safe Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less

F. NEMA PB 1.2 - Application Guide for Ground-fault Protective Devices for Equipment

G. UL 248 - Low-Voltage Fuses

H. UL 67 - Panelboards

1.05 SUBMITTALS

A. Submit shop drawings for equipment and component devices under provisions of Section 26 0500.

B. Include outline and support point dimensions, voltage, main bus ampacity, integrated short circuit ampere rating, circuit breaker and fusible switch arrangement and sizes.

C. Submit manufacturer's instructions under provisions of Section 26 0500.

1.06 SPARE PARTS

A. Keys: Furnish four (4) each to the Owner.

PART 2 PRODUCTS

2.01 RATINGS

A. Definitions:
   1. Fully rated equipment shall be defined as equipment where all devices in that equipment shall carry a minimum of the AIC rating that is specified.

B. The panelboards for this project shall be fully rated unless otherwise specifically noted in the Drawings or Specifications.

2.02 BRANCH CIRCUIT PANELBOARDS

A. General
   1. Manufacturers:
      a. Square D NQ, NF

b. ABB ReliaGear Series
c. Siemens P1
d. Eaton PRL1, PRL2

B. Lighting and Appliance Branch Circuit Panelboards: NEMA PB 1; circuit breaker type.

C. Enclosure: NEMA PB 1; Type 1.

D. Provide cabinet front with hinged trim to allow access to wiring gutters without removal of trim and flush lock all keyed alike. Hinged trim shall be secured with screws. Door hardware shall provide swing clear operation (180-degree swing). Finish in manufacturer's standard gray enamel.

E. Provide panelboards with copper bus, ratings as scheduled on the drawings. Provide copper ground bus in all panelboards.

F. All unlabeled circuits shown on the panelboard schedule shall be fully prepared spaces for future breakers.

G. All multiple-section panelboards shall have the same dimensional back box and cabinet front size.

H. Minimum Integrated Short Circuit Rating: As shown on the drawings.

I. Provide handle lock-on devices for all breakers serving exit sign and lighting circuits with emergency battery units. Provide handle lock-on devices and red handles for breakers serving fire alarm panels.

J. Molded Case Circuit Breakers: Bolt-on type thermal magnetic trip circuit breakers, with common trip handle for all poles. Provide circuit breakers UL listed as Type SWD for lighting circuits. Provide UL Class A ground fault interrupter circuit breakers where scheduled on the drawings. Do not use tandem circuit breakers.

K. Current Limiting Molded Case Circuit Breakers: Provide circuit breakers with integral thermal and instantaneous magnetic trip in each pole, coordinated with automatically resetting current limiting elements in each pole. Interrupting rating 100,000 symmetrical amperes, let-through current and energy level less than permitted for same size Class RK-5 fuse.

L. Suitable for use as service entrance equipment. Provide line side (service style) barriers.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install panelboards plumb as indicated on the drawings in conformance with NEMA PB 1.1.

B. Height: 6 feet (182.88 cm) to handle of highest device.

C. Provide filler plates for unused spaces in panelboards.

D. . Provide updated custom typed circuit directory for each existing branch circuit panelboard with new or revised circuits per the scope of work. Label shall include equipment name or final approved room name, room number, and load type for each circuit (examples: SUMP SP-1 or ROOM 101 RECEPT). Revise directory to reflect circuit changes required to balance phase loads. Printed copies of the bid document panel schedules are not acceptable as circuit directories.

E. Stub five (5) empty one-inch conduits to accessible location above ceiling out of each recessed panelboard and panelboards installed in electrical closets less than 36" deep.

F. Install fuses in fusible switch assemblies.

3.02 FIELD QUALITY CONTROL

A. Measure steady state load currents at each panelboard feeder. Should the difference at any panelboard between phases exceed 20 percent, rearrange circuits in the panelboard to balance the phase loads within 20 percent. Take care to maintain proper phasing for multi-wire branch circuits.

B. Visual and Mechanical Inspection: Inspect for physical damage, proper alignment, anchorage, and grounding. Check proper installation and tightness of connections for circuit breakers, fusible switches, and fuses.

END OF SECTION 262416

SECTION 262726
WIRING DEVICES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Device plates and box covers

B. Receptacles (REC-#)

1.02 REFERENCE STANDARDS

A. FS W-C-596 - Connector, Electrical, Power, General Specification for; 2014h (Validated 2022).

B. NEMA WD 1 - General Color Requirements for Wiring Devices; 1999 (Reaffirmed 2020).

C. NEMA WD 6 - Wiring Devices - Dimensional Specifications; 2021.

D. UL 498 - Attachment Plugs and Receptacles; Current Edition, Including All Revisions.

E. UL 943 - Ground-Fault Circuit-Interrupters; Current Edition, Including All Revisions.

1.03 QUALITY ASSURANCE

A. Provide similar devices from a single manufacturer.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in the Electrical Code, by a testing agency to Authorities Having Jurisdiction and marked for intended use.

C. Comply with the Electrical Code.

1.04 REFERENCES

A. DSCC W-C-896F - General Specification for Electrical Power Connector

B. FS W-C-596 - Electrical Power Connector, Plug, Receptacle, and Cable Outlet

C. NEMA WD 1 - General Color Requirements for Wiring Devices

D. NEMA WD 6 - Wiring Devices - Dimensional Requirements

E. CEC California Electrical Code

F. UL 498 - Standard for Attachment Plugs and Receptacles

G. UL 943 - Standard for Ground Fault Circuit Interrupters

1.05 COORDINATION

A. Receptacles for Owner Furnished Equipment: Match plug configurations.

B. Cord and Plug Sets: Match equipment requirements.

PART 2 PRODUCTS

2.01 DEVICE COLOR

A. All switch, receptacle, and outlet colors shall be ivory, unless indicated otherwise.

2.02 COVERPLATES

A. All switches, receptacles, and outlets shall be complete with the following:
   1. Galvanized steel coverplates in unfinished spaces for surface mounted boxes.

B. Install nameplate identification as indicated in Section 26 0553.

2.03 RECEPTACLES

A. Refer to Electrical Symbols List for device type.

B. Devices that are shaded on the drawings shall be red.

C. REC-DUP-GFI: NEMA 5-20R Ground Fault Duplex Receptacle:
   1. Standard Grade: 125-volt, 20 amp, 3-wire grounding type with test and reset buttons in impact resistant thermoplastic face, listed.

a. Device shall perform self-test of GFCI circuitry in accordance with UL 943.
b. Manufacturers:
1) Hubbell GFCI type devices are not allowed. Contractor may substitute an alternative manufacturer when Hubbell is the basis of submittal for all other wiring devices.
2) Leviton GFNT2
3) Pass & Seymour 2097
4) Cooper SGF20

D. REC-DUP-W: NEMA 5-20R Weatherproof While-In-Use Ground Fault Duplex Receptacle:
1. 125-volt, 20 amp, 3-wire grounding type with test and reset buttons in impact resistant thermoplastic face, weather resistant WR listed. Provide extra-duty NEMA 3R rated while-in-use cast aluminum outlet box hood.
2. Device shall perform self-test of GFCI circuitry in accordance with UL 943.
a. Manufacturers:
1) Hubbell:
(a) GFCI type devices are not allowed. Contractor may substitute an alternative manufacturer when Hubbell is the basis of submittal for all other wiring devices.
2) Leviton GFWT2 with aluminum housing M5979
3) Pass & Seymour 2097TRWR with aluminum housing WIUCAST1
4) Cooper WRSGF20 with aluminum housing WIUMV-1

E. Back wired devices shall be complete with eight holes that are screw activated with metal clamps for connection to #12 or #10 copper conductors.

F. Side wired devices shall have four binding screws that are undercut for positive wire retention.

G. Ground fault circuit interrupter (GFCI) receptacles shall be listed and comply with UL 943 requiring increased surge immunity, improved corrosion resistance, improved resistance to false tripping and diagnostic indication for miswiring if the line and load conductors are reversed during installation.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install convenience receptacles at elevations indicated in the General Installation Notes on the contract drawings.

B. Install specific-use receptacles at heights shown on the contract drawings. Install devices level, plumb, and square with building lines. Coordinate installation of adjacent devices of separate systems with common mounting heights, including lighting, power, systems, technology, and temperature control device rough-ins.

C. Ground Fault Protection: Provide ground fault protection for all branch circuit breakers serving 120/208 receptacles and electrical outlets rated 50 amps or less single-phase and 100 amps or less three-phase in the following locations, as shown on drawings, or required by adopted code:
1. Interior/Exterior locations subject to damp/wet conditions
2. When located within 6 feet (182.88 cm) of sinks
3. Plug-and-cord receptacles when the utilization appliance is located within 6 feet (182.88 cm) of a sink edge.

D. Install receptacles vertically with ground slot up or where indicated on the drawings, horizontally with ground slot to the left.

E. Install galvanized steel plates on outlet boxes and junction boxes in unfinished areas, above accessible ceilings, and on surface-mounted outlets.

F. Install devices and wall plates flush and level.

G. Install nameplate identification to receptacle cover plates indicated. Identification shall identify panel name and circuit number. Refer to Specification Section 26 0553 - Electrical Identification.

H. Test receptacles for proper polarity, ground continuity and compliance with requirements.

END OF SECTION 262726

SECTION 262813
FUSES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fuses

1.02 REFERENCES

A. UL 198C - High-Interrupting Capacity Fuses; Current Limiting Types

B. UL 198E - Class R Fuses

C. FS W-F-870 - Fuseholders (For Plug and Enclosed Cartridge Fuses)

D. NEMA FU 1 - Low Voltage Cartridge Fuses

E. CEC California Electrical Code

1.03 SUBMITTALS

A. Submit product data under provisions of Section 26 0500.

1.04 EXTRA MATERIALS

A. Provide two fuse pullers.

B. Provide three of each size and type of fuse installed.

1.05 PROJECT CONDITIONS

A. Where ambient temperature to which fuses are directly exposed is less than 40°F or more than 100°F, apply manufacturer's ambient temperature adjustment factors to fuse ratings.

PART 2 PRODUCTS

2.01 MANUFACTURERS - FUSES

A. Bussman, Division of Eaton

B. Edison Fuse, Division of Cooper Industries

C. Mersen

D. Littelfuse Inc

2.02 FUSES

A. Dimensions and Performance: NEMA FU 1, Class as specified or indicated.

B. Voltage: Provide fuses with voltage rating suitable for circuit phase-to-phase voltage.

C. Fuses with ratings larger than 600 amperes: Class L (time delay), unless otherwise noted on the drawings.

D. Fuses with ratings larger than 200 amperes but equal to or less than 600 amperes: Class RK-1 (time delay), unless otherwise noted on the drawings.

E. Fuses with ratings less than or equal to 200 amperes (not including control transformer fuses): Class RK-5, unless otherwise noted on the drawings.

F. Control transformer fuses: Class CC (time delay).

G. Fuses for packaged equipment: Size and type as recommended by equipment manufacturer.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install fuses where indicated on the drawings and specifications.

B. Install fuses in accordance with manufacturer's instruction.

C. Install fuses in packaged equipment as required by equipment manufacturer.

D. Install fuse with label oriented such that manufacturer, type, and size are easily read.

END OF SECTION 262813

SECTION 262816
DISCONNECT SWITCHES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fusible switches

B. Non-fusible switches

C. Enclosures

1.02 REFERENCE STANDARDS

A. NEMA BS 31047 - Heavy Duty Enclosed and Dead-Front Switches (600 Volts Maximum); 2013 (Reaffirmed 2023).

B. UL 508 - Industrial Control Equipment; Current Edition, Including All Revisions.

1.03 RELATED SECTIONS AND WORK

A. Refer to the Disconnect and Starter Schedule for rating and configuration.

1.04 REFERENCES

A. NEMA BS 31047 - Enclosed Switches

1.05 SUBMITTALS

A. Submit product data under provisions of Section 26 0500.

B. Product Data: For each type of enclosed switch, circuit breakers, accessory and component indicated, include dimensions, weights, and manufacturer's technical data on features, performance, and ratings.

C. Electrical Characteristics: For each type of enclosed switch, enclosure types, current and voltage ratings, short-circuit current ratings, UL listing for series rating of installed devices, features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.

1.06 COORDINATION

A. Coordinate layout and installation of switches, circuit breakers, and components with other construction, including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

PART 2 PRODUCTS

2.01 FUSIBLE AND NON-FUSIBLE SWITCHES

A. Acceptable Manufacturers:
   1. Square D 3110 Series
   2. Eaton DH Series
   3. ABB TH Series
   4. Siemens HNF / HF Series

B. FDS-#; Fusible Switch Assemblies: NEMA BS 31047; Type heavy duty, quick-make, quick-break, load interrupter enclosed knife switch with externally operable handle interlocked to prevent opening front cover with switch in ON position without a tool. Handle lockable in OFF position. Fuse Clips: Class 'R' fuse clips only, unless indicated otherwise on the drawings.

C. DS-#; Non-fusible Switch Assemblies: NEMA BS 31047; Type heavy duty, quick-make, quick-break, load interrupter enclosed knife switch with externally operable handle interlocked to prevent opening front cover with switch in ON position without a tool. Handle lockable in OFF position.

D. Enclosures: Type as indicated on the disconnect schedule.

E. Accessories: Provide the following accessories. Refer to Disconnect Schedule for additional requirements for each application.

1. Lockable
2. Provide finger safe barriers for exposed line-side terminations and energized components when the switch is in the open position.

2.02 MOTOR DISCONNECT SWITCH

A. Acceptable Manufacturers:
   1. Square D 3110 Series
   2. Eaton r5 Series
   3. ABB ML Series
   4. Siemens LBR Series

B. MD-#; Rotary Switch Assemblies: Rated for making and breaking loads, rotary type enclosed switch with externally operable handle interlocked to prevent opening front cover with switch in ON position without a tool. Handle lockable in OFF position.

C. Enclosures: Type as indicated on the Disconnect Schedule.

D. Ground lug connection provided in enclosure.

E. Accessories: Provide the following accessories. Refer to Disconnect Schedule for additional requirements for each application.
   1. Lockable
   2. Provide finger safe barriers for exposed line-side terminations and energized components when the switch is in the open position.

F. Listed UL 508 suitable for motor control.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install disconnect switches where indicated on the drawings.

B. Install fuses in fusible disconnect switches.

C. Field coordinate installation with other contractors and equipment to maintain code required working space requirements.

D. Provide adhesive label on inside door of each switch indicating UL fuse class and size for replacement.

3.02 ADJUSTING

A. Set field-adjustable circuit breaker trip ranges.

END OF SECTION 262816

SECTION 263213
PACKAGED ENGINE GENERATOR SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Packaged engine generator system

B. Heat exchanger

C. Battery and charger

D. Weatherproof enclosure

E. Radiator mounted load bank

1.02 REFERENCE STANDARDS

A. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2020.

B. NFPA 37 - Standard for the Installation and Use of Stationary Combustion Engines and Gas Turbines; 2024, with Amendment.

C. NFPA 99 - Health Care Facilities Code; 2024, with Errata.

D. NFPA 110 - Standard for Emergency and Standby Power Systems; 2025.

E. UL 142 - Steel Aboveground Tanks for Flammable and Combustible Liquids; Current Edition, Including All Revisions.

F. UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures; Current Edition, Including All Revisions.

G. UL 2200 - Stationary Engine Generator Assemblies; Current Edition, Including All Revisions.

1.03 REFERENCES

A. ANSI/NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum)

B. ANSI/NEMA AB 1 - Molded Case Circuit Breakers

C. ANSI/NEMA MG 1 - Motors and Generators

D. NFPA 37 - Installation and Use of Stationary Combustion Engines and Gas Turbines

E. CEC California Electrical Code

F. NFPA 110 - Standard for Emergency and Standby Power Systems

G. IEEE 446 - Recommended Practice for Emergency and Standby Power Systems for Commercial and Industrial Applications

H. Environmental Protection Agency EPA Emission Standards for Compressed Ignition Engines

I. Noise Emission: Comply with applicable state and local government requirements for maximum noise level at property boundaries due to sound emitted by the generator set, its components and the operation thereof.

1.04 SUBMITTALS

A. Submit shop drawings and product data under provisions of Section 26 0500.

B. Submit shop drawings showing plan and elevation views with overall and interconnection point dimensions, fuel consumption rate curves at various loads, ventilation and combustion air requirements, and electrical diagrams including schematic and interconnection diagrams.

C. Submit product data showing dimensions, weights, ratings, interconnection points, and internal wiring diagrams for engine, generator, control panel, battery, battery rack, battery charger, exhaust silencer, vibration isolators, day tank, remote radiator, and remote annunciator.
   1. Include work clearance and equipment access information. Clearly identify required equipment access locations for installation, maintenance, testing, and repair.

D. Submit certificates for compliance with EPA Emissions Standards for Compressed Ignition Engines.

E. Submit manufacturer's installation instructions under provisions of Section 26 0500.

1.05 EXTRA MATERIALS

A. Submit maintenance materials under provisions of Section 26 0500.

B. Furnish one set of tools required for preventative maintenance of the engine generator system. Package tools in adequately sized metal toolbox.

C. Provide two additional sets of each fuel, oil, and air filter element required for the engine generator system. Provide additional fuel polishing filters for one year of operation.

D. Provide one fuse for every type and rating used.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site under provisions of Section 26 0500.

B. Store and protect products under provisions of Section 26 0500.

C. Accept packaged engine generator set and accessories on site in crates and verify damage.

D. Protect equipment from dirt and moisture by securely wrapping in heavy plastic.

1.07 SYSTEM DESCRIPTION

A. Engine generator system to provide source of emergency and standby power.

B. Operation: In accordance with ANSI/NFPA 110.

1.08 COORDINATION DRAWINGS

A. Reference Coordination Drawings article in Section 26 0500 for required generator electronic CAD drawings to be provided to Coordinating Contractor for inclusion into composite coordination drawings.

1.09 PROJECT RECORD DOCUMENTS

A. Submit record documents under provisions of Section 26 0500.

B. Accurately record location of engine generator and mechanical and electrical connections.

1.10 OPERATION AND MAINTENANCE DATA

A. Submit operation and maintenance data under provisions of Section 26 0500.

B. Include instructions for normal operation, routine maintenance requirements, service manuals for engine and day tank, oil sampling and analysis for engine wear, and emergency maintenance procedures.

1.11 QUALIFICATIONS

A. Manufacturer: Company specializing in packaged engine generator system with minimum five (5) years documented experience.

B. Manufacturer: Company with minimum five (5) years of documented on-board paralleling system experience.

C. Supplier: Authorized distributor of engine generator manufacturer with service facilities within 50 miles (80.47 kilometers) of the project site.

1.12 WARRANTY

A. Provide a five (5) year warranty under provisions of Section 26 0500.

1.13 MAINTENANCE SERVICE

A. Furnish service and maintenance of packaged engine generator system for one (1) year from Date of Substantial Completion. Maintenance service shall be performed by skilled employees of manufacturer's designated service organization. Include quarterly exercising, and routine preventive maintenance as recommended by manufacturer and adjusting as required for proper operation. Maintenance agreements shall include parts, supplies, and labor.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Caterpillar.

B. Cummins Power Generation.

C. MTU On Site Energy.

D. Generac.

2.02 PACKAGED ENGINE-GENERATOR SET (GEN-#)

A. Packaged engine-generator set shall be a coordinated assembly of compatible components. Stationary generators shall be listed.

B. Safety Standard: Comply with ASME B15.1 and UL 2200.

C. Nameplates: Each major system component shall be equipped with a nameplate to identify manufacturer's name and address, model and serial number, and component rating in integrated set and as required by the contract documents.

D. Fabricate engine-generator set mounting frame and attachment of components to resist generator-set movement during a seismic event when generator-set mounting frame is anchored to building structure.

E. Mounting Frame: Adequate strength and rigidity to maintain alignment of mounted components without depending on concrete foundation. Mounting frame shall be free from sharp edges and corners and shall have lifting attachments arranged for lifting with slings without damaging components. Provide a rigging diagram permanently attached to the mounting frame to indicate the capacity of each lifting attachment and the generator-set center of gravity.

2.03 ENGINE

A. Type: Water-cooled in-line or V-type, compression ignition diesel electric ignition internal combustion engine.

B. Rating: Sufficient to operate at 100 percent load for two hours at specified elevation and ambient limits.

C. Fuel: Appropriate for use of No. 2 fuel oil.

D. Engine Speed: 1800 RPM.

E. Governor: Isochronous type with speed sensing.

F. Safety Devices: Engine shutdown on high water temperature, low oil pressure, overspeed, and engine overcrank. Limits as selected by manufacturer.

G. Frequency Response:
   1. Steady State Operational Bandwidth: 0.5 percent of rated frequency from no load to full load.
   2. Transient Response: Less than 5 percent for a 50 percent step-load increase or decrease. Frequency shall recover and remain within the steady state operating band within 5 seconds.

H. Fuel System:Engine mounted diesel fuel pump and relief-bypass valve.

I. Fuel Supply System:
   1. Base-Mounted Fuel Tank: UL 142 listed fuel tank with 12 hour rated (((NFPA 110)) minimum run time by class) capacity. Integral rupture basin with leak detection. Provide fueling port with an overfill prevention type receptacle and lockable cap for exterior units. The tank shall include structural steel supports for top mounted engine generator set. Furnish complete with flexible fuel line connectors lockable cover, and analog level gauge. Furnish complete with float switches to indicate low 25% fuel level. The footprint of the base-mounted fuel tank shall not exceed the footprint of the generator frame for interior applications or the footprint of the enclosure for exterior installations.

J. Engine Jacket Heater: Thermal circulation type water heater with integral thermostatic control, sized to maintain engine jacket water at 90F, and suitable for operation on 120 208-1Ø volts AC. The minimum wattage of the heater shall be watts or as recommended by the manufacturer.

K. Cooling System: Closed loop, liquid cooled, with radiator factory mounted on engine-generator set mounting frame and integral engine-driven coolant pump.
   1. Fan and Core: Nonferrous-metal construction sized to contain expansion of total system. Blower type fan, sized to maintain safe engine temperature in ambient temperature of 110F. Radiator Airflow Restriction: 0.5 inches (12.7 mm) of water, maximum.
   2. Coolant: Solution of 50 percent ethylene-glycol-based antifreeze and 50 percent water, with anti-corrosive additives.
   3. Provide expansion tank with gage glass and petcock, and self-contained, thermostatic-control temperature control valve.

L. Engine Starting: DC starting system with positive engagement, number and voltage of starter motors in accordance with manufacturer's instructions. Include remote starting control circuit, with MANUAL-OFF-REMOTE selector switch on engine-generator control panel. Provide the following accessories:
   1. Battery: Voltage to match starter with capacity for three cranking cycles without recharge. Provide with battery cables and acid resistant battery tray.
   2. Battery-Charging Alternator: Factory mounted on engine with solid state voltage regulation.
   3. Remote Start Circuit Monitoring: Provide continuous monitoring of the generator start circuits. A failure shall initiate visual and audible alarms at the generator, remote annunciators, and start the generator.
   4. BC- Battery Charger: Current limiting type designed to float at 2.17 volts per cell and equalize at 2.33 volts per cell. Include overload protection, full wave rectifier, DC voltmeter and ammeter, and 120 volts AC fused input. Provide wall-mounted enclosure to meet ANSI/NEMA 250, Type 1 requirements.

M. Exhaust System: Industrial type silencer (20 to 75 Hz frequency range; 87 dBA max at 25 feet (762 cm)), side inlet with muffler companion flanges and flexible stainless steel exhaust fitting, suitable for horizontal orientation, sized in accordance with engine manufacturer's instructions. Silencer shall include a threaded opening for connection of ¾" drain line. Opening shall be flush on inside of silencer.

N. The packaged engine generator shall comply with the current Environmental Protection Agency EPA Emissions standards.

O. Engine Accessories: Fuel filter, lube oil filter, intake air filter, lube oil cooler, fuel transfer pump, fuel priming pump, gear-driven water pump. Include fuel pressure gauge, water temperature gauge, and lube oil pressure gauge on engine-generator control panel.

P. Mounting: Provide unit with suitable spring-type vibration isolators.

2.04 GENERATOR

A. Generator: ANSI/NEMA MG 1; three phase, re-connectible brushless synchronous generator with brushless exciter and PMG alternator excitation.

B. Rating: As indicated on the drawings, at 0.8 power factor, 60 Hertz at RPM to match engine rating.

C. Insulation: ANSI/NEMA MG 1, Class F.

D. Temperature Rise: 105C continuous.

E. Enclosure: ANSI/NEMA MG 1; open drip-proof.

F. Voltage Regulation:
   1. Include solid-state type voltage regulator, separate from exciter to match engine and generator characteristics, with voltage regulation ±1 percent from no load to full load. Include manual controls to adjust voltage drop ±5 percent voltage level, and voltage gain.

G. Windings: Two-thirds pitch stator winding and fully linked amortisseur winding.

H. Strip Heater: Thermostatically controlled unit arranged to maintain stator windings above dew point.

2.05 CONTROLS AND INDICATION

A. 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 generator set. Mounting method shall isolate the control panel from generator-set vibration.

B. Ground Fault: Provide ground fault sensing at the generator. The sensor shall be located ahead of the generator service disconnect. Provide a ground fault indication on the engine-generator control panel. Provide an instruction nameplate at the control panel.
   1. Instruction nameplate: Provide operational instructions for a ground fault indication as approved by the local Authority Having Jurisdiction.

C. GCP-; Engine-Generator Control Panel: ANSI/NEMA 250, Type 1 generator mounted control panel enclosure with engine and generator controls and indicators. Include provision for padlock and the following equipment and features:
   1. Alarm indication as required by NFPA 110 for a Level 2 system.
   2. AC frequency meter.
   3. AC output voltmeter with phase selector switch.
   4. AC output ammeter with phase selector switch.
   5. Output voltage adjustment.
   6. DC voltmeter (alternator battery charging).
   7. Engine start/stop selector switch.
   8. Engine running time meter.
   9. Oil pressure gauge.
   10. Engine coolant temperature gauge.
   11. Shut down devices for overspeed, coolant high-temperature, coolant low-level, and oil low-pressure.
   12. Fuel derangement alarm.
   13. Generator overload.
   14. Auxiliary Relay: 3PDT, operates when engine runs, with contact terminals prewired to terminal strip.
   15. Remote Alarm Contacts: Pre-wire SPST contacts to terminal strip for remote alarm functions required by ANSI/NFPA 99.
   16. Ground fault indication.
   17. Generator control and start signal failure.
   18. 80% load alarm.
   19. Key switch, three-position selection switch.

2.06 ACCESSORIES

A. Generator Circuit Breaker: Molded or insulated case, service-rated thermal-magnetic type; 100% rated breaker complying with NEMA AB1 and UL 489. The disconnect shall simultaneously open all associated ungrounded conductors and be lockable in the open position.
   1. Tripping Characteristic: Designed specifically for generator protection.
   2. Trip Rating: Matched to generator rating.
   3. Shunt Trip: Connected to trip breaker when generator is shut down by other protective devices.
   4. Mounting: Provide freestanding enclosure or mount integrally with control and monitoring panel.
   5. The disconnecting means shall also shut down the prime mover, disable all start control circuits, and be configured with a mechanical reset.

B. EPO; Remote Manual Stop Station (Emergency Power Off EPO): Provide a remote manual stop station with weather proof stainless steel or die cast housing, red mushroom button - push to stop operation, breakable cover/lens to access mushroom button, 120-volt rated. The manufacturer shall provide automatic monitoring of the EPO switch. Placing the EPO switch in the "Generator Powered OFF" status shall initiate a visual and audible alarm at each generator annunciator panel.
   1. The Remote Manual Stop Station may be located within the generator enclosure when allowed by code. Provide an engraved plastic nameplate "EMERGENCY DISCONNECT - define location", red background, white letters, minimum 4" letters. Provide one nameplate on each side of the generator enclosure with accessible doors.

2.07 RADIATOR MOUNTED LOAD BANK

A. The generator load bank shall be a completely self-contained unit that includes all resistive load elements, load control devices, load element branch circuit fuse protection, terminal, system protection devices and NEMA enclosure.

B. System protection shall include protection against overheating by disconnecting the load elements and activating an alarm. Load element control shall be a magnetic contactor with fuses. A remote load dump circuit shall remove the load bank upon opening of a contact in the automatic transfer switches.

C. Control power shall be derived internally from the main load bus. Control and protective circuits shall operate at 120 volt via a control power transformer and shall be fused.

D. The load bank shall be installed within the air outlet of the engine unit-mounted radiator. Coordinate mounting with ventilation contractor.

E. The control section shall be thermally isolated from the load elements and airflow. Load bank power and control wiring shall be 150C XLP insulated.

F. Load Bank Rating:
   1. Capacity: 100KW, 1.0 power factor.
   2. Load Steps: 25 KW.
   3. Voltage: 480 volts AC, 3 phase 3 wire plus ground.
   4. Load Bank Controls:
      a. Manual controls including:
         1) Power ON/OFF switch
         2) Master load ON/Off switch
         3) Load step control switches
         4) Over-temperature alarm indicator.

G. Load Bank Wiring:
   1. Contractor shall wire load bank power and controls. Wire remote load dump control to all automatic transfer switches connected to generator distribution.
      a. Manufacturers:
         1) Simplex, Inc.
         2) LBD series
         3) Avtron Loadbank, Inc. K711 series.

2.08 OUTDOOR GENERATOR-SET ENCLOSURE SKIN-TIGHT

A. Prefabricated or pre-engineered skintight enclosure with the following features:
   1. Construction: Reinforced galvanized steel, metal clad, integral structural steel framed housing anchored to a concrete foundation. Panelized aluminum housing with integral structural framing anchored to a concrete foundation. Construction shall allow access to control panels and service points. The panels shall enclose all components, including intake/exhaust louvers and sound attenuators. Extend the enclosure base frame as required for panels.
   2. The generator control panel shall be located no greater than 5'-0" above finished grade for ease of access.

3. Structural Design and Anchorage: Wind resistant up to 100 mph.
4. Louvers: Equipped with bird screen and filter arranged to permit air circulation when engine is not running while excluding exterior dust, birds, and rodents. Motor operators shall be spring open, power close operating at 24 volts DC. The louvers shall be connected to the generator starting batteries through appropriate control relays. Louvers shall not extend outside main generator enclosure.
5. Hinged Doors: Provide a minimum of four doors with padlocking provisions. Single doors shall be 36" wide and 84" high. Double doors shall be 60" wide and 84" high. As standard, doors shall include rain-rail moldings above all door openings, recessed, keyed mortise locks, panic bar door hardware and full weather-stripping. Doors shall be removable.
6. Thermal Insulation: Manufacturer's standard materials and thickness selected in coordination with space heater to maintain winter interior temperature within operating limits as required by engine-generator-set components.
7. Fuel Tank Vent: Provide vent piping from the fuel tank to the exterior of the enclosure.
8. Fuel Fill: Provide fill access on the exterior of the enclosure at an elevation not to exceed 5'-0" above finished grade.
9. The exhaust system silencer shall be installed within the enclosure housing.
10. Acoustical Treatment: Provide acoustical treatment of the generator enclosure including wall panels, intake and exhaust air paths, ventilation openings, and tailpipe exhaust. Maximum sound level horizontally from the generator set shall be 95dBA at 33 feet (1005.84 cm) in a hemispherical free field in the configuration shown on the drawings. Sound attenuators shall be concealed within the enclosure panels. Panels shall extend from the enclosure base frame to the height of the generator section.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces are ready to receive work and field dimensions are as shown on the drawings.

B. Verify that required utilities are available in proper location and ready for use.

C. Beginning of installation means installer accepts existing conditions.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install remote manual stop station in location shown on plans. Provide 120 Volt power and wiring in conduit as required. Coordinate installation with the manufacturer approved shop drawings and wiring diagrams. The remote manual stop station shall shunt trip the generator mounted circuit breaker and signal the engine prime mover to stop.

C. The A-B-C phase rotation of the generator source shall match the A-B-C phase rotation of the utility source. The Contractor shall verify the generator and utility phase rotation match to prevent three phase motors and similar loads from operating backwards while being served by the generator.

D. Provide field supplies and installation of miscellaneous piping, wiring, loose shipped accessories, and other components for a turn-key and complete system. Example, provide field piping for non-ingestive crankcase ventilation system when required. Field coordinate pipe routing through the roof or side wall with manufacturer requirements and engineer.

3.03 FIELD QUALITY CONTROL

A. Field inspection and testing will be performed under provisions of Section 26 0500 and in compliance with NFPA 110 requirements.

B. Provide portable test bank for full load test, if required. Simulate power failure including operation of transfer switch, automatic starting cycle, and automatic shutdown, and return to normal.

C. Fill fuel tank prior to start of test.

D. The on-site installation test shall be conducted as follows:
   1. With the prime mover in a "cold start" condition and the emergency load at standard operating level, a primary power failure shall be initiated by opening all switches or breakers supplying the primary power to the building or facility.
   2. The test load shall be that load that is served by the Emergency Power Supply System (EPSS).
   3. The time delay on start shall be observed and recorded.
   4. The cranking time until the prime mover starts and runs shall be observed and recorded.
   5. The time taken to reach operating speed shall be observed and recorded.
   6. The voltage and frequency overshoot shall be recorded.
   7. The time delay on transfer to emergency power for each switch shall be recorded. Life safety and critical branch transfer switches must transfer within 10 seconds.
   8. The time taken to achieve a steady-state condition with all switches transferred to the emergency position shall be observed and recorded.
   9. The voltage, frequency, and amperes shall be recorded.
   10. The prime mover oil pressure and water temperature shall be recorded, where applicable.
   11. The battery charge rate shall be recorded at 5-minute intervals for the first 15 minutes and at 15-minute intervals thereafter.
   12. When primary power is returned to the building or facility, the time delay on retransfer to primary for each switch with a minimum setting of 5 minutes shall be recorded.
   13. The time delay on the prime mover cool down period and shutdown shall be recorded.
   14. Allow prime mover to cool for 5 minutes.
   15. A load shall be applied for 4 hours total. The building load shall be permitted to serve as part or all of the load, supplemented by a load bank of sufficient size to provide a load equal to 100 percent of the nameplate rating of the Emergency Power Supply (EPS), less applicable derating factors for site conditions. Observe and record load changes and the resultant effect on voltage and frequency.
   16. The full load test shall be initiated immediately after the cooling time has expired by any method that starts the prime mover and, immediately upon reaching rated rpm, picks up 100 percent of the nameplate kW rating on one step, less applicable derating factors for site conditions.
   17. During test, record the following at 5-minute intervals for the first 15 minutes and every 15 minutes for the rest of the test:
      a. Kilowatts
      b. Amperes
      c. Voltage
      d. Frequency
      e. Coolant temperature
      f. Enclosure temperature (interior)
      g. Oil pressure
      h. Engine exhaust temperature
      i. Engine inlet temperature
      j. Oil Temperature
      k. Battery charge rate
   18. Upon completion of the test and after a cool down period, the crank/rest cycle shall be tested.
      a. Any method recommended by the manufacturer for the cycle crank test shall be utilized to prevent the prime mover from running.
      b. The control switch shall be set at "run" to cause the prime mover to crank.
      c. The complete crank/rest cycle shall be observed and recorded.
   19. Test alarm and shutdown circuits by simulating conditions.

E. Contractor shall fill fuel tanks upon completion of test.

F. Testing documentation shall be submitted to the Engineer for review and approval.

G. Generator testing worksheets are included with this specification section.

3.04 MANUFACTURER'S FIELD SERVICES

A. Prepare, start, test, and adjust systems under provisions of Section 26 0500.

B. Provide UL field inspection of generator.

3.05 COMMISSIONING: ON-BOARD GENERATOR PARALLELING CONTROL

A. Prepare, start, test, and adjust systems under provisions of Section 26 0500. The on-board paralleling startup, testing, and commissioning may be conducted with other startup, testing, and commissioning requirements of this specification.

B. Provide on-site manufacturer representative for on-board generator paralleling system startup, testing, and commissioning.

C. Simulate a utility power loss test of the EPSS and on-board generator paralleling control system.
   1. Refer to the emergency power system sequence of operation schedule on the drawings.
   2. Report and document deviations from the sequence of operation schedule, system adjustments, and deficiencies.
   3. Obtain and Submit Authority Having Jurisdiction AHJ observation and certificate of acceptable emergency power system operation when required for facility occupancy certificate.

3.06 ADJUSTING

A. Adjust generator output voltage and engine speed.

3.07 CLEANING

A. Clean work under provisions of Section 26 0500.

B. Clean engine and generator surfaces. Replace oil and fuel filters.

3.08 DEMONSTRATION

A. Provide systems demonstration. Coordinate the demonstration schedule with the Owner and Engineer.

B. Describe loads connected to emergency and standby systems and restrictions for future load additions.

C. Simulate power outage by interrupting normal source and demonstrate that system operates to provide emergency and standby power.

END OF SECTION 263213

SECTION 263600
TRANSFER SWITCH

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Automatic transfer switch with delayed transition ATS-#

1.02 REFERENCE STANDARDS

A. NEMA ICS 1 - Industrial Control and Systems General Requirements; 2022.

B. NEMA ICS 2 - Industrial Control and Systems Controllers, Contactors and Overload Relays Rated 600 Volts; 2008 (Reaffirmed 2020).

C. NFPA 99 - Health Care Facilities Code; 2024, with Errata.

D. NFPA 110 - Standard for Emergency and Standby Power Systems; 2025.

E. UL 1008 - Transfer Switch Equipment; Current Edition, Including All Revisions.

1.03 RELATED SECTIONS AND WORK

A. Refer to the Transfer Switch Schedule for rating and configuration.

1.04 QUALITY ASSURANCE

A. Manufacturer: Company specializing in automatic transfer equipment with three (3) years documented experience.

1.05 REFERENCES

A. NEMA ICS 1 - General Standards for Industrial Control and Systems

B. NEMA ICS 2 - Standards for Industrial Control Devices, Controllers, and Assemblies

C. NEMA ICS 6 - Enclosures for Industrial Controls and Systems

D. NEMA ICS 10 - Guide to Application of Low-Voltage Automatic Transfer Switch Equipment

E. UL 1008 - Standard for Automatic Transfer Switches

F. NFPA 99 - Health Care Code

G. NFPA 110 - Standard for Emergency and Standby Power Systems

1.06 SUBMITTALS

A. Submit shop drawings and product data under provisions of Section 26 0500.

B. Submit product data for transfer switches showing overall dimensions, electrical connections, electrical ratings, and environmental requirements.

C. Submit manufacturer's installation instructions under provisions of Section 26 0500.

1.07 OPERATION AND MAINTENANCE DATA

A. Submit operation and maintenance data under provisions of Section 26 0500.

B. Include instructions for operating equipment.

C. Include instructions for operating equipment under emergency conditions when engine generator is running.

D. Identify operating limits which may result in hazardous or unsafe conditions.

E. Document ratings of equipment and each major component.

F. Include routine preventive maintenance and lubrication schedule.

G. List special tools, maintenance materials, and replacement parts.

1.08 REGULATORY REQUIREMENTS

A. Conform to applicable code for emergency and standby electrical systems.

PART 2 PRODUCTS

2.01 SERVICE CONDITIONS, ENCLOSURE, AND RATINGS

A. Service Conditions: NEMA ICS 1. Suitable for use as service entrance equipment. Provide line side (service style) barriers.

B. Enclosure: NEMA ICS 6; Type 1 or per transfer switch schedule.

C. Ratings: Refer to the electrical diagrams for the Withstand and Close Ratings WCR available interrupting capacity (AIC) at the transfer switch. The transfer switch shall be series rated with the equipment feeding the transfer switch. The series rating shall be the larger of the two Short Circuit Current Ratings SCCR values when the SCCR rating of the equipment feeding the normal and emergency sides of the transfer switch is not equal. Series rating with upstream devices shall be allowed per UL 1008.

2.02 AUTOMATIC TRANSFER WITH DELAYED TRANSITION AND BYPASS/ISOLATION SWITCH

A. Automatic transfer switch, microprocessor controlled, three-position switch mechanism with bypass isolation, delayed transition and load shed capable, with local manual operation.

B. Acceptable Manufacturers:
   1. Schneider Electric ASCO 7ATB Series
   2. Siemens Russelectric RTB Series
   3. ABB Zenith ZBTS / ZBTE Series
   4. Caterpillar CBTS Series
   5. Cummins BPTC Series

C. Description: NEMA ICS 2; automatic transfer switch with center position delayed transition, center position off capable for load shed, and manual bypass switch.

D. Configuration: Draw-out type electrically-operated, mechanically-held transfer switch with manually-operated CONNECTED, TEST, and DISCONNECTED draw-out positions, and with mechanically-operated, mechanically-held transfer switch connected to bypass automatic switch.

E. Bypass Switch Ratings: Match automatic transfer switch for electrical ratings.

2.03 AUTOMATIC SEQUENCE OF OPERATION

A. Initiate Time Delay to Start Alternate Source Engine Generator: Upon initiation by normal source monitor.

B. Time Delay to Start Alternate Source Engine Generator: 0 to 10 seconds, adjustable.

C. Initiate Transfer Load to Alternate Source: Upon initiation by normal source monitor and permission by alternate source monitor.

D. Time Delay Before Transfer to Alternate Power Source: 0 to 30 seconds, adjustable.

E. Initiate Retransfer Load to Normal Source: Upon permission by normal source monitor.

F. Time Delay Before Transfer to Normal Power: 0 to 30 minutes, adjustable; bypass time delay in event of alternate source failure.

G. Time Delay Before Engine Shut Down: 0 to 30 minutes, adjustable, of unloaded operation.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces are ready to receive work.

B. Verify field measurements are as instructed by the manufacturer.

C. Verify that required utilities are available, in proper location, and ready for use.

D. Beginning of installation means acceptance of existing conditions.

3.02 CONTROL AND SIGNAL CABLING

A. Provide control and signal cabling per manufacturer recommendations for the following systems components:
   1. Remote annunciator.
   2. Elevator controller. Provide wiring to elevator controller for emergency source mode and emergency to normal pre-signal.
   3. Generator start signal. The generator start signal cabling for the following transfer switches shall be fire protected for a minimum of 2 hours using an approved method:
      a. Equipment branch transfer switches
      b. Approved Methods:
         1) Raceway or cable encased in a minimum of 2 inches (50.8 mm) of concrete cover.
         2) Listed fire resistive raceway / cable system.
         3) Raceway / cable is protected by a listed electrical circuit protective system.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions.

END OF SECTION 263600

SECTION 264300
SURGE PROTECTION DEVICES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. This section describes materials and installation requirements for factory and field wired low voltage surge protection devices (SPD) for the protection of all AC electrical circuits. SPD equipment to be installed at designated service entrance equipment, distribution panels, and electronic equipment.

1.02 REFERENCE STANDARDS

A. IEEE C62.41.2 - IEEE Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and less) AC Power Circuits; 2002 (Corrigendum 2012).

B. UL 67 - Panelboards; Current Edition, Including All Revisions.

C. UL 96A - Standard for Installation Requirements for Lightning Protection Systems; Current Edition, Including All Revisions.

D. UL 248-1 - Low-Voltage Fuses - Part 1: General Requirements; Current Edition, Including All Revisions.

E. UL 1283 - Standard for Electromagnetic Interference Filters; Current Edition, Including All Revisions.

F. UL 1449 - Standard for Surge Protective Devices; Current Edition, Including All Revisions.

1.03 QUALITY ASSURANCE

A. The specified unit shall be designed, manufactured, tested and installed in compliance with the above references. The unit shall be "Listed by Underwriters Laboratories" to UL 1449.

B. Each unit shall be designed and manufactured by a qualified manufacturer of power conditioning equipment. The qualified manufacturer must have been engaged in the design and manufacturer of such products for a minimum of five years.

1.04 REFERENCES

A. ANSI/IEEE C62.33 - IEEE Guide on Testing of MOV components

B. ANSI/IEEE C62.35 - IEEE Guide on Testing of SAD components

C. ANSI/IEEE C62.41 - IEEE Recommended Practice on Surge Voltage in Low Voltage AC Power Circuits

D. ANSI/IEEE C62.45 - IEEE Guide on Surge Testing for Equipment Connected to Low Voltage AC Power Circuits

E. ANSI/UL 1449 Latest Edition - UL Standard for Safety for Surge Protective Devices

F. CBEMA - Computer Business Equipment Manufacturers Association

G. IEC 664 - International Engineering Consortium, Standard for Clamping Voltage

H. CEC California Electrical Code

I. UL 67 - Listed for Internal Panelboard Transient Voltage Surge Suppressors

J. UL 96A - Devices listed as approved for secondary surge arrestors (VZCA)

K. UL 248-1 - Fusing

L. UL 1283 - Electromagnetic Interference Filters, Fifth Edition

1.05 SUBMITTALS

A. Shop Drawings: Should include device dimensions, mounting requirements including wire size and over-current protection device rating, nameplate nomenclature, electrical ratings, short circuit current rating, and test results as indicated below under "Testing, Warranty and Life Expectancy" as provided by an independent test lab or a UL certified test lab for the

category(ies) of suppression device(s) specified using the appropriate IEEE test wave. Product data sheets with installation instructions for each size and type of device are required. Shop drawings submitted without the testing data as required by section this section will be rejected.

B. Fuse information: Provide fuse information if required for operation. Include size, manufacturer, time-current chart responses to UL 1449 testing requirements, maximum surge protection capability per mode and phase as limited by the fuse, and verification of repetitive surge protection device operation without system degeneration greater than 10%.

1.06 SPARE PARTS

A. Surge Protection Modules: Furnish 1 replacement module for each type installed.

B. Fuses: Furnish to the Owner 3 spare fuses of each type and rating installed.

1.07 TESTING, WARRANTY AND LIFE EXPECTANCY

A. Manufacturer must provide independent testing on repetitive capability and maximum surge current rating of service entrance suppressor units. This shall be performed at a nationally recognized lab not affiliated with the manufacturer.
   1. Single pulse surge current capacity: Single pulse surge current tested in a mode at rated surge currents.
   2. Single pulse surge current capacity test: An initial UL 1449 defined 1.2 x 50µs, 6000V open circuit voltage waveform and an 8 x 20µs, 500A and 3kA short circuit current waveform shall be applied to benchmark the unit's suppression voltage (VPR).
   3. A single 8 x 20µs waveform pulse of maximum rated surge current per mode shall then be applied. To complete the test, another UL 1449 surge shall be applied to verify the unit's survival. Survival is achieved if the suppression voltage measured from the two UL 1449 surges does not vary by more than 10%.

B. Minimum Repetitive Surge Current Capacity:
   1. Service entrance suppressor units should be tested repetitively at an independent lab to verify repetitive capacity.
   2. Minimum Repetitive Surge Current Capacity Test:
      a. An initial UL 1449 surge defined as 1.2 x 50µs, 6000V open circuit voltage waveform and an 8 x 20µs, 500A and 3kA short circuit current waveform shall be applied to benchmark the unit's suppression voltage.
      b. A repetitive number of ANSI/IEEE C62.41.2-2002 (Category C3) surges, defined as a 1.2 x 50µs 10kV or 20kV open circuit voltage waveform and an 8 x 20µs 10,000A short circuit current waveform, shall then be applied at one-minute intervals.
      c. To complete the test, another UL 1449 surge shall be applied to verify the unit's survival.
   3. Survival is achieved if the suppression voltage (VPR) does not vary by more than 10%.
   4. Proof of such testing shall be the test log generated by the surge generator.

C. Provide UL 1449 classification white sheet pages indicating the VPR (voltage protection rating) for each SPD unit submitted for this product using the 6kV/3kA combination wave surge.

D. Warranty: Ten (10) years. Includes workmanship, installation and programming.

E. No scheduled parts replacement or preventative maintenance shall be required.

PART 2 PRODUCTS

2.01 DESCRIPTION

A. General: The unit shall provide transient voltage suppression, surge current diversion and high-frequency noise attenuation, when connected in parallel to the facilities distribution system. The unit MCOV shall not be less than 115% of the nominal system voltage. Operating frequency shall be for a 60 Hz system. The unit shall provide protection in all normal modes for "wye" and "delta" systems.

B. Short Circuit Current Rating: Provide factory label for SCCR rating. The short circuit current rating shall be the larger of the listed value on the drawings or as required by the equipment protected.

2.02 RATINGS

A. SPD-; Service Entrance Suppressors:
   1. For 277/480-volt, 3 phase, 4 wire, type 2, category C3 unit.
      a. Surge current capacity: 80,000/160,000 amps per protection mode/phase
      b. Nominal Discharge Current: 20 kA.
      c. Mounting: Refer to the drawings.
      d. Voltage Protection Rating: Refer to requirements below.
      e. Components: Minimum component size of 20mm thermally protected metal oxide varistors (MOV).
      f. Disconnect: Surge-rated disconnect with 200,000 SCCR.
   2. Manufacturers:
      a. Current Technology Current Guard Plus
      b. ASCO Power Technologies 400 Series
      c. LEA International LSS Series

B. Voltage Protection Rating:
   1. Protection modes and UL 1449 voltage protection rating for surge suppression units per each mode (L-N, L-L, L-G, and N-G as appropriate).
      a. 277/480 Volt, 3 phase, 4 wire.1200 Volt L-N, L-G, N-G and 1800 Volt L-L
      b. 480 Volt, 3 phase, 3 wire. 2000 Volt L-G, L-L
      c. 120/208 Volt, 3 phase, 4 wire. 700 Volt L-N, N-G, 800 Volt L-G and 1200 Volt L-L

C. EMI/RFI Noise Rejection or Filtering:
   1. Each unit shall include a UL 1283 first order, high-frequency filter for noise filtering between 10 KHz and 100 MHz.

D. Indication:
   1. Each unit shall include solid-state indicators with externally mounted LED visual status indicators that indicate on-line status of each protection mode of the unit.
   2. Each unit shall include a visual indicator that indicates the unit is functioning properly and providing protection.
   3. Each unit shall contain form "C" contacts for remote indication of an alarm status.

E. Fuses:
   1. Use fuses recommended by the manufacturer to satisfy repetitive UL 1449 operation of the surge suppression unit.
   2. Fuses shall be rated 200, 000 AIC minimum interrupting capacity.

PART 3 EXECUTION

3.01 INSPECTION

A. Examine equipment for size and type of surge protection device to be used to ensure physical compatibility.

B. Inspect surge protection device for any signs of physical damage due to shipping or handling before installing surge protection device.

3.02 INSTALLATION

A. Mounting Location:
   1. The unit shall be installed as close as practical to the panel secondary lugs in accordance with applicable national/Local Electrical Codes and the manufacturer's recommended installation instructions. Connect the unit to the panel using a conduit nipple. Flush mount the unit in the front of the switchboard. Mount unit directly across from the breaker or disconnect serving it.

B. Connections:

1. Conductors from the protected bus to the unit shall not be any longer than necessary avoiding unnecessary bends. The conductor leads shall be twisted together and as short as possible. Connection shall be with mechanical lugs for each phase, neutral, and ground if applicable. Contractor shall provide wire and circuit breakers sized per the approved manufacturer's requirements. Maximum lead length from protected bus to surge protection device shall be per manufacturer's requirements, but no greater than 5'-0".
2. The surge protection unit shall be isolatable from the electrical distribution system via 3 pole circuit breaker mounted in the switchboard/panelboard or be equipped with a factory supplied integral fused switch or circuit breaker.
3. Neutral and ground shall not be bonded together at secondary panelboard locations.

C. General:
1. Check unit for proper operation of protection and indication under start-up.
2. Check unit to ensure all MOVs for each mode of protection are operational. Verify integral fuse links are operational and have not melted.
3. Surge suppression devices shall not be installed ahead of the main service disconnect(s).
4. Install fuses in all fuse holders and fused disconnects internal to the surge protection unit. Use fuses recommended by the manufacturer to satisfy repetitive UL 1449 operation of the surge suppression unit. External fusing of the surge protection device is not allowed.
5. Coordinate location of surge protection device to allow adequate clearances for maintenance.
6. Manufacturer service phone number shall be posted on the front of the surge protection device.

END OF SECTION 264300

Division 31 Earthwork

SECTION 310513
COMMON FILL

PART 1 GENERAL

1.01 REFERENCE STANDARDS

A. ASTM D2487 - Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System); 2017, with Editorial Revision (2020).

B. ASTM D3282 - Standard Practice for Classification of Soils and Soil-Aggregate Mixtures for Highway Construction Purposes; 2015.

C. ASTM D3740 - Standard Practice for Minimum Requirements for Agencies Engaged in Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction; 2023.

1.02 SECTION INCLUDES

A. Common fill material.

1.03 REFERENCES

A. ASTM Standards:

1. C136 Sieve Analysis of Fine and Coarse Aggregates.
2. D448 Classification for Sizes of Aggregate for Road and Bridge Construction.
3. D1883 CBR (California Bearing Ratio) of Laboratory-Compacted Soils.
4. D2487 Classification of Soils for Engineering Purposes.
5. D2844 Resistance R-Value and Expansion Pressure of Compacted Soils.
6. D3282 Classification of Soils and Soil-Aggregate Mixtures for Highway Construction Purposes.
7. D3740 Evaluation of Agencies Engaged in Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction.
8. F1647 Organic Matter Content of Putting Green and Sports Turf Root Zone Mixes.

1.04 SUBMITTALS

A. General. If a change in source of material is required, submit name of Supplier, source and gradation analysis of material before delivery to site.

B. Topsoil. Submit certification from topsoil Supplier assuring topsoil product meets requirements in this Section.

C. Borrow, granular borrow, granular backfill borrow, recycled fill, sand, gravel. Before delivering material to site, identify:

1. Name of Supplier and source.
2. Gradation, classification and CBR.
3. Percent composition of reclaimed bitumionous concrete or Portland cement concrete included in the mix.

D. Slag, pumice, scoria. Identify name of supplier, source, and density.

1.05 QUALITY ASSURANCE

A. Use a laboratory that complies with ASTM D3740 and Section 01 45 00 requirements.

B. Reject fill products that do not meet requirements of this section.

C. Remove product found defective after installation and install acceptable product at no additional cost to OWNER.

1.06 ACCEPTANCE

A. General:

B. Acceptance is by Lot. One (1) lot is one (1) day productionl

C. Dispute resolution, Section 01 35 10.

D. Roadway Backfill: Sub-lot size is 5,000 tons.

PART 2 PRODUCTS

2.01 BORROW

A. Classifications A-1-a through A-4, ASTM D3282.

2.02 GRANULAR BORROW

A. Classifications A-1-a, A-1-b, A-2-4, or A-3, ASTM D3282.

B. Material meets design CBR-value (((ASTM D1883))) or R value (ASTM D2844) for suitability of source, not for project control testing.

2.03 GRANULAR BACKFILL BORROW

A. Classification A-1, ASTM D3282.

B. Well graded.

C. Particle size, two (2) inch maximum.

D. Material meets design CBR-value (((ASTM D1883))) or R value (ASTM D2844) for suitability of source, not for project control testing.

2.04 RECYCLED FILL

A. Material: Pulverized Portland cement concrete, pulverized bitumionous concrete pavement or combination, either mixed with or not mixed with a new aggregate.

B. Gradation: Meet requirements of this section based upon use; e.g. borrow, granular borrow, granular backfill borrow, etc.

2.05 NATIVE

A. When allowed by ENGINEER, material obtained from Excavations may be used as fill, provided organic material, rubbish, debris, and other objectionable materials are removed and CONTRACTOR has submitted the appropriate proctor density data (see Section 31 23 26).

2.06 CLAY

A. Classification CL, CL-ML, or ML, ASTM D2487.

B. Free of organic matter, frozen material, debris, rocks, and deleterious materials.

C. Homogeneous, relatively uniform.

2.07 SAND

A. Friable river or bank aggregate, free of loam and organic matter. Graded as follows.

SIEVE	**PERCENT PASSING BY WEIGHT**
3/8	100
100	**1 – 10**

2.08 GRAVEL

A. Material: Rock, stone, or other high quality mineral particle or combination.

B. Sewer Rock.

NOMINAL SIZE	ASTM SIZE NO.
3.5 TO 1.5”	**1**
2.5 TO 1.5”	**2**
2 TO 1”	**3**
1.5 TO 3/4”	**4**
1 TO 1/2"	**5**

2.09 PEA GRAVEL.

NOMINAL SIZE	ASTM SIZE NO.
3/4 TO 3/8”	6
1/2 TO NO. 4	7
3/8 TO NO. 8	8
NO. 4 TO NO. 16	9
NO. 4 (SCREENINGS)	10

2.10 TOPSOIL

A. Chemical Characteristics:
   1. Acidity and alkalinity range: pH 5.5 to 7.7

B. Soluble Salts: Less than 2.0 mmhos/cm.

C. Sodium Absorption Ratio (SAR): less than 3.0

D. Nitrogen (NO3N): 48 ppm minimum

E. Phosphorus (P): 11 ppm minimum

F. Potash (K): 130 ppm minimum

G. Iron (Fe): 5.0 ppm minimum

H. Physical Characteristics:
   1. Fertile, loose, friable.
   2. Free of weeds, subsoil, lumps or clods of hard earth, plants or their roots, sticks, toxic minerals, chemicals and stones greater than 1-1/2 inch (38 mm) diameter.
   3. Composition, ASTM D2487:

MATERIAL	PERCENT
SAND	**15 – 60**
SILT	**10 – 70**
CLAY	**5 – 30**
ORGANIC MATTER	**2 - 5**

Humus determined by ASTM F1647. Peat may be used as an organic amendment to meet the humus requirements.

2.10 SLAG, PUMICE, SCORIA

2.11 SOURCE QUALITY CONTROL

A. Verify gradation, ASTM C136.

B. Select samples on a random location and time basis.

C. If tests indicate materials do not meet specified requirements, change materials and retest at no additional cost to OWNER.

PART 3 EXECUTION NOT USED

END OF SECTION 310513

SECTION 312200
GRADING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Rough grading.

B. Fine grading.

1.02 RELATED REQUIREMENTS

A. Section 312316 - Excavation.

1.03 PRICE AND PAYMENT PROCEDURES

A. Unit Prices:
   1. See Section 012200 - Unit Prices for additional requirements.

1.04 REFERENCE STANDARDS

A. ASTM D2487 - Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System); 2017, with Editorial Revision (2020).

PART 2 PRODUCTS

2.01 MATERIALS

A. Gravel: Excavated on-site.
   1. Graded according to ASTM D2487 Group Symbol GW, GP, or SP.

PART 3 EXECUTION

3.01 ROUGH GRADING

A. Excavate and fill subgrade material to elevations indicated on plans.

B. Remove and replace unsuitable materials as specified fill.

3.02 FINE GRADING

A. Scrape and spread subgrade material uniformly smooth and without disruptions as indicated on drawings.

B. Slopes: Transition smoothly to adjacent areas.

END OF SECTION 312200

SECTION 312316
EXCAVATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Excavation.

1.02 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Field Quality Control Submittals: Document visual inspection of loadbearing excavated surfaces.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify survey bench mark elevations are as indicated on drawings.

3.02 EXCAVATION

A. Grade top perimeter of excavation to prevent surface water collection.

B. General Excavation:
   1. Excavate to indicated contours, elevations, and grades.

C. Excavation to accommodate foundations, underground tanks, and underground utilities.
   1. Excavate to specified elevations.

D. Notify Engineer of unexpected subsurface conditions and discontinue affected work in area until notified to resume work.

3.03 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements for additional requirements.

B. Provide access for visual inspection of loadbearing excavated surfaces by Engineer before proceeding with work.

END OF SECTION 312316

SECTION 312323
FILL

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Filling, backfilling, and compacting for building volume below grade, footings, slabs-on-grade, paving, and utilities within the building.

B. Backfilling and compacting for utilities outside the building to utility main connections.

1.02 RELATED REQUIREMENTS

A. Section 033000 - Cast-in-Place Concrete.

B. Section 312200 - Grading: Site grading.

C. Section 312316 - Excavation: Removal and handling of soil to be re-used.

1.03 PRICE AND PAYMENT PROCEDURES

A. See Section 012200 - Unit Prices, for general requirements applicable to unit prices for earthwork.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

PART 2 PRODUCTS

2.01 FILL MATERIALS

A. General Fill - Fill (Type I): Complying with CALTRANS standard.

PART 3 EXECUTION

3.01 EXAMINATION

A. Identify required lines, levels, contours, and datum locations.

B. Verify areas to be filled are not compromised with surface or ground water.

3.02 PREPARATION

A. Scarify and proof roll subgrade surface to a depth of 6 inches to identify soft spots.

B. Cut out soft areas of subgrade not capable of compaction in place. Backfill with general fill.

C. Compact subgrade to density equal to or greater than requirements for subsequent fill material.

D. Until ready to fill, maintain excavations and prevent loose soil from falling into excavation.

3.03 FILLING

A. Fill to contours and elevations indicated using unfrozen materials.

B. Employ a placement method that does not disturb or damage other work.

C. Systematically fill to allow maximum time for natural settlement. Do not fill over porous, wet, frozen or spongy subgrade surfaces.

D. Maintain optimum moisture content of fill materials to attain required compaction density.

E. Slope grade away from building minimum 2 inches in 10 feet, unless noted otherwise. Make gradual grade changes. Blend slope into level areas.

F. Correct areas that are over-excavated.
   1. Other areas: Use general fill, flush to required elevation, compacted to minimum 97 percent of maximum dry density.

G. Compaction Density Unless Otherwise Specified or Indicated:

H. Reshape and re-compact fills subjected to vehicular traffic.

I. Maintain temporary means and methods, as required, to remove all water while fill is being placed as required, or until directed by the Engineer. Remove and replace soils deemed

unsuitable by classification and which are excessively moist due to lack of dewatering or surface water control.

3.04 FILL AT SPECIFIC LOCATIONS

A. Use general fill unless otherwise specified or indicated.

END OF SECTION 312323

SECTION 312326
COMPACTION

PART 1 GENERAL

1.01 REFERENCE STANDARDS

A. ASTM D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)); 2012 (Reapproved 2021).

B. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN-m/m3)); 2012 (Reapproved 2021).

C. ASTM D3282 - Standard Practice for Classification of Soils and Soil-Aggregate Mixtures for Highway Construction Purposes; 2015.

D. ASTM D3740 - Standard Practice for Minimum Requirements for Agencies Engaged in Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction; 2023.

1.02 SECTION INCLUDES

A. Compaction of granular fill materials.

1.03 REFERENCES

A. ASTM Standards:

1. D698 Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)).
2. D1557 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ftlbf/ft3 (2,700 kN-m/m3))
3. D2216 Laboratory Determination of Water (Moisture) Content of Soil and Rock.
4. D2922 Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
5. D3017 Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).
6. D3282 Classification of Soils and Soil-Aggregate Mixtures for Highway Construction Purposes.
7. D3740 Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction.

1.04 DEFINITIONS

A. A-1 Soil: Defined in ASTM D3282.

B. Modified Proctor Density: The maximum laboratory density, as defined in and determined by ASTM D1557 using procedure A, B or C as applicable.

C. Relative Density (or Relative Compaction): The ratio of field dry density to the maximum laboratory density expressed as a percentage.

D. Standard Proctor Density: The maximum laboratory density, as defined in and determined by ASTM D698 using procedure A, B or C as applicable.

1.05 QUALITY ASSURANCE

A. Use a soil and rock laboratory that complies with ASTM D3740.

PART 2 PRODUCTS NOT USED

PART 3 EXECUTION

3.01 COMPACTION

A. Moisten or dewater backfill material to obtain optimum moisture for compaction.

B. When no density compactive effort is specified, compact the entire area to 95 percent and eliminate unstable zones.

C. Correct deficient compaction conditions. Replace or repair materials and damaged facilities.

3.02 FIELD QUALITY CONTROL

A. Testing: Perform control testing of materials. Perform additional testing at no additional cost to OWNER, for

1. Changes in source of materials or proportions requested by CONTRACTOR, or
2. Failure of materials to meet specification requirements, or
3. Other testing services needed or required by CONTRACTOR.

B. Optimum Soil Density: Use ASTM D2216 and the following industry standards.

1. For A-1 Soils: Method C of ASTM D1557 (Modified Proctor)
2. For All Other Soils: Method C of ASTM D698 (Standard Proctor).

C. Field Density:

1. Use ASTM D3017 and test method C of ASTM D2922 for shallow depth nuclear testing.
2. No density determinations are required on any material containing more than 65 percent material retained on the number 10 sieve or more than 60 percent material retained on the number 4 sieve. In lieu of reporting densities in such cases, report the sieve analysis to document the material type.

3.03 REPORT

A. For each material tested, document the following:

1. Vertical and horizontal location of the test.
2. Optimum laboratory moisture content.
3. Field moisture content.
4. Maximum laboratory dry density.
5. Field density.
6. Percent compaction results.
7. Certification of test results by Independent Testing Agency.

END OF SECTION 312326

Division 32 Exterior Improvements

SECTION 321123
AGGREGATE BASE COURSE

PART 1 GENERAL

1.01 REFERENCE STANDARDS

A. ASTM D2487 - Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System); 2017, with Editorial Revision (2020).

1.02 1.1 SECTION INCLUDES

A. Coarse and fine aggregates are defined in accordance with ASTM D2487. Material property requirements for specific uses are provided in applicable MAG sections.

B. Apparent specific gravity shall be at least 2.50, when tested in accordance with ASTM C127

1.03 SUBMITTALS

A. Submit before use in the Work product data showing riprap source, gradation, aggregate wear and placement technique.

PART 2 PRODUCTS

2.01 COARSE AGGREGATE

A. Rock and gravel shall be clean, hard, sound, durable, uniform in quality, and free of any detrimental quantity of soft, friable, thin elongated, or laminated pieces, disintegrated material, organic matter, oil, alkali, or other deleterious substance. Aggregate sources shall include, but not be limited to alluvial deposits, terrace aggregates, quarry stone, or other suitable sources including recycled products that meet all material test requirements as approved by the Engineer. Aggregate classification shall be made by size as noted herein.

1. Boulders: Particles of rock that will not pass a 12-inch square opening.
2. Cobbles: Particles of rock that will pass a 12-inch square opening, but are retained on a 3-inch square opening.
3. Coarse Gravel: Particles of rock that will pass a 3-inch U.S. standard sieve, but are retained on a 3/4-inch U.S. standard sieve.
4. Fine Gravel: Particles of rock that will pass a 3/4-inch U.S. standard sieve, but are retained on a No. 4 U.S. standard sieve.

2.02 FINE AGGREGATE (SAND)

A. Fine aggregate (sand) shall be fine granular material produced by the crushing of rock or gravel or naturally produced by disintegration of rock and shall be sufficiently free of organic material, mica, loam, clay, and other deleterious substances to be thoroughly suitable for the purpose for which it is intended. Fine aggregates particles shall pass a No. 4 U.S. standard sieve, but are retained on a No. 200 U.S. standard sieve.

2.03 RECLAIMED CONCRETE MATERIAL (RCM)

A. Reclaimed concrete material (RCM) is defined as an aggregate material that is derived from the crushing, processing and classification of Portland cement concrete construction materials recovered, salvaged, or recycled from roadways, sidewalks, buildings, bridges, and other sources.

B. In accordance with Section 7 of AASHTO M-319, RCM shall not contain more than five percent by mass of brick or concrete block and shall be substantially free of wood, metal, plaster, and gypsum board, RCM shall be free of all materials that fall under the category of solid waste or hazardous materials as defined by the state or local jurisdiction. With the approval of the Engineer, these respective quantities may be adjusted if the performance of the RCM is not adversely impacted. RCM may be used alone or uniformly blended with other approved aggregate materials to obtain the applicable performance criteria. RCM shall not be used in Portland Cement Concrete without the prior approval of the Engineer.

2.04 RECLAIMED ASPHALT PAVEMENT (RAP)

A. Reclaimed asphalt pavement (RAP) is defined as all recovered, salvaged or recycled asphalt road waste, large particles or milled material that has been size-reduced, crushed and or screened appropriately, making it reusable. This material shall be of a consistent and relatively clean manner as to not adversely affect the final material usage. RAP may be used alone or uniformly blended with other approved aggregate materials to obtain the applicable performance criteria. RAP shall not be used in Portland Cement Concrete without the prior approval of the Engineer.

PART 3 EXECUTION

3.01 SAMPLING

A. Sampling of aggregates shall be performed in accordance with ASTM D75.

END OF SECTION 321123

Division 33 Utilities

SECTION 330110.58
DISINFECTION OF WATER UTILITY PIPING SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Disinfection of site domestic water lines and site fire water lines specified in Section 331416.

1.02 RELATED REQUIREMENTS

A. Section 221005 - Plumbing Piping: Disinfection of building domestic water piping system.

B. Section 331416 - Site Water Utility Distribution Piping.

1.03 REFERENCE STANDARDS

A. AWWA B300 - Hypochlorites; 2024.

B. AWWA B301 - Liquid Chlorine; 2024.

C. AWWA B302 - Ammonium Sulfate; 2023.

D. AWWA B303 - Sodium Chlorite; 2024.

E. AWWA C651 - Disinfecting Water Mains; 2023.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Disinfection report:
   1. Type and form of disinfectant used.
   2. Date and time of disinfectant injection start and time of completion.
   3. Test locations.
   4. Initial and 24 hour disinfectant residuals (quantity in treated water) in ppm for each outlet tested.
   5. Date and time of flushing start and completion.
   6. Disinfectant residual after flushing in ppm for each outlet tested.

PART 2 PRODUCTS

2.01 DISINFECTION CHEMICALS

A. Chemicals: AWWA B300 Hypochlorite, AWWA B301 Liquid Chlorine, AWWA B302 Ammonium Sulfate, and AWWA B303 Sodium Chlorite.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that piping system and water well has been cleaned, inspected , and pressure tested.

B. Schedule disinfecting activity to coordinate with start-up, testing, adjusting and balancing, demonstration procedures, including related systems.

3.02 DISINFECTION

A. Use method prescribed by the applicable state or local codes, or health authority or water purveyor having jurisdiction, or in the absence of any of these follow AWWA C651.

B. Provide and attach equipment required to perform the work.

C. Inject treatment disinfectant into piping system.

D. Maintain disinfectant in system for 24 hours.

E. Flush, circulate, and clean until required cleanliness is achieved; use municipal domestic water.

F. Replace permanent system devices removed for disinfection.

END OF SECTION 330110.58

SECTION 331416
SITE WATER UTILITY DISTRIBUTION PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Water pipe for site conveyance lines.

B. Pipe valves.

1.02 RELATED REQUIREMENTS

A. Section 099113 - Exterior Painting.

B. Section 260583 - Wiring Connections.

C. Section 330110.58 - Disinfection of Water Utility Piping Systems: Disinfection of site service utility water piping.

1.03 PRICE AND PAYMENT PROCEDURES

A. See Section 012200 - Unit Prices, for additional unit price requirements.

B. Pipe and Fittings: By the linear foot (linear meter). Includes hand trimming excavation, pipe and fittings, bedding, concrete thrust restraints, connection to building service piping, and to municipal utility water source.

C. Valves: By the unit. Includes valve, fittings and accessories.

1.04 REFERENCE STANDARDS

A. AWWA C111/A21.11 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings; 2023.

B. AWWA C115/A21.15 - Flanged Ductile-Iron Pipe with Ductile-Iron or Gray-Iron Threaded Flanges; 2020.

C. AWWA C500 - Metal-Seated Gate Valves for Water Supply Service; 2019.

D. AWWA C509 - Resilient-Seated Gate Valves for Water Supply Service; 2023.

E. AWWA C600 - Installation of Ductile-Iron Mains and Their Appurtenances; 2023.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on pipe materials, pipe fittings, valves and accessories.

C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store valves in shipping containers with labeling in place.

PART 2 PRODUCTS

2.01 OWNER-FURNISHED PRODUCTS

A. New Products: _____.

2.02 WATER PIPE

A. Ductile Iron Pipe: AWWA C151/A21.51:
   1. Fittings: Ductile iron, standard thickness.
   2. Joints: AWWA C111/A21.11, Styrene butadiene rubber (SBR) or vulcanized SBR gasket with rods.

2.03 VALVES

A. Valves: Manufacturer's name and pressure rating marked on valve body.

B. Gate Valves Up To 3 Inches (75 mm):
   1. Brass or Bronze body, non-rising stem, inside screw, single wedge or disc, compression ends, with control rod, post indicator, valve key, and extension box.

C. Gate Valves 3 Inches (75 mm) and Over:
   1. AWWA C500, iron body, bronze trim, non-rising stem with square nut, single wedge, flanged ends, control rod, post indicator, valve key, and extension box.
   2. AWWA C509, iron body, bronze trim, non-rising stem with square nut, single wedge, resilient seat, flanged ends, control rod, post indicator, valve key, and extension box.

PART 3 EXECUTION

3.01 PREPARATION

A. Cut pipe ends square, ream pipe and tube ends to full pipe diameter, remove burrs.

B. Remove scale and dirt on inside and outside before assembly.

C. Prepare pipe connections to equipment with flanges or unions.

3.02 INSTALLATION - PIPE

A. Install ductile iron piping and fittings to AWWA C600.

B. Route pipe in straight line.

C. Install pipe to allow for expansion and contraction without stressing pipe or joints.

D. Slope water pipe and position drains at low points.

3.03 INSTALLATION - VALVES, HYDRANTS, BACKFLOW PREVENTERS

A. Set valves on solid bearing.

B. Center and plumb valve box over valve. Set box cover flush with finished grade.

END OF SECTION 331416

Division 46 Water and Wastewater Equipment

SECTION 464300
VORTEX TABLET CHLORINATOR

PART 1 - GENERAL

1.01 DESCRIPTION:

A. Provide protective coatings as indicated and in compliance with Contract Documents.
   1. Provide sizes and capacities as indicated or specified.

1.02 REFERENCE STANDARDS:

A. National Science Foundation (NSF)
   1. 61: Drinking Water System Components – Health Effects

1.03 SUBMITTALS:

A. Submit the following:
   1. Treatment system layout and cross-section of vessel
   2. Drawings show equipment, piping valves, and devices
   3. Wiring Diagrams
   4. Control Equipment
      a. Panel fabrication and dimension drawings, nameplate legends and wiring and piping schematic diagrams.
      b. Equipment dimensions drawing.
      c. Component specification sheets
      d. Equipment terminal and piping connections
   5. Submit dimensional drawings and equipment showing tanks, piping, valves, and installation details.

B. Operations and Maintenance (O&M) Data:
   1. Instruction manuals including detailed operating sequence descriptions
   2. Parts List
   3. Spare Parts List

1.04 QUALITY ASSURANCE:

A. Comply with the requirements per manufacturers recommendation.

B. Vortex tablet chlorinator shall be the product of one manufacturer.

C. Vortex tablet chlorinator shall be manufacturer's standard cataloged product and modified to provide compliance with the drawings, specifications and service conditions specified and indicated.

D. Shop tests as specified

E. The Contractor shall obtain the vortex tablet chlorinator from the manufacturer, as a complete and integrated package to ensure proper coordination and compatibility and operation of the system.

1.05 DELIVERY, STORAGE AND HANDLING:

A. Comply with the requirements specified herein.
   1. Transport and store media to avoid contamination.
   2. Coordinate delivery with Owner, Engineer, and Contractor.
   3. Pay for delivery, unloading, and if necessary, storage of equipment.
   4. Inspect equipment before and after delivery.

PART 2 - MATERIALS

2.01 MANUFACTURERS

A. Acceptable Manufacturers:
   1. Hammonds
   2. Engineer-Approved Equal

2.02 SYSTEM DESCRIPTION

A. Tablet recommendations: NSF®Std. 60 listed solid calcium hypochlorite only.

B. Performance: Typical 10 – 150 GPM wells and fresh water supply at dosing levels up to 2 PPM

C. Chlorine delivery: 0 – .15 pounds of chlorine per hour. Delivery will vary depending on size and manufacture of calcium hypochlorite tablet.

D. Solution metering pump:
   1. Type: Diaphragm, positive displacement, variable stroke and variable speed
   2. Performance: 0 – .5 GPM

E. Chlorine delivery controls:
   1. Manuel: Pump speed with variable control, panel mounted
   2. Automatic flow pacing: Automatically adjusts pump speed when supplied with 4-20mA signal from process flow meter or chlorine analyzer
   3. Solution Strength: Solution concentration can be varied by adjustment of Vortex by-pass water. (4 GPM feed water remains unchanged)

F. Tablet Capacity: 10 lbs.

G. Water required: 4 GPM clear, potable at pressures of 30 – 75 PSI (Feed water pressures above 75 PSI requires an optional inlet pressure regulator)

H. Frame: Laser cut, hot dip galvanized steel

I. Leveling legs: (4) stainless steel adjustable with leveling bubble

J. Dimensions: 21 9/16” W x 2’ - 9 9/16” L x 4’ - 2 1/16” H

K. Weight: 80 lbs

2.03 EQUIPMENT

A. Frame: Laser cut, hot dip galvanized steel with hot dip galvanized fasteners

B. Tablet feeder (eroder): PVC

C. Mixing chamber: HDPE 5 gallon tank with all PVC internal components including lid

D. Solution tank: 22 gallon, HDPE 24”L x 12”Wx 18”H

E. Piping: Sch. 80 PVC
   1. Inlet water supply at bulkhead: 1” Sch. 80 PVC
   2. System Outlet: ½” FNPT
   3. All piping is Sch. 80 PVC or 1” nylon reinforced PVC clear tubing

F. Relief valve: Sch. 80 PVC

G. Flow limiting valve: PVC

H. All pipe and hose fittings: Sch. 80 PVC

I. Bulkhead Fittings: HDPE spin welded and Sch. 80 PVC

J. Pump Suction Strainer: PVC

K. Pump:
   1. Fluid end: PVC,
   2. Valves: Ceramic with Viton® trim
   3. Diaphragms: Teflon®/EPDM OPTIONAL EQUIPMENT

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install items in accordance with accepted shop drawings, manufacturer's printed instructions as indicated.

3.02 FIELD TESTING

A. Field testing will not be conducted without an accepted procedure, calibration certificates for all testing equipment, gauges and flow meters and a completed and signed pretesting check list.

B. After installation of system equipment, and after inspection, operation and testing and adjustment have been completed by the manufacturer's field service technician, conduct running test for the system in the presence of the Engineer to determine the ability to operate as specified and to deliver is rated capacity under specified conditions

3.03 CONTRACT CLOSEOUT:

A. Provide in accordance with other project specifications.

END OF SECTION 464300