PROJECT
SPECIFICATIONS
for
ROSS 4850L SUBSTATION

TABLE OF CONTENTS

SDSTA DIVISION 01 SPECIFICATION

ROSS 4850L SUBSTATION

TABLE OF CONTENTS

Section 01 11 00 Summary of Work

1 GENERAL

1.1 WORK COVERED BY CONTRACT DOCUMENTS

1.1.1 Project Description

The work includes 1) design and installation of two 2-hour fire rated walls to enclose the substation room, 2) installation of access doors, 3) design and installation of a ventilation fan, duct work, and fire dampers, 4) design and installation of concrete equipment housekeeping pads, and incidental related work.

1.1.2 Location

The work is located at the Sanford Underground Research Facility, underground and approximately 200 feet southeast of the Ross Shaft station at the 4850 level Ross Campus.

1.2 OCCUPANCY OF PREMISES

Building and/or location of work will be occupied during performance of work under this contract. Occupancy notifications will be posted in a prominent location in the work area.

Before work is started, arrange with the Project Manager a sequence of procedure, means of access, space for storage of materials and equipment, and use of approaches, corridors, and stairways.

1.3 EXISTING WORK

Remove or alter existing work in such a manner as to prevent injury or damage to any portions of the existing work which remain. Repair or replace portions of existing work which have been altered during construction operations to match existing or adjoining work, as approved by the Project Manager. At the completion of operations, existing work must be in a condition equal to or better than that which existed before new work started.

--- End of Section ---

Section 01 30 00 Administrative Requirements

1 GENERAL

1.1 PROGRESS AND COMPLETION PICTURES

Photographically document site conditions prior to start of construction operations. Provide monthly digital photographs showing the sequence and progress of work to clearly capture the work performed during that period, in particular areas that will be covered as part of the scope of work. Submit photographs with the monthly invoice. Photographs provided are for unrestricted use by the SDSTA.

1.2 SUPERVISION

1.2.1 MINIMUM REQUIREMENTS

Have at least one qualified superintendent, or competent alternate, capable of reading, writing, and conversing fluently in the English language, on the jobsite at all times during the performance of contract work.

1.2.2 SUPERINTENDENT QUALIFICATIONS

The project superintendent must have a minimum of 10 years' experience in construction with at least 2 of those years as a superintendent on projects similar in size and complexity. The individual must have experience in the areas of hazard identification and safety compliance. The individual must be capable of interpreting a critical path schedule and construction drawings. The qualification requirements for the alternate superintendent are the same as for the project superintendent. The Contracting Officer may request proof of the superintendent's qualifications at any point in the project if the performance of the superintendent is in question.

For routine projects where the superintendent is permitted to also serve as the Quality Control (QC) Manager as established in Section QUALITY CONTROL, the superintendent must have qualifications in accordance with that section.

1.2.2.1 Duties

The project superintendent is primarily responsible for managing and coordinating day-to-day production and schedule adherence on the project. The superintendent is required to attend weekly progress meetings, and quality control meetings if applicable. The superintendent or qualified alternate must be on-site at all times during the performance of this contract until the work is completed and accepted.

1.2.3 NON-COMPLIANCE ACTIONS

The project superintendent is subject to removal by the Contracting Officer for non-compliance with requirements specified in the contract and for failure to manage the project to ensure timely completion. Furthermore, the Contracting Officer may issue an order stopping all or part of the work until satisfactory corrective action has been taken. No part of the time lost due to such stop orders is acceptable as the subject of claim for extension of time for excess costs or damages by the Contractor.

1.3 PRECONSTRUCTION

After award of the contract but prior to commencement of any work at the site, the Contractor must meet with the Project Manager to discuss and develop a mutual understanding relative to the administration of the quality control, safety program, preparation of the schedule of prices, shop drawings, and other submittals, scheduling programming, and execution of the work. Major subcontractors who will engage in the work must also attend.

--- End of Section ---

Section 01 32 00 Construction Progress Schedules

1 GENERAL

1.1 SUBMITTALS

Construction Schedule

Monthly Schedule Updates

1.2 ACCEPTANCE

Prior to the start of work, prepare and submit to the Project Manager for acceptance a construction schedule in the form of a Bar Chart Schedule.

The acceptance of a Baseline Construction Schedule is a condition precedent to:

- The Contractor starting work on the demolition or construction stage(s) of the contract.
- Processing Contractor's invoice(s) for construction activities.
- Review of any schedule updates.

Submittal of the Baseline Schedule, and subsequent schedule updates, is understood to be the Contractor's certification that the submitted schedule meets all of the requirements of the contract documents, represents the Contractor's plan on how the work will be accomplished, and accurately reflects the work that has been accomplished and how it was sequenced.

1.3 SCHEDULE FORMAT

1.3.1 Bar Chart Schedule

The Bar Chart must, as a minimum, show work activities, major material/equipment delivery, on-site construction, key inspections, and closeout activities. The Bar Chart must be time-scaled and generated using an electronic spreadsheet program.

1.3.2 Schedule Submittals and Procedures

Submit Bar Chart Schedules and updates in an electronic format that is acceptable to the Project Manager.

1.4 SCHEDULE MONTHLY UPDATES

Update the Construction Schedule at monthly intervals or when the schedule has been revised. The updated schedule must be kept current, reflecting actual progress and plan for completing the remaining work.

1.5 CONTRACT MODIFICATION

Submit a schedule analysis with each cost and time proposal for a proposed change. The analysis must illustrate the influence of each change or delay on the Contract Completion Date or milestones. No time extensions will be granted nor delay damages paid unless a delay occurs which consumes all available project float and extends the Projected Finish beyond the Contract Completion Date. Identify types of delays as follows:

- Excusable Delay: Force-Majeure (e.g. unusual weather) - Contractor may receive time extension, but time will not be compensable.
- Inexcusable Delay: Contractor Responsibility - Contractor will not receive time extension.
- Compensable Delay: SDSTA Responsibility - Contractor may receive compensable time extension.

If a combination of any of the delay types outlined above occurs, it is considered a Concurrent Delay, which will require an analysis of the facts to determine compensability and entitlement to any time extension under the applicable contract clauses.

1.6 WEEKLY PROJECT STATUS MEETING AND 3-WEEK LOOK AHEAD SCHEDULE

Each week during the active construction period, a Weekly Status Meeting will be held. At a minimum, the project superintendent and QC Manager should attend representing the contractor. Meeting minutes will be taken by the superintendent or other designated rep to capture the discussions. As part of the process, the contractor will prepare and issue a 3-Week Look Ahead schedule to provide a more detailed day-to-day plan of upcoming work identified on the Construction Schedule. Additionally, include upcoming outages, closures, etc. The detailed work plans are to be bar chart type schedules, separate from the Construction Schedule and in an electronic format acceptable to the Project Manager. In additional to schedule discussions, the Weekly Status meeting should discuss status of submittal reviews and approvals, Requests For Information (RFI), outstanding change orders, and other relevant project coordination issues.

--- End of Section ---

Section 01 33 00 Submittal Procedures

1 GENERAL

1.1 DEFINITIONS

1.1.1 Submittal Descriptions (SD)

Submittal requirements in addition to those noted below may be specified in the technical specification sections and drawings.

Preconstruction Submittals

Submittals required prior to start of construction:

- List of Proposed Subcontractors
- Construction Progress Schedule
- Submittal Register
- Schedule of Prices
- Health and Safety Plan
- Quality Control (QC) Plan
- Environmental Protection Plan

Shop Drawings

Drawings, diagrams, and schedules specifically prepared to illustrate some portion of the work.

Diagrams and instructions from a manufacturer or fabricator for use in producing the product and as aids to the Contractor for integrating the product or system into the project.

Drawings prepared by or for the Contractor to show how multiple systems and interdisciplinary work will be coordinated.

Product Data

Catalog cuts, illustrations, schedules, diagrams, performance charts, instructions and brochures illustrating size, physical appearance and other characteristics of materials, systems or equipment for some portion of the work.

Samples of warranty language when the contract requires extended product warranties.

Samples

Fabricated or unfabricated physical examples of materials, equipment or workmanship that illustrate functional and aesthetic characteristics of a material or product and establish standards by which the work can be judged.

Color samples from the manufacturer's standard line (or custom color samples if specified) to be used in selecting or approving colors for the project.

Field samples and mock-ups constructed on the project site establish standards by which the ensuring work can be judged. Includes assemblies or portions of assemblies which are to be incorporated into the project and those which will be removed at conclusion of the work.

Test Reports

Report signed by authorized official of testing laboratory that a material, product or system identical to the material, product or system to be provided has been tested in accord with specified requirements. Unless specified in another section, testing must have been within three years of date of contract award for the project.

Report which includes findings of a test required to be performed by the Contractor on an actual portion of the work or prototype prepared for the project before shipment to job site.

Report which includes finding of a test made at the job site or on a sample taken from the job site, on a portion of work during or after installation.

Certificates

Statements created using the manufacturer's letterhead and signed by responsible officials of manufacturer of product, system, or material attesting that the product, system, or material meets specification requirements. Statements must be dated after award of project contract and clearly name the project.

Operation and Maintenance Data

Data that is furnished by the manufacturer, or the system provider, to the equipment operating and maintenance personnel, including manufacturer's help and product line documentation necessary to maintain and install equipment. This data is needed by operating and maintenance personnel for the safe and efficient operation, maintenance and repair of the item.

This data is intended to be incorporated in an operations and maintenance manual or control system.

Closeout Submittals

Documentation to record compliance with technical or administrative requirements or to establish an administrative mechanism.

Special requirements necessary to properly close out a construction contract. For example, as-built drawings. Also, submittal requirements necessary to properly close out a major phase of construction on a multi-phase contract.

1.2 SUBMITTAL REGISTER

1.2.1 Use of Submittal Register

Submit a register of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, ordering, manufacturing, fabrication, and delivery when establishing dates. Include additional time required for making corrections or revisions to submittals noted by Architect and additional time for handling and reviewing submittals required by those corrections.

Initial Submittal. Submit concurrently with startup construction schedule. Include submittals required during the first 60 days of construction. List those submittals required to maintain orderly progress of the Work and those required early because of long lead time for manufacture or fabrication.

Submit revised submittal schedule to reflect changes in current status and timing for submittals.

Format. Arrange the following information in a tabular format. (As applicable)

a. Scheduled date for first submittal.
b. Specification/RFP Section number and title.
c. Name of subcontractor.
d. Description of the Work covered.
e. Scheduled date for final release or approval.
f. Scheduled date of fabrication.
g. Scheduled dates for purchasing.
h. Scheduled dates for installation.
i. Activity or event number.

1.3 VARIATIONS

Variations from contract requirements require both A/E and SDSTA approval and will be considered where advantageous to SDSTA.

1.3.1 Considering Variations

Discussion with Project Manager and A/E (if applicable) prior to submission will help ensure functional and quality requirements are met and minimize rejections and re-submittals.

Specifically point out variations from contract requirements in transmittal letters. Failure to point out deviations may result in the rejection and removal of such work at no additional cost to the SDSTA.

1.3.2 Proposing Variations

When proposing variation, deliver a written request to the Project Manager, with documentation of the nature and features of the variation and why the variation is desirable and beneficial to SDSTA. If lower cost is a benefit, also include an estimate of the cost savings. In addition to the documentation required for variation, include the submittals required for the item. Clearly mark the proposed variation in all documentation.

1.3.3 Warranting that Variations are Compatible

When delivering a variation for approval, Contractor, including its Designer(s) of Record (if applicable), warrants that this contract has been reviewed to establish that the variation, if incorporated, will be compatible with other elements of work.

1.3.4 Review Schedule Extension

In addition to normal submittal review period, a period of 10 working days will be allowed for consideration by the A/E and SDSTA of submittals with variations.

1.4 SCHEDULING

Schedule and submit interrelated submittals concurrently, such as component items forming a system. Include certifications to be submitted with the pertinent drawings at the same time. No delay damages or time extensions will be allowed for time lost in late submittals.

- Coordinate scheduling, sequencing, preparing and processing of submittals with performance of work so that work will not be delayed by submittal processing. Allow for potential resubmittal of requirements.
- Resubmit register and annotate monthly with actual submission and approval dates. When all items on the register have been fully approved, no further resubmittal is required.
- Carefully control procurement operations to ensure that each individual submittal is made on or before the Contractor scheduled submittal date shown on the approved Submittal Register.

1.4.1 Review Notations

Submittals will be returned to the Contractor with the following notations:

- Submittals marked "accepted" authorize the Contractor to proceed with the work covered.
- Submittals marked "accepted as noted" or "accepted as noted, resubmittal not required," authorize the Contractor to proceed with the work covered, provided Contractor takes no exception to the corrections.
- Submittals marked “revise and resubmit," indicate noncompliance with the contract requirements or design concept, or that submittal is incomplete. Resubmit with appropriate changes. No work shall proceed for this item until resubmittal is approved.

- Submittals marked "not reviewed" will indicate that the submittal has been previously reviewed and accepted, is not required, does not have evidence of being reviewed and approved by Contractor, or is not complete. A submittal marked "not reviewed" will be returned with an explanation of the reason it has not been reviewed. Resubmit submittals that have been returned for lack of review by Contractor or for being incomplete, with appropriate action, coordination, or change.

1.5 REJECTED SUBMITTALS

If the Contractor considers any correction or notation on the returned submittals to constitute a change to the contract drawings or specifications, notice must be given to the Contracting Officer. Contractor is responsible for the dimensions and design of connection details and construction of work. Failure to point out deviations may result in the SDSTA requiring rejection and removal of such work at the Contractor's expense.

If changes are necessary to submittals, make such revisions and submission of the submittals in accordance with the procedures above. No item of work requiring a submittal change is to be accomplished until the changed submittals are approved.

1.6 ACCEPTED SUBMITTALS

The acceptance of submittals is not to be construed as a complete check and indicates only that acceptance will not relieve the Contractor of the responsibility for any error which may exist, as the Contractor under Section QUALITY CONTROL FOR CONSTRUCTION requirements of this contract is responsible for dimensions, the design of adequate connections and details, and the satisfactory construction of all work.

After submittals have been accepted, no resubmittal for the purpose of substituting materials or equipment will be considered unless accompanied by an explanation of why a substitution is necessary.

1.7 APPROVED SAMPLES

Approval of a sample is only for the characteristics or use named in such approval and is not to be construed to change or modify any contract requirements. Before submitting samples, the Contractor will ensure that the materials or equipment will be available in quantities required in the project. No change or substitution will be permitted after a sample has been approved.

Match the approved samples for materials and equipment incorporated in the work. If requested, approved samples, including those which may be damaged in testing, will be returned to the Contractor, at his expense, upon completion of the contract.

Samples of various materials or equipment delivered on the site or in place may be taken by the SDSTA for testing. Samples failing to meet contract requirements will automatically void previous approvals. Contractor will replace such materials or equipment to meet contract requirements.

Approval of the Contractor's samples does not relieve the Contractor of his responsibilities under the contract.

--- End of Section ---

Section 01 35 23 Safety and Environmental Requirements

1 GENERAL

1.1 CONTRACTOR'S RESPONSIBILITY FOR PROJECT SAFETY AND ENVIRONMENTAL PROTECTION

1.1.1 The Contractor recognizes the importance of performing the work in a safe and responsible manner to prevent damage, injury, or loss to individuals, the environment, and the work itself, including materials and equipment incorporated into the work or stored on-site or off-site. Contractor assumes responsibility for implementing and monitoring all Environment, Safety and Health (ESH) precautions and programs related to the performance of the work.

1.1.2 The Contractor and subcontractors shall comply with all legal and SDSTA-specific reporting requirements relating to ESH set forth in the contract documents. The Contractor will verbally notify of any injury, loss, damage, or accident arising from the work to Project Manager and to the SDSTA ESH Safety Representative (ESH Safety Rep), to the extent mandated by legal requirements, to all government or quasi-government authorities having jurisdiction over safety-related matters involving the project or the work. All persons injured while working at SURF will be immediately evaluated, and treated as necessary, by a medical professional before returning to work. Contractor and its subcontractors will immediately report to the Project Manager all spills of a regulated substance of one gallon or greater, and all other significant impacts to the environment (soil, water, air) in performance of the work. Contractor will also immediately notify the Project Manager of any failure to comply with state and federal environmental laws, rules, and regulations.

1.1.3 The Contractor's responsibility for ESH under this specification is not intended in any way to relieve subcontractors and sub-subcontractors of their own contractual and legal obligations and responsibilities.

1.1.4 The Contractor is responsible for screening all subcontractors with respect to safety and to adopt a safety selection process consistent with requirements defined herein. In addition, Contractor is responsible for flowing down all ESH requirements of the Contract to its subcontractors, including monitoring and enforcing compliance.

1.2 ESH REQUIREMENTS AND COORDINATION

1.2.1 Safety and protection of the environment are of the utmost concern on this contract. Safety in this context refers to the health and safety of people and the protection of the environment. Nothing contained herein relieves the Contractor from complying with all applicable standards and regulations found in 29 CFR Part 1926 (OSHA construction standard), 40 CFR (Federal environmental regulations, and Part 74 of the Administrative Rules of South Dakota (State environmental regulations), where applicable. Site specific safety requirements are defined in the SDSTA ESH Manual located at: https://www.sanfordlab.org/esh. Mine Safety and Health Administration (MSHA) compliance may be acceptable, where applicable.

1.2.2 The Contractor will address the safety requirements defined herein and in the SDSTA ESH Manual. Contractor costs associated with the implementation of the requirements will be borne by the Contractor. Safety deficiencies discovered after the award will be remedied at no cost to SDSTA and may at the Contracting Officer's discretion be deducted from the contract amount.

1.2.3 The Contractor shall have a designated Safety Representative (SR), approved by SDSTA, present on the Project at all times when work is physically being performed. The SR may have other

minor duties, but the position's primary role is to oversee safety of the worksite and work being performed by the Contractor, as well as that of its subcontractors. For a crew of 10 people or less the project superintendent or a qualified designee may act as the SR. If shift work will be utilized, the Contractor must have a SR for each shift. In the case of shift work, the Contractor will designate one SR as the lead for the project. The training requirements for the second SR are the same as the lead and are as follows:

- The SR shall have underground safety experience and training (e.g., MSHA part 48) when applicable.
- The SR shall be certified in CPR, AED, and First Aid.
- The SR is responsible for administering the Contractor's ESH program.
- The SR will escort the ESH Safety Rep on a monthly ESH site visit.
- The SR will provide training to all employees working on their behalf in regard to oil pollution prevention, solid and hazardous waste management, and storm water management, if applicable.
- The Contractor will supply a weekly ESH report to the ESH Safety Rep, detailing any ESH related items.

1.2.4 The Contractor shall have at least one individual certified in CPR, AED, and First Aid onsite at all times.

1.2.5 The Contractor is responsible for identifying the need for Qualified and/or Competent Persons for specific tasks as defined in 29 CFR 1926.

1.2.6 The Contractor must have a documented Site-Specific Environment, Safety and Health Program/Plan in place and accepted by SDSTA before work will be authorized to start. This program must be consistent with the requirements in the SDSTA ESH Manual. The program will be based on the hazards inherent to the Means and Methods adopted by the Contractor and its associated work environment. The scope of work will dictate the required program elements for this contract. Program elements may include those listed on the ESH Manual of the SURF website at https://www.sanfordlab.org/esh.

- If the Contractor chooses to adopt one or more specific elements of the SDSTA ESH program, it must adopt that element in its entirety.

1.2.7 The Contractor is expected to follow a work planning and controls process that is aligned with the SDSTA. (See SURF website ESH Manual at https://www.sanfordlab.org/esh.) The work planning and controls process must be conducted and documented prior to the start of work in the form of a Job Hazards Analysis (JHA). A JHA, developed by the SR, approved by the Project Manager and ESH Safety Rep. The JHA will be reviewed with the individual(s) expected to perform the work prior to work starting on a specified task. The SR is expected to review all JHAs. Copies of JHA(s) must be present at the location where work is being performed and accessible to the individuals performing the work and to SDSTA representatives.

1.2.8 The Contractor will conduct a daily crew work planning meeting (tailgate/toolbox talk), including, when necessary, subcontractor employees, prior to the beginning of each shift. This talk will include the plan of work for the day, a review of hazards and potential regulatory issues, inspection/removal of loose puncture hazards as part of a general daily cleanup requirement of the work area, and the review of applicable JHAs. These documented talks will be submitted to the Project Manager or uploaded to a designated electronic database at the end of each day, or by the end of the work week.

1.2.9 The Contractor is responsible for assuring that all Contractor employee safety training is completed in compliance with SDSTA guidelines, standards, and associated regulations. The following training is required for all Contractor personnel before they start work:

- Sanford Underground Research Facility (SURF) Surface and/or Underground Orientation Training, if onsite for less than 40 hours in a 12-month period
- Cultural Awareness video
- Any specific equipment training (e.g.: crane operator)
- Site specific training for environmental compliance (e.g.: spill prevention, Hazmat, storm water, etc.)

For contractor personnel working on-site more than 40 hours in a 12-month period, the following training is required:

- General Safety Basic Training (Surface and/or Underground)

1.2.10 The Contractor must have an individual trained and qualified as a SURF Guide for each area that the Contractor will be working. The Guide must be onsite with the workers at all times. Refer to ESH-(1000-S)-73189 Facility Access Standard or the SURF Training Department for Contractor Guide training.

1.2.11 The Contractor shall provide all common Personal Protective Equipment (PPE) required for the work (hard hats, safety toe boots, safety glasses with side shields, hi-visibility clothing and required fall protection equipment including suspension trauma straps, and full body harness (ANSI A10.14 approved). All contractor personnel shall follow the ESH-(7000-S)-71493 PPE Standard and supporting documents.

- Unique PPE required for aerial lift equipment:
  - Anyone working from an aerial lift must wear a personal fall restraint system or SRL following manufacturer's recommendations.
  - Fall protection must be attached to the manufacturer's designated anchor point.
- Unique PPE required for any underground work will be provided by SDSTA for the duration of the project and at a minimum includes:
  - W65 Self Rescuers (must be maintained according to MSHA requirements) (always required when working underground)
  - Gas Tester(s) (M40M or equivalent)
  - Cap lamps

1.2.12 Smoking, use of tobacco products, including vapor, alcohol, controlled substances, or weapons are not allowed within the boundaries of SURF. All property owned and operated by the SDSTA is designated as tobacco and vapor-free. This applies to all areas of the surface and the underground. The Contractor shall manage and maintain a drug and alcohol policy that aligns with that of SDSTA written policy and procedures. The ESH department review of this document may be required.

1.2.13 If SDSTA perceives the Contractor has created or is exposed to an imminent danger, unacceptable risk, or a non-compliance situation, SDSTA will stop work until safe conditions are re-established. Such work stoppages will be at the expense of the Contractor and will not add time to the completion date of the contract. All personnel have the right and responsibility to authorize a stop work onsite whenever encountering an unsafe condition or act. Refer to the ESH-(2000-S)-202124 Stop Work Standard.

1.2.14 In the event of an incident, Contractor will notify the Project Manager and/or ESH Safety Rep immediately and never later than the end of shift on the day of incident. Contractor shall complete the ESH-(3000-F)-173324 First Report form and submit to the Project Manager or ESH Safety Rep. Contractor shall conduct an incident investigation in accordance with the SDSTA Standard. The investigation will include preparing a written report summarizing the results of the investigation, corrective actions taken to prevent a reoccurrence, and any lessons learned. SDSTA may at its discretion participate in and facilitate the incident investigation. Time and expense incurred by Contractor performing an incident investigation will be at the Contractor's expense.

1.2.15 The Contractor may, with SDSTA written permission, operate SURF-owned equipment. The Incidental Operator must first meet SDSTA requirements for the operation of said equipment. The Contractor shall regularly inspect, test, and calibrate as necessary all equipment, machinery, tools, or other items furnished by SDSTA that are employed in Contractor's work. Contractor shall take reasonable precautions to avoid damage to facility structures and utilities. If apparent defects are found in SDSTA-provided materials or equipment, defective equipment shall be taken out of service and Contractor shall promptly notify the Project Manager of such defect(s) in writing. Contractor provided equipment shall be inspected and maintained prior to arriving on-site and before each use. Failure of Contractor-provided equipment shall not be entitled to any compensation for downtime or delays or schedule extensions.

1.2.16 When working in the headframes, the Contractor will maintain six-foot distance away from an open shaft hole when the cage gate is open or have 100% tied-off (Fall Arrest) protection.

1.2.17 The Contractor acknowledges that periodic evacuation drills and exercises are required by SDSTA to validate the adequacy and effectiveness of the ESH-(6000-S)-185207 Emergency Management Standard. Contractor also recognizes that such drills and exercises enhance its employees' understanding of Emergency Management Standard. Contractor agrees to participate in quarterly evacuation drills, which may or may not be scheduled in advance, during the term of this contract. It is understood that Contractor will not be entitled to any additional compensation for participating in these evacuation drills or exercises.

1.2.18 The Contractor agrees to assess whether Contractor's employees have the physical, mental, and emotional capacity to perform assigned tasks competently and in a manner that does not unreasonably threaten safety, health, or property, including participation in emergency procedures applicable to Contractor's work location. The ESH-(2000-S)-15209 Fatigue Management Standard regulates the impacts of fatigue for safety, health, and productivity onsite. Refer to the SURF website ESH Manual at https://www.sanfordlab.org/esh for further information.

1.2.19 The Contractor shall follow use of ladders and shall meet the requirements of OSHA 1926.1053 (Subpart X) and OSHA 1910.23 (Subpart D). Prior to using a ladder, the following shall be considered:

- Alternative methods, such as platform/podium ladder, scaffolding, scissor lift, or aerial lift.
- Fall protection is required when working from a standard ladder at a height greater than four feet.
- Fall protection is required when working from the platform of a three-sided podium ladder at a height greater than six feet.
- Additional fall protection is not required when working from a four-sided podium ladder.

For further information on the ESH-(7000-S)-73415 Fall Protection and Prevention Standard, refer to the SURF website ESH Manual at https://www.sanfordlab.org/esh.

1.2.20 The Contractor shall manage all waste, both solid and hazardous, as well as all obsolete, expired, or unused materials procured by the Contractor, including the cost of disposal. The Contractor shall manage and dispose of all wastes generated in compliance with all applicable state and federal laws and regulations. The Contractor shall minimize, to the extent practical, the generation and accumulation of waste during the lifespan of the project. Waste shall not be allowed to accumulate to the point of becoming a threat to the environment (air, land, water) and must not be stored on the ground for longer than a single work shift. Where large amounts of waste are anticipated, a roll off bin should be used. When a roll off bin is not used, wastes must be removed from the work site on a regular basis.

All clean-up and disposal costs associated with Contractor spills or equipment leaks of environmentally regulated substances in the performance of their work are the responsibility of the Contractor. Spills and leaks must be cleaned up immediately, and leaks must be repaired to prevent further environmental contamination.

If the Contractor will be disturbing one or more acres, it is the responsibility of the Contractor to obtain a South Dakota Stormwater Construction Permit and to comply with that permit, including the installation and maintenance of stormwater pollution controls. Stormwater flowing off the work site must be clean, with no visible sheen or solids. Any existing stormwater pollution controls that are altered during Contractor activities must be returned to full operating condition as soon as possible.

Work that results in the storage of petroleum products (55 gallons or greater in a single container) or the installation of oil-filled operational equipment with a volume of 55 gallons or greater must be reported to the Environmental Department, and secondary containment must be installed.

Visible air emissions occurring from roads, stockpiles, conveyors, etc. used during Contractor work must be controlled by the Contractor.

1.2.21 All chemicals to be used at SURF must be pre-approved by SDSTA and Safety Data Sheets (SDS) must be maintained by the Contractor and be readily available to workers on site.

1.2.22 Flammables (defined in 30 CFR Part §57.4460 Storage of flammable liquids underground) are not allowed underground. Flammables used on the surface are to be stored in engineered flammable cabinets or in containers with a minimum one-hour fire resistance.

1.2.23 Combustibles in the underground work areas shall be managed as per 30 CFR Part 57.4104 - 57.4531, as applicable.

1.2.24 Tier 4 engines are required at SURF for underground use. Lower Tier 3 equipment may be allowed underground but only with SDSTA permission. All underground diesel equipment must be approved by SDSTA prior to usage.

1.2.25 SDSTA reserves the right to restrict or deny access of any Contractor employee to the work location.

1.2.26 The Contractor shall report the hours worked on site by Contractor's employees on a monthly basis to the Project Manager named in the contract. Hours shall be emailed to the Project Manager no later than the 3rd day of the month for hours worked the previous month.

--- End of Section ---

Section 01 45 00 Quality Control for Construction

1 GENERAL

1.1 SUBMITTALS

Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

- Preconstruction Submittals
- QC Plan

Submit a QC plan within 15 calendar days of Contract award.

1.2 INFORMATION REQUIREMENTS

Prior to commencing work on construction, the Contractor can obtain a single copy set of the current report forms from the Project Manager. The report forms will consist of the Contractor Daily Report, Rework Items List, and Testing Plan and Log.

Deliver the following to the Project Manager and the designated SDSTA QA Rep:

- DAILY Report: By 10:00am the next working day after each day that work is performed, or by the time determined and accepted by the team.
- Field Test Reports: One copy, within one week after the test is performed.
- QC Certifications: As required by the paragraph entitled "QC Certifications."

1.3 QC PROGRAM REQUIREMENTS

Establish and maintain a QC program as described in this section. The QC program consists of a QC Manager, a QC plan, a Project Preconstruction Conference, Weekly Status Meeting, submittal review, testing, and QC certifications and documentation necessary to provide materials, equipment, workmanship, fabrication, construction, and operations that comply with the requirements of this contract. The QC program shall cover on-site and off-site work and shall be keyed to the work sequence. No work or testing may be performed unless the QC Manager is on the work site.

1.3.1 Preliminary Work Authorized Prior to Acceptance

The only work that is authorized to proceed prior to the acceptance of the QC plan is the mobilization of storage and office trailers, the installation of temporary utilities, and surveying.

1.3.2 Acceptance

Acceptance of the QC plan is required prior to the start of construction. SDSTA reserves the right to require changes in the QC plan and operations as necessary, including removal of personnel, to ensure the specified quality of work.

1.3.3 Notification of Changes

Notify the Contracting Officer, in writing, of any proposed change, including changes in the QC organization personnel, a minimum of seven calendar days prior to a proposed change. Proposed changes shall be subject to the acceptance by the Contracting Officer.

1.4 QC ORGANIZATION

1.4.1 QC Manager

1.4.1.1 Duties

Provide a QC Manager at the work site to implement and manage the QC program. In addition to implementing and managing the QC program, the QC Manager may perform the duties of project

superintendent. The QC Manager is required to attend the Preconstruction Conference, conduct the QC meetings (If separate from the Weekly Status meeting), perform submittal review, ensure testing is performed, and provide QC certifications and documentation required in this contract. The QC Manager is responsible for managing and coordinating documentation performed by others.

1.4.1.2 Qualifications

An individual with a minimum of 5 years' combined experience as a superintendent, inspector, QC manager, project manager, or construction manager on similar size and type construction contracts which included the major trades that are part of this contract. The individual must be familiar with and have experience in the areas of hazard identification and safety compliance.

1.4.2 Alternate QC Manager Duties and Qualifications

Designate an alternate for the QC Manager to serve in the event of the designated QC Manager's absence. The period of absence may not exceed two weeks at one time, and not more than 30 workdays during a calendar year. The qualification requirements for the Alternate QC Manager shall be the same as for the QC Manager.

1.5 QC PLAN

1.5.1 Requirements

Provide a QC plan that covers both on-site and off-site work and includes the following with a table of contents listing the major sections identified with tabs.

I. QC ORGANIZATION: A chart showing the QC organizational structure and its relationship to the production side of the organization.

II. NAMES AND QUALIFICATIONS: In resume format, for each person in the QC organization.

III. DUTIES, RESPONSIBILITY AND AUTHORITY OF QC PERSONNEL: Of each person in the QC organization.

IV. OUTSIDE ORGANIZATIONS: A listing of outside organizations, such as architectural and consulting engineering firms that will be employed by the Contractor and a description of the services these firms will provide.

V. SUBMITTAL PROCEDURES AND INITIAL SUBMITTAL REGISTER: Procedures for reviewing and managing submittals. Provide the name(s) of the person(s) in the QC organization authorized to review and certify submittals prior to approval.

VI. TESTING LABORATORY INFORMATION: Testing laboratory information required by the paragraphs "Accredited Laboratories" or "Testing Laboratory Requirements", as applicable.

VII. TESTING PLAN AND LOG: A Testing Plan and Log that includes the tests required, referenced by the specification paragraph number requiring the test, the frequency, and the person responsible for each test.

VIII. PROCEDURES TO COMPLETE REWORK ITEMS: Procedures to identify, record, track and complete rework items.

IX. DOCUMENTATION PROCEDURES: Use SDSTA formats or agreed upon formats with SDSTA QA Manager and Contractor.

X. PROCEDURES FOR COMPLETION INSPECTION: See the paragraph entitled "COMPLETION INSPECTIONS".

1.6 PROJECT PRECONSTRUCTION CONFERENCE

During the Preconstruction Conference and prior to the start of construction, discuss the QC program required by this contract. The purpose is to develop a mutual understanding of the QC details, including documentation, administration for on-site and off-site work, and the coordination of the Contractor's management, production and the QC personnel. At the meeting, the Contractor will be required to explain how quality control will be implemented for key features of work. Contractor's personnel required to attend shall include the QC Manager, Project Manager, and superintendent.

1.7 TESTING

Except as stated otherwise in the specification sections, perform sampling and testing required under this contract.

1.7.1 Test Results

Cite applicable contract requirements, tests or analytical procedures used. Provide actual results and include a statement that the item tested or analyzed conforms or fails to conform to specified requirements. If the item fails to conform, notify the Contracting Officer immediately. Conspicuously stamp the cover sheet for each report in large red letters "CONFORMS" or "DOES NOT CONFORM" to the specification requirements, whichever is applicable. Test results shall be signed by a testing laboratory representative authorized to sign certified test reports. Furnish the signed reports, certifications, and other documentation to the Project Manager.

1.8 QC CERTIFICATIONS

1.8.1 Invoice Certification

Furnish a certificate with each payment request signed by the QC Manager, attesting that as-built drawings are current and attesting that the work for which payment is requested, including stored material, is in compliance with contract requirements.

1.8.2 Completion Certification

Upon completion of work under this contract, the QC Manager shall furnish a certificate attesting that "the work has been completed, inspected, tested and is in compliance with the contract."

1.9 COMPLETION INSPECTIONS

1.9.1 Final Inspection

Near the completion of all work, a Final Inspection is scheduled with the QC Manager and SDSTA project team, including the A/E. During this inspection, the QC Manager develops a punch list of items which do not conform to the approved drawings and specifications. Include in the punch list any remaining items on the "Rework Items List" which were not corrected prior to the Final Inspection. The punch list includes the estimated date by which the deficiencies will be corrected. A copy of the punch list shall be provided to the Project Manager. Any items noted on the punch list shall be corrected in a timely manner and shall be accomplished before the Contract Completion Date. The QC Manager or staff shall make follow-on inspections to ascertain that all deficiencies have been corrected. Once this is accomplished, the Contractor shall notify SDSTA that the project is ready for the SDSTA Final Acceptance Inspection. A pre-final walkthrough with the PM is recommended to ensure the Contractor is adequately prepared for the Final Inspection.

1.9.2 Final Acceptance

When all items on the punch list have been completed, a Final Acceptance inspection is performed. The QC Manager, superintendent or other Contractor management personnel, and SDSTA project team will attend this inspection to verify that the facility is complete and ready to be occupied.

1.10 DOCUMENTATION

Maintain current and complete records of on-site and off-site QC program operations and activities. Reports are required for each day work is performed. Account for each calendar day throughout the life of the contract. The superintendent and the QC Manager (if separate) must prepare and sign the Contractor Daily Report. The reporting of work shall be identified by terminology consistent with the construction schedule. In the "remarks" section in this report which will contain pertinent information including directions received, problems encountered during construction, work progress and delays, conflicts or errors in the drawings or specifications, field changes, safety hazards encountered, instructions given and corrective actions taken, delays encountered and a record of visitors to the work site.

1.10.1 As-Built Drawings

The QC Manager is required to review the as-built drawings and ensure they are kept current on a regular basis and marked to show deviations, which have been made from the contract drawings. Ensure each deviation has been identified with the appropriate modifying documentation, e.g. modification number, RFI number, etc. The QC Manager shall initial each deviation or revision.

1.11 NOTIFICATION ON NON-COMPLIANCE

The Project Manager or QA Rep will notify the Contractor of any detected non-compliance with the foregoing requirements. The Contractor shall take immediate corrective action. If the Contractor fails or refuses to correct the non-compliant work, the Contracting Officer will issue a non-compliance notice. Such notice, when delivered to the Contractor at the work site, shall be deemed sufficient for the purpose of notification. If the Contractor fails or refuses to comply promptly, the Contracting Officer may issue an order stopping all or part of the work until satisfactory corrective action has been taken. The Contractor shall make no part of the time lost due to such stop orders the subject of claim for extension of time, for excess costs, or damages.

--- End of Section ---

Section 01 50 00 Temporary Construction Facilities and Controls

1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA C511 Standard for Reduced-Pressure Principle Backflow Prevention Assembly (latest edition)

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 241 Standard for Safeguarding Construction, Alteration, and Demolition Operations (latest edition)

NFPA 70 National Electrical Code (latest edition)

1.2 SUBMITTALS

Submit the following in accordance with Section SUBMITTAL PROCEDURES:

- Construction Site Plan
- Traffic Control Plan

1.3 CONSTRUCTION SITE PLAN

Prior to the start of work, submit a site plan showing the locations and dimensions of temporary facilities (including layouts and details, equipment and material storage area (onsite and offsite), and access and haul routes, avenues of ingress/egress to the fenced area and details of the fence installation. Identify any areas which may have to be graveled to prevent the tracking of mud. Indicate if the use of a supplemental or other staging area is desired. Show locations of safety and construction fences, site trailers, construction entrances, trash dumpsters, temporary sanitary facilities, and worker parking areas.

2.1 TEMPORARY WIRING

Provide temporary wiring in accordance with NFPA 241 and NFPA 70. The Contractor is required to conduct frequent inspections of all installed equipment and apparatus and report this on the daily report.

3.1 EMPLOYEE PARKING

Contractor employees will park privately owned vehicles in an area designated by the Project Manager. This area is approximately 1 mile from the Ross Shaft that accesses the 4850L project area. The contractor will be required to shuttle their employees from the designated parking area to Ross Shaft and park in a designated area that is a reasonable walking distance to the shaft. Contractor employee parking must not interfere with existing and established parking requirements of the SDSTA installation.

3.2 AVAILABILTIY AND USE OF UTILITY SERVICES

3.2.1 Temporary Utilities

Provide temporary utilities required for construction. Materials may be new or used, must be adequate for the required usage, must not create unsafe conditions, and must not violate applicable codes and standards.

3.2.2 Sanitation

SDSTA toilet facilities will be available to Contractor's personnel.

3.2.3 Fire Protection

Provide temporary fire protection equipment for the protection of personnel and property during construction. Remove debris and flammable materials daily to minimize potential hazards.

3.3 TRAFFIC PROVISIONS

3.3.1 Maintenance of Traffic

Conduct operations in a manner that will not close any thoroughfare or interfere in any way with traffic except with written permission of the Project Manager at least 15 calendar days prior to the proposed modification date and provide a Traffic Control Plan detailing the proposed controls to traffic movement for approval. Contractor may move oversized and slow-moving vehicles to the worksite provided the requirements of the highway authority have been met.

Conduct work so as to minimize obstruction of traffic and maintain traffic on at least half of the roadway width at all times. Obtain approval from the Contracting Officer prior to starting any activity that will obstruct traffic.

3.3.2 Protection of Traffic

Maintain and protect traffic on all affected roads during the construction period except as otherwise specifically directed by the Project Manager. Measures for the protection and diversion of traffic, including the provision of watchmen and flagmen, erection of barricades, placing of lights around and in front of equipment the work, and the erection and maintenance of adequate warning, danger, and direction signs, will be as required by the State and local authorities having jurisdiction. Protect the traveling public from damage to persons and property. Minimize the interference with public traffic on roads selected for hauling material to and from the site. Investigate the adequacy of existing roads and their allowable load limit. Contractor is responsible for the repair of any damage to roads caused by construction operations.

3.3.3 Dust Control

Dust control methods and procedures must be approved by the Project Manager. Treat dust abatement on access roads with applications of calcium chloride, water sprinklers, or similar methods or treatment.

3.4 CONTRACTOR’S TEMPORARY FACILITIES

3.4.1 Administrative Field Offices

Provide and maintain administrative field office facilities within the construction area at the designated site. SDSTA office and warehouse facilities will not be available to the Contractor's personnel.

3.4.2 Storage Area

Construct a temporary 1.8 m (6 foot) high chain link fence around trailers and materials. Include colored plastic strip inserts so that visibility through the fence is obstructed. Fence posts may be driven, in lieu of concrete bases, where soil conditions permit. Do not place or store Trailers, materials, or equipment outside the fenced area unless such trailers, materials, or equipment are assigned a separate and distinct storage area by the Project Manager away from the vicinity of the construction site but within SURF boundaries. Do not stockpile materials outside the fence in preparation for the next day's work. Park mobile equipment, such as tractors, wheeled lifting equipment, cranes, trucks, and like equipment within the fenced area at the end of each work day.

3.4.3 Appearance of Temporary Facilities

a. Trailers utilized by the Contractor for administrative or material storage purposes must present a clean and neat exterior appearance and be in a state of good repair.

b. Keep fencing in a state of good repair and proper alignment. Grassed or unpaved areas, which are not established roadways, will be covered with a layer of gravel as necessary to prevent rutting and the tracking of mud onto paved or established roadways, should the Contractor elect to traverse them with construction equipment or other vehicles, gravel gradation will be at the Contractor's discretion. Mow and maintain grass located within the boundaries of the construction site for the duration of the project.

3.4.4 Security Provisions

Provide adequate outside security lighting at the Contractor's temporary facilities. The Contractor will be responsible for the security of its own equipment.

3.5 CLEANUP

Remove construction debris, waste materials, packaging material and the like from the work site daily. Any dirt or mud which is tracked onto paved or surfaced roadways must be cleaned away. Store any salvageable materials resulting from demolition activities within the fenced area described above or at the supplemental storage area. Neatly stack stored materials not in trailers, whether new or salvaged.

3.6 RESTORATION OF STORAGE AREA

Upon completion of the project remove the bulletin board, signs, barricades, haul roads, and any other temporary products from the site. After removal of trailers, materials, and equipment from within the fenced area, remove the fence that will become the property of the Contractor. Restore areas used by the Contractor for the storage of equipment or material, or other use to the original or better condition. Remove gravel used to traverse grassed areas and restore the area to its original condition, including top soil and seeding as necessary.

--- End of Section ---

Section 01 78 00 Closeout Submittals

1 GENERAL

1.1 DEFINITIONS

1.1.1 As-Built Drawings

As-built drawings are developed and maintained by the Contractor and depict actual conditions, including deviations from the contract documents. These deviations and additions may result from coordination required by, but not limited to, contract modifications, official responses to Contractor submitted Requests for Information, direction from the Contracting Officer, designs which are the responsibility of the Contractor, and differing site conditions. Maintain the as-builts throughout construction as red-lined hard copies on site. These files serve as the basis for the creation of the record drawings.

1.1.2 Record Drawings

The record drawings are the final compilation of actual conditions reflected in the as-built drawings.

1.2 SUBMITTALS

Submit the following in accordance with Section SUBMITTAL PROCEDURES:

- Product Data
- Spare Parts Data
- Manufacturer's Instructions
- Posted Instructions
- As-Built Drawings
- Final Approved Shop Drawings

2 PRODUCTS

2.1 AS-BUILT DRAWINGS

2.1.1 Markup Guidelines

Make comments and markup the drawings complete without reference to letters, memos, or materials that are not part of the as-built drawing. Show what was changed, how it was changed, where item(s) were relocated, and change related details. These working as-built markups must be neat, legible, and accurate.

2.1.2 As-Built Drawings Content

Show the following information on the as-built drawings:

- The actual location, kinds, and sizes of all sub-surface utility lines. In order that the location of these lines and appurtenances may be determined in the event the surface openings or indicators become covered over or obscured, show by offset dimensions to two permanently fixed surface features the end of each run including each change in direction on the record drawings. Locate valves, splice boxes and similar appurtenances by dimensioning along the utility run from a reference point. Also record the average depth below the surface of each run.
- The location and dimensions of any changes within the building structure.
- Layout and schematic drawings of electrical circuits and piping.
- Correct grade, elevations, cross section, or alignment of roads, earthwork, structures, or utilities if any changes were made from contract plans.

- Changes in design details or additional information obtained from working drawings specified to be prepared and/or furnished by the Contractor; including but not limited to shop drawings, fabrication, erection, installation plans and placing details, pipe sizes, insulation material, dimensions of equipment foundations, etc.
- The topography, invert elevations, and grades of drainage installed or affected as part of the project construction.
- Where contract drawings or specifications present options, show only the option selected for construction on the working as-built markup drawings.
- Systems designed or enhanced by the Contractor, such as HVAC controls, fire alarm, fire sprinkler, and irrigation systems.
- Actual location of anchors, construction and control joints, etc., in concrete.
- Unusual or uncharted obstructions that are encountered in the contract work area during construction.

2.2 CLEANUP

Leave premises "broom clean." Clean interior and exterior glass surfaces exposed to view; remove temporary labels, stains, and foreign substances; polish transparent and glossy surfaces; vacuum carpeted and soft surfaces. Clean equipment and fixtures to a sanitary condition. Clean or replace filters of operating equipment. Clean debris from roofs, gutters, downspouts, and drainage systems. Sweep paved areas and rake clean landscaped areas. Remove waste, surplus materials, rubbish, and construction facilities from the site.

--- End of Section ---

Section 01 93 00 Operation and Maintenance Data

1 GENERAL

1.1 SUBMITTALS

Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

- Operation and Maintenance Data
- Training Plan

1.2 OPERATION AND MAINTENANCE DATA

Submit Operation and Maintenance (O&M) data for the provided equipment, product, or system, defining the importance of system interactions, troubleshooting, and long-term preventive operation and maintenance. Compile, prepare, and aggregate O&M data to include clarifying and updating the original sequences of operation to as-built conditions. Organize and present information in sufficient detail to clearly explain O&M requirements at the system, equipment, component, and subassembly level. Include an index preceding each submittal.

1.2.1 Package Quality

Documents must be fully legible. Operation and Maintenance data must be consistent with the manufacturer's standard brochures, schematics, printed instructions, general operating procedures, and safety precautions.

1.3 OPERATION AND MAINTENANCE MANUAL FILE FORMAT

Assemble data packages into electronic Operation and Maintenance Manuals. Assemble each manual into a composite electronically indexed file using the most current version of Adobe Acrobat or similar software capable of producing PDF file format. Include a complete electronically linked operation and maintenance directory.

1.3.1 O&M MANUAL LABEL REQUIREMENTS

Provide the following information on the label:

a. Building Number

b. Project Title

c. Activity and Location

d. Construction Contract Number

e. Prepared By: (Name, title, phone number and email address)

f. Date

1.4 TYPES OF INFORMATION REQUIRED IN O&M DATA PACKAGES

The following are detailed descriptions of the data package items required.

1.4.1 Operating Instructions

Provide specific instructions, procedures, and illustrations for the following phases of operation for the installed model and features of each system:

1.4.1.1 Safety Precautions and Hazards

List personnel hazards and equipment or product safety precautions for operating conditions. List all residual hazards identified in the Activity Hazard Analysis provided under Section 01 35 26 SDSTA SAFETY REQUIREMENTS. Provide recommended safeguards for each identified hazard.

1.4.1.2 Operator Prestart

Provide procedures required to install, set up, and prepare each system for use.

1.4.1.3 Startup, Shutdown and Post-Shutdown Procedures

Provide narrative description for Startup, Shutdown and Post-shutdown operating procedures including the control sequence for each procedure.

1.4.1.4 Normal Operations

Provide Control Diagrams with data to explain operation and control of systems and specific equipment. Provide narrative description of Normal Operating Procedures.

1.4.1.5 Emergency Operations

Provide Emergency Procedures for equipment malfunctions to permit a short period of continued operation or to shut down the equipment to prevent further damage to systems and equipment. Provide Emergency Shutdown Instructions for fire, explosion, spills, or other foreseeable contingencies. Provide guidance and procedures for emergency operation of utility systems including required valve positions, valve locations and zones or portions of systems controlled.

1.4.1.6 Operator Service Requirements

Provide instructions for services to be performed by the operator such as lubrication, adjustment, inspection, and recording gauge readings.

1.4.1.7 Environmental Conditions

Provide a list of Environmental Conditions (temperature, humidity, and other relevant data) that are best suited for the operation of each product, component or system. Describe conditions under which the item equipment should not be allowed to run.

1.4.1.8 Additional Requirements for HVAC Control Systems

a. Narrative description on how to perform and apply functions, features, modes, and other operations, including unoccupied operation, seasonal changeover, manual operation, and alarms. Include detailed technical manual for programming and customizing control loops and algorithms.

b. Full as-built sequence of operations.

c. Copies of checkout tests and calibrations performed by the Contractor (not Cx tests).

1.4.2 Preventive Maintenance

Provide the following information for preventive and scheduled maintenance to minimize repairs for the installed model and features of each system. Include potential environmental and indoor air quality impacts of recommended maintenance procedures and materials.

1.4.2.1 Lubrication Data

Include the following preventive maintenance lubrication data, in addition to instructions for lubrication required under paragraph OPERATOR SERVICE REQUIREMENTS:

a. A table showing recommended lubricants for specific temperature ranges and applications.

b. Charts with a schematic diagram of the equipment showing lubrication points, recommended types and grades of lubricants, and capacities.

c. A Lubrication Schedule showing service interval frequency.

1.4.2.2 Preventive Maintenance Plan, Schedule, and Procedures

Provide manufacturer's schedule for routine preventive maintenance, inspections, condition monitoring (predictive tests) and adjustments required to ensure proper and economical operation and to minimize repairs. Provide instructions stating when the systems should be retested. Provide manufacturer's projection of preventive maintenance work-hours on a daily, weekly, monthly, and annual basis including craft requirements by type of craft. For periodic calibrations, provide manufacturer's specified frequency and procedures for each separate operation.

a. Define the anticipated time required to perform each test (work-hours), test apparatus, number of personnel identified by responsibility, and a testing validation procedure permitting the record operation capability requirements within the schedule. Provide a remarks column for the testing validation procedure referencing operating limits of time, pressure, temperature, volume, voltage, current, acceleration, velocity, alignment, calibration, adjustments, cleaning, or special system notes. Delineate procedures for preventive maintenance, inspection, adjustment, lubrication and cleaning necessary to minimize repairs.

b. Repair requirements must inform operators how to check out, troubleshoot, repair, and replace components of the system. Include electrical and mechanical schematics, diagrams, and diagnostic techniques necessary to operate and troubleshoot the system after acceptance.

1.4.3 Appendices

Provide information required below and information not specified in the preceding paragraphs but pertinent to the maintenance or operation of the product or equipment. Include the following:

1.4.3.1 Parts Identification

Provide identification and coverage for the parts of each component, assembly, subassembly, and accessory of the end items subject to replacement.

1.4.3.2 Warranty Information

List and explain the various warranties and clearly identify the servicing and technical precautions prescribed by the manufacturers or contract documents in order to keep warranties in force. Include warranty information for primary components of the system.

1.4.3.3 Personnel Training Requirements

Provide information available from the manufacturers that is needed for use in training designated personnel to properly operate and maintain the equipment and systems.

1.4.3.4 Testing Equipment and Special Tool Information

Include information on test equipment required to perform specified tests and on special tools needed for the operation, maintenance, and repair of components. Provide final set points.

2 PRODUCTS

Not Used

3 EXECUTION

3.1 TRAINING

Prior to acceptance of the facility for Beneficial Occupancy, provide comprehensive training for the systems and equipment specified in the technical specifications. The training must be targeted for the building maintenance personnel and applicable building occupants. Training must include classroom or field lectures based on the system's operating requirements. The location of classroom training requires approval by the Project Manager.

3.1.1 Training Plan

Submit a written training plan to the Project Manager for approval. The training plan must be approved by the Quality Control Manager prior to forwarding to the SDSTA. Also, coordinate the training schedule with the Contracting Officer and QC. Include within the plan the following elements:

3.1.2 Training Content

The core of this training must be based on manufacturer's recommendations and the operation and maintenance information. The QC Manager is responsible for overseeing and approving the content and adequacy of the training. Include the following for each system training presentation:

a. Start-up, normal operation, shutdown, unoccupied operation, seasonal changeover, manual operation, controls set-up and programming, troubleshooting, and alarms.

b. Relevant health and safety issues.

c. Discussion of how the feature or system is environmentally responsive. Advise adjustments and optimizing methods for energy conservation.

d. Design intent.

e. Use of O&M Manual Files.

f. Review of control drawings and schematics.

g. Interactions with other systems.

h. Special maintenance and replacement sources.

i. Tenant interaction issues.

--- End of Section ---

Revision History

Rev	Date	Section	Paragraph	Summary of Change	Authorized by
02	8/6/2024	NA	NA	Updated First Report title; removed hyperlinks and spacing between sections.	CCR 979
03	12/17/2024	NA	NA	Change document number, corrected Director of Engineering title	CCR 1043

SECTION 03 30 00

CAST-IN-PLACE CONCRETE

PART 1: GENERAL

1.01 SCOPE

A. The contractor will design and install cast-in-place concrete housekeeping pads to support electrical equipment in the Ross Substation area as indicated on drawings.

1.02 RELATED DOCUMENTS

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

1.03 SUMMARY

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

1. Housekeeping Pads for MEP equipment.

B. Related Sections:

1.04 REFERENCES

A. Refer to the following:

1. AASHTO – American Association of State Highway and Transportation Officials
2. ACI – American Concrete Institute
3. AISC – American Institute of Steel Construction
4. ASTM – American Society for Testing and Materials
5. CRSI – Concrete Reinforcing Steel Institute
6. NRMCA – National Ready Mixed Concrete Association

1.05 DEFINITIONS

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

B. Defective Areas: Surface defects that include honeycomb, rock pockets, indentations, spalls, chips, embedded debris, leakage from form joints, fins and other projections, and form popouts.

C. New Concrete: Less than 60 days old.

1.06 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings:

1. Steel Reinforcement in accordance with CRSI Manual of Standard Practice and ACI SP-66. Include 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.
2. Formwork Shop Drawings.

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

1. Indicate amounts of mixing water to be withheld for later addition at Point of Placement.

D. Quality Control Plan: Detail the inspection types and frequency to be performed during the Project duration.

E. Inspection and field-testing reports.

1.07 INFORMATIONAL SUBMITTALS

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

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

B. A complete description of the system proposed for meeting the specified floor slab flatwork tolerances. Submit survey data from a minimum of two previous slab installations to demonstrate capability to satisfy specified tolerances.

C. Floor surface flatness and levelness measurements indicating compliance with specified tolerances.

D. Field quality-control reports.

1.08 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs on Project personnel qualified as ACI certified Flatwork Technician and Finisher and a supervisor who is an ACI-certified Concrete Flatwork Technician.

B. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C94/C94M-23 requirements for production facilities and equipment.

1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

C. Testing Agency Qualifications: An independent agency, acceptable to authorities having jurisdiction, qualified according to ASTM C1077-17 and ASTM E329-21 for testing indicated.

1. Personnel conducting field tests shall be qualified as ACI Concrete Field-Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.
2. Personnel performing laboratory tests shall be ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician - Grade I. Testing Agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician - Grade II.

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

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

1. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."
2. ACI 301, "Specifications for Structural Concrete," Sections 1 through 5.
3. ACI 305, “Hot Weather Concreting.”
4. ACI 318, “Building Code Requirements for Structural Concrete and Commentary.”
5. ACI 347, “Guide to Formwork for Concrete.”

F. Concrete Testing Service: It is the Contractor’s responsibility to engage a qualified independent testing agency to design concrete mixtures and to perform material evaluation tests.

G. Preinstallation Conference: Conduct conference at Project site to comply with

requirements in Division 01 specifications.

1. Before submitting design mixtures, review concrete design mixture and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:
   a. Contractor's superintendent.
   b. Independent testing agency responsible for concrete design mixtures.
   c. Concrete manufacturer.
   d. Concrete subcontractor.

2. Review special inspection and testing and inspecting agency procedures for field quality control, concrete finishes and finishing, hot weather concreting procedures, curing procedures, forms and form removal limitations, shoring and reshoring procedures, vapor retarder installation, anchor rod and anchorage device installation tolerances, steel reinforcement installation, floor and slab flatness and levelness measurement, concrete repair procedures, and concrete protection.

1.09 DELIVERY, STORAGE, AND HANDLING

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

1.10 ENVIRONMENTAL REQUIREMENTS

A. Do not place concrete when the ambient temperature is below 40 degrees F or approaching 40 degrees F and air temperature will be less than 40 degrees F for the first 7 days, without special protection to keep concrete above 40 degrees F. Follow requirements of ACI 306.

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, lumber, metal, or other approved panel materials.

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

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

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.

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

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 on removal.

1. Furnish units that will leave no corrodible metal closer than 1 inch to the plane of exposed concrete surface.
2. Furnish ties that, when removed, will leave holes no larger than 1 inch in diameter in concrete surface.
3. Furnish ties with integral water-barrier plates to walls indicated to receive damp proofing or waterproofing.

2.02 STEEL REINFORCEMENT

A. Recycled Content of Steel Products: Not required as part of this contract.

B. Reinforcing Bars: ASTM A615/A615M-22, Grade 60 (Grade 420), deformed.

C. Low-Alloy-Steel Reinforcing Bars: ASTM A706/A706M-22, deformed.

2.03 REINFORCEMENT ACCESSORIES

A. Joint Dowel Bars: ASTM A615/A615M-22, Grade 60 (Grade 420), plain-steel bars, cut true to length with ends squared and free of burrs.

B. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars 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.

2.04 CONCRETE MATERIALS FOR EQUIPMENT HOUSEKEEPING PADS

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

1. Portland Cement: ASTM C150-07, Type I/II, gray. Supplement with the following:

a. Fly Ash: ASTM C618-22, Class F.
b. Ground Granulated Blast-Furnace Slag: ASTM C989/C989M-18a, Grade 100 or 120.

B. Normal-Weight Aggregates: ASTM C33/C33M-18, use Class 3M coarse aggregate or better, graded for underground works. Provide aggregates from a single source with documented service record data of at least 10 years' satisfactory service in similar applications and service conditions using similar aggregates and cementitious materials.

1. Maximum Coarse-Aggregate Size: 3/4-inch nominal, unless noted otherwise, not to exceed the largest aggregate size that meets the following criteria:
   a. 1/5 of narrowest dimension between sides of forms.
   b. 1/3 of depth of slab.
   c. 3/4 of minimum clear distance between reinforcing bars, or between bars and forms, whichever is least.
   d. Provide aggregate gradation starting with largest aggregate meeting criteria.

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

C. Water: ASTM C94/C94M-23 and potable.

2.05 ADMIXTURES

A. Air-Entraining Admixture: ASTM C260-10.

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

1. Water-Reducing Admixture: ASTM C494/C494M-17, Type A.
2. Retarding Admixture: ASTM C494/C494M-17, Type B.
3. Water-Reducing and Retarding Admixture: ASTM C494/C494M-17, Type D.
4. High-Range, Water-Reducing Admixture: ASTM C494/C494M-17, Type F.
5. High-Range, Water-Reducing and Retarding Admixture: ASTM C494/C494M-17, Type G.
6. Plasticizing and Retarding Admixture: ASTM C1017/ C1017M-13, Type II.

2.06 VAPOR RETARDERS

A. Sheet Vapor Retarder: ASTM E1745-17, Class A. Include manufacturer's recommended adhesive or pressure-sensitive tape.

2.07 CURING MATERIALS

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

B. Absorptive Cover: AASHTO M 182-05, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. when dry.

C. Moisture-Retaining Cover: ASTM C171-20, polyethylene film or white burlap-polyethylene sheet.

D. Water: Potable.

E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C309-19, Type 1, Class B, dissipating.

F. Clear, Waterborne, Membrane-Forming Curing and Sealing Compound: ASTM C1315-19, Type 1, Class A.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
   a. BASF Construction Chemicals - Building Systems; Kure-N-Seal 25 LV.
   b. ChemMasters; Spray-Cure & Seal Plus.
   c. Dayton Superior Corporation; Day-Chem Cure and Seal (J-22UV).
   d. L&M Construction Chemicals, Inc.; Lumiseal Plus.
   e. Meadows, W. R., Inc.; CS-309/30.

G. Clear, Waterborne, Membrane-Forming Dust Sealing Compound for slabs:

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
   a. BASF Construction Chemicals - MasterKure-HD-100wb.
   b. Curecrete – Ashford Formula.

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

2.08 BONDING AGENTS

A. Epoxy-Modified, Cementitious Bonding and Anticorrosion Agent: Manufactured product that consists of water-insensitive epoxy adhesive, Portland cement, and water-based solution of corrosion-inhibiting chemicals that forms a protective film on steel reinforcement.

B. Latex Bonding Agent: ASTM C1059/C1059M-21, Type II, non-redispersible, acrylic emulsion or styrene butadiene.

C. Epoxy Bonding Adhesive: ASTM C881/C881M-20, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade to suit requirements, and as follows:

1. Type V and free of VOCs, for use in load-bearing applications for bonding freshly mixed concrete to hardened concrete.

2.09 RELATED MATERIALS

A. Expansion- and Isolation-Joint-Filler Strips: ASTM D1751-18, asphalt-saturated cellulosic fiber or ASTM D1752-18, cork or self-expanding cork.

B. Non-shrink Grout: Nonmetallic, Shrinkage-Resistant Grout: ASTM C1107/C1107M-20, factory-packaged, nonmetallic aggregate grout, noncorrosive and nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

2.10 REPAIR MATERIALS

A. Repair Underlayment/Overlayment: Cement-based, polymer-modified, self-leveling product. Underlayment that can be applied in thicknesses from 1/8 inch and that can be feathered at edges to match adjacent floor elevations. Overlayment that can be applied in thicknesses from 1/4 inch and that can be filled in over a scarified surface to match adjacent floor elevations.

1. Cement Binder: ASTM C150-07, Portland cement or hydraulic or blended hydraulic cement as defined in ASTM C219-25.
2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by the underlayment manufacturer.
4. Compressive Strength: Not less than 4100 psi (Underlayment) or 5000 psi (Overlayment) at 28 days when tested according to ASTM C109/C109M-20.

2.11 PATCHING MORTAR

A. Patching Mortar Requirements:

1. Only use patching mortars that are recommended by the manufacturer for the intended application.

B. Cementitious Patching Mortar: Packaged, dry mix for repair of concrete.

1. Compressive Strength: Not less than 5000 psi at 28 days when tested according to ASTM C109/C109M-20.

2.12 CONCRETE MIXTURES, GENERAL

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

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

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

1. Fly Ash: 25 percent.
2. Combined Fly Ash and Pozzolan: 25 percent.
3. Ground Granulated Blast-Furnace Slag: 50 percent.
4. Combined Fly Ash or Pozzolan and Ground Granulated Blast-Furnace Slag: 50 percent Portland cement minimum, with fly ash or pozzolan not exceeding 25 percent.

C. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.

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

1. Use water-reducing, high-range water-reducing, or plasticizing admixture in concrete, as required, for placement and workability.
2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
3. Use corrosion-inhibiting admixture in concrete mixtures where indicated.
4. Shrinkage reducing admixture if required.
5. Avoid use of shrinkage reducing admixtures which are not compatible with dustproof sealant products for concrete where dustproof sealant is to be applied.

2.13 CONCRETE MIXTURES FOR BUILDING ELEMENTS

A. Slabs-on-Grade, Housekeeping Pads: Proportion normal-weight concrete mixture as follows:

1. Minimum Allowable Compressive Field Strength when cured and tested in accordance with ASTM C31 and C39:
   a. 3000 psi at 7 days.
   b. 4000 psi at 28 days.
   c. 5000 psi at 56 days.

2. Coarse Aggregate Size: 3/4 inches and smaller.
3. Minimum Cementitious Materials Content: 520 lb./cu. yd.
4. Maximum Cementitious Materials Content: 600 lb./cu. yd.
5. Maximum Portland cement content: 300 lb./cu. yd.
6. Maximum water/cementitious Ratio: 0.40.
7. Slump Limit: 4 inches plus or minus 1 inch.
8. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery for 3/4-inch nominal maximum aggregate size.
9. Air Content: Do not allow air content of trowel-finished floors to exceed 3 percent.

10. Maximum concrete mix temperature before placing: 70 degrees F.

2.14 FABRICATING REINFORCEMENT

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

2.15 CONCRETE MIXING

A. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete according to ASTM C94/C94M-23. Mix concrete materials in appropriate drum-type batch machine mixer.

1. For mixer capacity of 1 cu. yd. or smaller, continue mixing at least 1-1/2 minutes, but not more than 5 minutes after ingredients are in mixer, before any part of batch is released.
2. For mixer capacity larger than 1 cu. yd., increase mixing time by 15 seconds for each additional 1 cu. yd.

PART 3 – EXECUTION

3.01 EXAMINATION

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

1. For the record, prepare a written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
2. Verify that reinforcement is properly placed.
3. Verify that substrates are free of substances that would impair mortar bond.

B. Before installation, examine rough-in and built-in construction for UFER electrical grounding systems to verify actual locations of grounding electrode pigtails.

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

3.02 TOLERANCES

A. Construct formwork so concrete and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117-10.

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

1. Class A, 1/8 inch for smooth-formed finished surfaces.

3.03 FORMWORK

A. Construction:

1. Design, erect, brace, and maintain formwork, according to ACI 301-16, as required to prevent distortion during concrete placement.
2. Clean and repair forms to be reused in the Work. When forms are reused, clean surfaces, remove fins and laitance. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Do not use patched forms for exposed concrete surfaces.
3. Align and secure joints to avoid offsets.
4. Make joints tight to prevent the escape of mortar and to avoid formation of fins.
5. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast concrete surfaces.
   a. Install keyways, reglets, recesses, and the like, for easy removal.
   b. Do not use rust-stained steel form-facing material.
6. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.
7. Chamfer exterior corners and edges of permanently exposed concrete.
8. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.
9. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.
10. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

B. Form Removal:

1. Remove after concrete has attained at least 1200 psi compressive strength or approval is obtained in writing from Engineer.
2. Remove forms with care to prevent scarring and damaging the surface.

3.04 VAPOR RETARDERS

A. Sheet Vapor Retarders: Place, protect, and repair sheet vapor retarder according to ASTM E1643-18a and manufacturer's written instructions.

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

3.05 STEEL REINFORCEMENT

A. General: See drawings for reinforcing steel required at mechanical pads.

B. Comply with CRSI's "Manual of Standard Practice" and CRSI's "Placing Reinforcing Bars."

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

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

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

1. Weld reinforcing bars according to AWS D1.4/D 1.4M, where indicated.

E. Splices and Laps: As specified on the Drawings or as listed below:

1. Lap all bars 30 diameters or minimum 18 inches.
2. Tie splices with 18-gauge annealed wire as specified in CRSI Standard.

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

3.06 JOINTS

A. General: Construct joints true to line with faces perpendicular to surface plane of concrete. Locate as shown or as approved by Engineer.

B. Construction Joints: Install so strength and appearance of concrete are not impaired.

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

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

1. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch-wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.
2. Maximum Spacing Between Contraction Joints: nominal 20 feet.

D. Joints between existing and new concrete.

1. Saw cut Joints: Install dowels at 1'-4" O.C. minimum (or as indicated) at joints where new concrete abuts saw-cut concrete. Lubricate or asphalt coat one-half of dowel length. Epoxy bond 6" of dowel into existing concrete.

3.07 CONCRETE PLACEMENT

A. Notify Engineer at least 24 hours in advance of all concrete pours.

B. Place concrete in accordance with ACI 301.

C. Prior to placing concrete, remove water from excavation and debris and foreign material from forms.

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

E. Check that UFER grounding system is installed, and ground system pigtails are located in correct positions.

F. Before depositing new concrete on old concrete, clean surface using sandblast or bushhammer or other mechanical means to obtain a 1/4-inch rough profile and pour a cement-sand grout to minimum depth of 1/2-inch over the surface. Proportion 1 part cement to 2.5 parts sand by weight.

G. Place concrete as soon as possible after leaving mixer, without segregation or loss of ingredients, without splashing forms, walls, structures or equipment. Place within 1-1/2 hours after adding cement to mix.

H. 4 feet maximum vertical drop from mixer to final placement, when not guided with chutes or other devices to prevent segregation due to impact with reinforcing.

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

1. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
2. Vibrate concrete as follows:
    a. Apply approved vibrator at points spaced not farther apart than vibrator's effective radius.
    b. Apply close enough to forms to vibrate surface effectively but not damage form surfaces.
    c. Vibrate until concrete becomes uniformly plastic.
    d. Vibrator must penetrate fresh placed concrete and into previous layer of fresh concrete below.

3. Screed slab surfaces with a straightedge and strike off to align with adjacent existing slab elevations.

4. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.

3.08 FINISHING EQUIPMENT HOUSEKEEPING PADS

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

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

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

C. Trowel and Fine-Broom Finish: Apply a first trowel finish to surfaces. While concrete is still plastic, slightly scarify surface with a fine broom.

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

3.09 MISCELLANEOUS CONCRETE ITEMS

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

B. Equipment Housekeeping Pads:

1. Coordinate sizes and locations of concrete bases with actual equipment provided.
2. Construct concrete bases 4 inches high unless otherwise indicated; and extend base not less than 2 inches in each direction beyond the maximum dimensions of supported equipment unless otherwise indicated or unless required for seismic anchor support.
3. Minimum Compressive Strength: 5000 psi at 28 days.
4. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of concrete base.
5. Prior to pouring concrete, place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
6. Cast anchor-bolt insert into bases. Install anchor bolts to elevations required for proper attachment to supported equipment.

3.10 CONCRETE PROTECTING AND CURING

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

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

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

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

1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
   a. Water.
   b. Continuous water-fog spray.
   c. Absorptive cover, water saturated and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.

2. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during the curing period.
   a. Removal: After the curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer.

3. Curing and Sealing Compound: Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller according to manufacturer's written instructions. Repeat the process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during the curing period.

3.11 JOINT FILLING

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

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

B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joint clean and dry.
C. Install semirigid joint filler full depth in saw-cut joints and at least 2 inches deep in formed joints. Overfill joint and trim joint filler flush with top of joint after hardening.

3.12 CONCRETE SURFACE REPAIRS

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

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

C. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas.

1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
2. After concrete has cured at least 14 days, correct high areas by grinding.
3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing them with patching mortar. Finish repaired areas to blend into adjacent concrete.
4. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch to match adjacent elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
5. Repair defective areas, except random cracks and single holes 1 inch or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least a 3/4-inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of the same materials and mixture as original concrete except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
6. Repair random cracks and single holes 1 inch or less in diameter with patching mortar. Groove the top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.

D. Perform structural repairs of concrete, subject to Owner's Representative approval, using epoxy adhesive and patching mortar.

E. Repair materials and installation not specified above may be used, subject to the Owner's Representative approval.

3.13 FIELD QUALITY CONTROL

A. Testing and Inspecting: The Contractor is responsible for engaging special inspectors to perform tests and inspections and prepare reports. Retesting of materials that fail to comply with specified requirements shall be done at Contractor's expense.

B. Inspections: Special inspections according to Level B in ACI 530/ASCE 5/TMS 402.

1. Steel reinforcement placement: Visual inspection to check for conformance.
2. Steel reinforcement welding.
3. Embed Plates: Visual inspection to check for conformance.
4. Headed bolts and studs.
5. Verification of use of required design mixture.
6. Concrete placement, including conveying and depositing.
7. Curing procedures and maintenance of curing temperature.
8. Verification of concrete strength before removal of forms from slabs.

C. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C172/C172M-17 shall be performed according to the following requirements:

1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd., but less than 25 cu. yd., plus one set for each additional 50 cu. yd. or fraction thereof.
   a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.

2. Slump: ASTM C143/C143M-12; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
3. Concrete Temperature: ASTM C1064/C1064M-17; one test hourly when air temperature is 40 deg F and below and when 80 deg F and above, and one test for each composite sample.
4. Compression Test Specimens: ASTM C31/C31M-23.
   a. Cast and laboratory cure two sets of two standard cylinder specimens for each composite sample.
   b. Cast and field cure two sets of two standard cylinder specimens for each composite sample.

5. Compressive-Strength Tests: ASTM C39/C39M-21; test one set of two laboratory-cured specimens at 7 days and one set of two specimens at 28 days.
   a. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.
   b. When the strength of field-cured cylinders is less than 85 percent of companion laboratory cured cylinders, the Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
   c. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.

d. Test results shall be reported in writing to Owner Representative, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.
e. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by the Owner's Representative but will not be used as a sole basis for approval or rejection of concrete.

6. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by the Engineer. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C42/C42M-20 or by other methods as directed by the Engineer.
7. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
8. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.

D. Survey and Adjustment:

1. Measure floor and slab flatness and levelness according to ASTM E1155-95(2021) within 24 hours of finishing.
2. Certify, by written report, that the slab surfaces are within flatness and levelness tolerances.

END OF SECTION 03 30 00

SECTION 04 20 00

UNIT MASONRY

PART 1: GENERAL

1.01 SCOPE

A. The contractor will design and install cement masonry unit walls to enclose the Ross Substation area as indicated on drawings.

1.02 RELATED DOCUMENTS

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

1.03 PERFORMANCE REQUIREMENTS

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

1. Determine net-area compressive strength of masonry from average net-area compressive strengths of masonry units and mortar types (unit-strength method) according to TMS 602/ACI 530.1/ASCE 6.
2. Determine net-area compressive strength of masonry by testing masonry prisms according to ASTM C1314-21.

1.04 SUMMARY

A. Section Includes:

1. Concrete masonry units.
2. Mortar and grout.
3. Steel reinforcing bars.
4. Masonry joint reinforcement.
5. Miscellaneous masonry accessories.

B. Related Sections:

1.05 DEFINITIONS

A. CMU(s): Cement Masonry Unit(s)

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

1.06 SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For the following:

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

C. Qualification Data: For testing agency.

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

1. Masonry Units:
   a Include data on material properties and material test reports substantiating compliance with requirements.
   b For masonry units, include data and calculations establishing average net-area compressive strength of units.
2. Cementitious materials. Include brand, type, and name of manufacturer.
3. Preblended, dry mortar mixes. Include description of type and proportions of ingredients.
4. Grout mixes. Include description of type and proportions of ingredients.
5. Reinforcing bars.
6. Joint reinforcement.
7. Anchors, ties, and metal accessories.

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

1. Include test reports for mortar mixes required to comply with property specification. Test according to ASTM C109/C109M-20 for compressive strength, ASTM C1506-17 for water retention, and ASTM C91/C91M-25 for air content.
2. Include test reports, according to ASTM C1019-20, for grout mixes required to comply with compressive strength requirement.

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

1.07 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to ASTM C1093-22 for testing indicated.

B. Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these

characteristics, from single source from single manufacturer for each product required.

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

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

E. Preinstallation Conference: Conduct conference at Project site.

1.08 DELIVERY, STORAGE, AND HANDLING

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

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

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

D. Deliver pre-blended, dry mortar mix in moisture-resistant containers. Store pre-blended, dry mortar mix in delivery containers on elevated platforms in a dry location or in covered weatherproof dispensing silos.

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

1.09 FIELD CONDITIONS

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

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

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

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

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

PART 2: PRODUCTS

2.01 MANUFACTURERS

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

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

2.02 MASONRY UNITS, GENERAL

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

B. Fire-Resistance Ratings: Where indicated, provide units that comply with requirements for fire resistance ratings indicated as determined by testing according to ASTM E119-20, by equivalent masonry thickness, or by other means, as acceptable to authorities having jurisdiction.

C. Fire-Resistance Ratings: Comply with requirements for fire-resistance-rated assembly designs indicated.

1. Where fire-resistance-rated construction is indicated, units shall be listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction.

2.03 CONCRETE MASONRY UNITS

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

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

B. CMUs: ASTM C90-22.

1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 2150 psi.
2. Density Classification: Normal weight as required to achieve 2-hr fire rating.
3. Size (Width): Manufactured to dimensions 3/8 inch less than nominal dimensions.
4. Nominal Unit Size: 8” x 8” x 16”. No units longer than 16 inches (nominal) shall be used on the project.
5. Pattern and Texture: Standard pattern, ground-face finish.

2.04 MASONRY LINTELS

A. Masonry Lintels: Prefabricated or built-in-place masonry lintels made from bond beam CMUs with reinforcing bars placed as indicated and filled with coarse grout. Cure precast lintels before handling and installing. Temporarily support built-in-place lintels until cured.

2.05 MORTAR AND GROUT MATERIALS

A. Portland Cement: ASTM C150-07, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.

B. Hydrated Lime: ASTM C207-18, Type S.

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

D. Masonry Cement: ASTM C91/C91M-25.

E. Mortar Cement: ASTM C1329-05.

F. Aggregate for Mortar: ASTM C144-24.

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

G. Aggregate for Grout: ASTM C404-18.

H. Water: Potable.

2.06 REINFORCEMENT

A. Uncoated Steel Reinforcing Bars: ASTM A615/A615M-22 or ASTM A996-20, Grade 60.

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

C. Masonry Joint Reinforcement, General: ASTM A951/A951M-16e1.

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

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

2.07 TIES AND ANCHORS

A. General: Ties and anchors shall extend at least 1-1/2 inches into masonry but with at least a 5/8-inch cover on the outside face.

B. Materials: Provide ties and anchors specified in this article that are made from materials that comply with the following unless otherwise indicated.

1. Mill-Galvanized, Carbon-Steel Wire: ASTM A82-01, with ASTM A641/A641M-19, Class 1 coating.
2. Hot-dip Galvanized, Carbon-Steel Wire: ASTM A82-01; with ASTM A153/A153M-16a, Class B-2 coating.
3. Galvanized Steel Sheet: ASTM A653/A653M-20, Commercial Steel, G60 zinc coating.
4. Steel Sheet, Galvanized after Fabrication: ASTM A1008/A1008M-21a, Commercial Steel, with ASTM A153/A153M-16a, Class B coating.
5. Steel Plates, Shapes, and Bars: ASTM A36/A36M-19.

C. Partition Top Anchors: 0.105-inch-thick metal plate with a 3/8-inch-diameter metal rod 6 inches long welded to plate and with closed-end plastic tube fitted over rod that allows rod to move in and out of tube. Fabricate from steel, hot-dip galvanized after fabrication.

D. Rigid Anchors: Fabricate from steel bars 1-1/2 inches wide by 1/4 inch thick by 24 inches long, with ends turned up 2 inches or with cross pins unless otherwise indicated.

1. Corrosion Protection: Hot-dip galvanized to comply with ASTM A153/A153M-16a.

2.08 MISCELLANEOUS MASONRY ACCESSORIES

A. Compressible Filler: Pre-molded filler strips complying with ASTM D1056-20, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene urethane or PVC.

B. Preformed Control-Joint Gaskets: Made from PVC, complying with ASTM D2287-19, Type PVC-65406 and designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.

C. Bond-Breaker Strips: Asphalt-saturated, organic roofing-felt complying with ASTM D226/ D226M-17, Type I (No. 15 asphalt felt).

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

2.09 MORTAR AND GROUT MIXES

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

1. Do not use calcium chloride in mortar or grout.
2. Use Portland cement-lime mortar unless otherwise indicated.

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

C. Mortar for Unit Masonry: Comply with ASTM C270-25, Proportion Specification. Provide the following types of mortar for applications stated unless another type is indicated or needed to provide the required compressive strength of masonry.

1. For reinforced masonry, use Type S.
2. For interior load-bearing walls; for interior non-load-bearing partitions; and for other applications where another type is not indicated, use Type S.

D. Grout for Unit Masonry: Comply with ASTM C476-23.

1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with ACI 530.1/ASCE 6/TMS 602 for dimensions of grout spaces and pour height.
2. Proportion grout in accordance with ASTM C476-23, Table 1 or paragraph 4.2.2 for specified 28-day compressive strength indicated, but not less than 2000 psi.
3. Provide grout with a slump of 8 to 11 inches as measured according to ASTM C143/C143M-12.

PART 3 – EXECUTION

3.01 EXAMINATION

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

1. For the record, prepare a written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
2. Verify that foundations are within tolerances specified.
3. Verify that reinforcing dowels are properly placed.
4. Verify that substrates are free of substances that would impair mortar bond.

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

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

3.02 INSTALLATION, GENERAL

A. Thickness: Build single-wythe walls to actual widths of masonry units, using units of widths indicated.

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

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

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

E. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures.

3.03 TOLERANCES

A. Dimensions and Locations of Elements:

1. For dimensions in cross section or elevation do not vary by more than plus 1/2 inch or minus 1/4 inch.

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

B. Lines and Levels:

1. For bed joints and top surfaces of bearing walls do not vary from level by more than 1/4 inch in 10 feet, or 1/2 inch maximum.
2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.
3. For vertical lines and surfaces do not vary from plumb by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2 inch maximum.
4. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.
5. For lines and surfaces do not vary from straight by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2 inch maximum.
6. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 feet, or 1/2 inch maximum.
7. For faces of adjacent exposed masonry units, do not vary from flush alignment by more than 1/16 inch except due to warpage of masonry units within tolerances specified for warpage of units.

C. Joints:

1. For bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch, with a maximum thickness limited to 1/2 inch.
2. For exposed bed joints, do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch.
3. For head and collar joints, do not vary from thickness indicated by more than plus 3/8 inch or minus 1/4 inch.
4. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch. Do not vary from adjacent bed-joint and head-joint thicknesses by more than 1/8 inch.
5. For exposed bed joints and head joints of stacked bond, do not vary from a straight line by more than 1/16 inch from one masonry unit to the next.

3.04 LAYING MASONRY WALLS

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

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

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

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

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

F. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath, wire mesh, or plastic mesh in the joint below and rod mortar or grout into core.

G. Fill cores in hollow CMUs with grout 24 inches under bearing plates, beams, lintels, posts, and similar items unless otherwise indicated.

H. Build non-load-bearing interior partitions full height of story to underside of solid floor or roof structure above unless otherwise indicated.

1. Install compressible filler in joint between top of partition and underside of structure above.
2. Fasten partition top anchors to structure above and build into top of partition. Grout cells of CMUs solidly around plastic tubes of anchors and push tubes down into grout to provide 1/2-inch clearance between end of anchor rod and end of tube. Space anchors 48 inches O.C. unless otherwise indicated.
3. Wedge non-load-bearing partitions against structure above with small pieces of tile, slate, or metal. Fill joint with mortar after dead-load deflection of structure above approaches final position.
4. At fire-rated partitions, treat joint between top of partition and underside of structure above to comply with Section 07 84 00 "Firestopping."

3.05 MORTAR BEDDING AND JOINTING

A. Lay hollow CMUs as follows:

1. Bed face shells in mortar and make head joints of depth equal to bed joints.
2. Bed webs in mortar in all courses of piers, columns, and pilasters.
3. Bed webs in mortar in grouted masonry, including starting course on footings.
4. Fully bed entire units, including areas under cells, at starting course on footings where cells are not grouted.

B. Lay solid CMUs with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.

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

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

E. Cut joints flush where indicated to receive waterproofing unless otherwise indicated.

3.06 MASONRY-JOINT REINFORCEMENT

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

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

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

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

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

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

3.07 LINTELS

A. Install steel lintels where indicated.

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

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

3.08 ANCHORING MASONRY TO STRUCTURAL STEEL AND CONCRETE

A. Anchor masonry to structural steel and concrete where masonry abuts or faces structural steel or concrete to comply with the following:

1. Provide an open space not less than 1/2 inch wide between masonry and structural steel or concrete unless otherwise indicated. Keep open space free of mortar and other rigid materials.
2. Anchor masonry with anchors embedded in masonry joints and attached to structure.
3. Space anchors as indicated, but not more than 24 inches O.C. vertically and 36 inches O.C. horizontally.

3.09 CONTROL AND EXPANSION JOINTS

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

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

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

C. Provide horizontal, pressure-relieving joints by either leaving an air space or inserting a compressible filler of width required for installing sealant and backer rod specified in Section 07 92 00 "Joint Sealants," but not less than 3/8 inch.

1. Locate horizontal, pressure-relieving joints beneath shelf angles supporting masonry.

3.10 REINFORCED UNIT MASONRY INSTALLATION

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

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

2. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and other loads that may be placed on them during construction.

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

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

1. Comply with requirements in ACI 530.1/ASCE 6/TMS 602 for cleanouts and for grout placement, including minimum grout space and maximum pour height.
2. Limit the height of vertical grout pours to not more than 60 inches.

3.11 FIELD QUALITY CONTROL

A. Testing and Inspecting: The Contractor is responsible for engaging special inspectors to perform tests and inspections and preparing reports. Allow inspectors to access scaffolding and work areas, as needed to perform tests and inspections. Retesting of materials that fail to comply with specified requirements shall be done at Contractor's expense.

B. Inspections: Special inspections according to Level B in ACI 530/ASCE 5/TMS 402.

1. Begin masonry construction only after inspectors have verified proportions of site prepared mortar.
2. Place grout only after inspectors have verified compliance of grout spaces and of grades, sizes, and locations of reinforcement.
3. Place grout only after inspectors have verified proportions of site-prepared grout.

C. Testing Prior to Construction: One set of tests.

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

E. Concrete Masonry Unit Test: For each type of unit provided, according to ASTM C140-13 for compressive strength.

F. Mortar Aggregate Ratio Test (Proportion Specification): For each mix provided, according to ASTM C780-25.

G. Mortar Test (Property Specification): For each mix provided, according to ASTM C780-25. Test mortar for compressive strength.

H. Grout Test (Compressive Strength): For each mix provided, according to ASTM C1019-20.

I. Prism Test: For each type of construction provided, according to ASTM C1314-21 at 28 days.

3.12 REPAIRING, POINTING, AND CLEANING

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

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

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

D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:

1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
2. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Owner Representative's approval of sample cleaning before proceeding with cleaning of masonry.
3. Protect adjacent stone and non-masonry surfaces from contact with cleaners by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
5. Clean concrete masonry by cleaning method indicated in NCMA TEK 8-2A applicable to type of stain on exposed surfaces.

3.13 MASONRY WASTE DISPOSAL

A. Salvageable Materials: Unless otherwise indicated, excess masonry materials are Contractor's property. At completion of unit masonry work, remove from Project site.

B. Waste Disposal as Fill Material: Dispose of clean masonry waste, including excess or soil contaminated sand, waste mortar, and broken masonry units, by crushing and mixing with fill material as fill is placed.

1. Crush masonry waste to less than 4 inches (100 mm) in each dimension.
2. Mix masonry waste with at least two parts of specified fill material for each part of masonry waste.
3. Do not dispose of masonry waste as fill within 18 inches (450 mm) of finished grade.

C. Masonry Waste Recycling: Return broken CMUs not used as fill to manufacturer for recycling.

D. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above or recycled, and other masonry waste, and legally dispose of off Owner's property.

END OF SECTION 04 20 00

SECTION 05 05 20

HANGER SUPPORT ANCHORS

PART 1: GENERAL

1.01 SCOPE

A. The contractor will install hanger support anchors around the Ross Campus area as indicated on drawings. The contractor will be required to install anchors according to the construction drawings.

1.02 SUMMARY

A. Section includes the following:

1. Hanger Support Anchors.

B. Related Sections:

1. Section 05 05 29 “Unistrut Support System.”

1.03 SUBMITTALS

A. Submittals should be provided to the owner (or representative) and the design engineer (or representative).

B. The Contractor shall prepare and submit to the Engineer for review a design submittal describing the rock anchor system or systems intended for use. The submittal shall be submitted a minimum of two (2) weeks prior to the commencement of the anchor installation work. Anchor installation cannot commence until the Engineer has reviewed the submittal. The design submittal shall include the following:

1. Type and details of rock anchors, including manufacturer’s recommendations for installation.
2. Type and details of rock anchor accessories.
3. Corrosion protection system(s) for rock anchors and accessories.
4. Equipment and procedures for rock hole drilling.
5. Adhesive type and manufacturer’s recommended installation method.
6. Manufacturer-published torque/load relationships.
7. Design data for any and all other system components.
8. Anchor resin type for horizontal, vertical, and overhead use.

1.04 INSPECTIONS

A. The following inspections are required:

1. Visual inspection of anchors after installation by the design engineer (or representative) prior to infrastructure installation.
2. 25% of installed anchors shall be pull-tested to 2000 lbs.

1.05 REFERENCES

A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel.

B. ASTM A194/A194M - Standard Specification for Carbon Steel, Alloy Steel, and Stainless-Steel Nuts for Bolts for High Pressure or High Temperature Service, or Both.

C. ASTM C579 - Standard Test Method for Compressive Strength of Chemical- Resistant Mortars, Grouts, Monolithic Surfacings, and Polymer Concretes.

D. ASTM F432 - Standard Specification for Roof and Rock Bolts and Accessories.

E. ASTM C881 - Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete.

F. ASTM A563 - Standard Specification for Carbon and Alloy Steel Nuts.

G. ASTM No. A123 or A153 – Standard Specification for hot-dip galvanizing.

PART 2: PRODUCTS

2.01 HANGER SUPPORT ANCHORS

A. Anchors shall consist of 1/2 inch High-performance anchor rod for injectable hybrid/epoxy anchors (carbon steel, ASTM F1554 grade 36, hot-dip galvanized).

B. All accessories shall be compatible with High-performance anchor rod for injectable hybrid/epoxy anchors (carbon steel, ASTM F1554 grade 36, hot-dip galvanized) or as noted on the Drawings.

C. Anchors shall be compatible with resin used for grouting.

D. Sufficient tail length of no less than 6 inches shall be provided beyond the end hardware to accommodate coupler attachment on vertical anchors.

2.02 RESIN GROUT

A. Resin shall conform to ASTM C881and perform equal to or better than Hilti HIT-HY 200-R V3 EPOXY.

B. Either slow or fast set resin may be used.

C. Provide sufficient resin to meet encapsulation length criterion based on adopted drill

hole diameter.

D. Provide resin cartridges with a shelf life of not less than 6 months as dated on the container and used within the stated shelf life.

E. Store resin under environmental conditions as recommended by the vendor's product literature until use.

PART 3: EXECUTION

3.01 INSTALLATION

A. Install anchors in accordance with this Specification and as shown on the Drawings.

3.02 HANGER SUPPORT ANCHORS

A. Install hanger support anchors in locations shown on the Drawings.

B. Position anchors in between standard bolt pattern.

C. Drill holes shall be drilled normal to the rock surface within a tolerance of 2% over the full hole length and the minimum hole diameter shall be 3/4 inches for ½ inch threaded rod using a hammer drill, or diamond core drill. Survey drill holes to ensure they normal to the rock surface prior to installing the anchors.

D. Unless noted otherwise, drill holes for thrust block anchors in accordance with the Drawings.

E. Just before setting the steel bolt, the bore hole must be cleaned using appropriate methods per the manufacturer's recommendation to assure it is free of dust and debris, inadequate hole cleaning could lead to poor load values.

F. Mark and set steel bolt to the required embedment depth until working time has elapsed.

G. The anchor bond length shall be no less than 100% of the total anchor length.

H. Clean and protect the tail of the threaded rods.

I. The Contractor shall follow all manufacturer's installation procedures for bolt and epoxy installation.

END OF SECTION 05 05 20

SECTION 05 05 29

UNISTRUT SUPPORT SYSTEMS

PART 1: GENERAL

1.01 SCOPE

A. The contractor will design and install hangers and supports for ventilation system fan and ductwork for the Ross Substation area as indicated on drawings.

B. Provide all Unistut metal framing material, fittings and related accessories (Strut System) as indicated on drawings.

C. Provide all labor, supervision, engineering, and fabrication required for installation of the strut system in accordance with the drawings and as specified herein.

D. Related work specified elsewhere.

1.02 RELATED DOCUMENTS

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

1.03 SUMMARY

A. Section includes the following:

1. Trapeze Hangers.

B. Related Sections:

1. Section 05 05 20 “Hanger Support Anchors.”
2. Section 23 31 13 "Metal Ducts" for duct hangers and supports.
3. Section 23 34 13 "Axial HVAC Fans" for vibration isolation spring hangers.

1.04 REFERENCES

A. Refer to the following:

1. ASTM – American Society for Testing and Materials
2. AISI – American Iron and Steel Institute
3. AWS – American Welding Society
4. SMACNA – Sheet Metal and Air Conditioning Contractors National Association

1.05 SUBMITTALS

A. Product Data: Submit manufacturers published data for each type of product indicated.

B. Delegated-Design Submittal:

1. Design Calculations: Calculations including, but are not limited to:
   a. Description of design criteria.
   b. Stress and deflection analysis.
   c. Selection of Unistrut framing members, fittings, and accessories.

2. Materials, fabrication, assembly, and spacing of hangers and supports in accordance with SMACNA's "HVAC Duct Construction Standards – Metal and Flexible," Table 5-1 (Table 5-1M), "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct."

C. Shop Drawings:

1. Drawings necessary to completely install the Strut System in compliance with the drawings including plans, elevations, sections, components, duct, equipment and building attachments, and vibration isolation.

D. Welding certificates.

E. Field quality-control reports.

1.06 QUALITY ASSURANCE

A. Manufacturer’s qualifications:

1. The manufacturer shall not have had less than 10 years’ experience in manufacturing Strut Systems.
2. The manufacturer must certify in writing all components supplied have been produced in accordance with an established quality assurance program.

B. Installer’s qualifications:

1. Structural Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code – Steel."
2. Installer must be a Unistrut trained manufacturer’s authorized representative/installer with not less than 5 years’ experience in the installation of Strut Systems of this size and conformation.
3. All Strut System components must be supplied by a single manufacturer.

1.07 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. All material is to be delivered to the work site in original factory packaging to avoid damage to the finish.

B. Upon delivery to the work site, all components shall be protected from the elements by a shelter or other covering.

1.08 GUARANTEE

A. Separate guarantees shall be issued from the erector and manufacturer, valid for a period of 1 year, against any defects that may arise from the installation or manufacture of the Strut System components.

PART 2: PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. All Strut System components shall be as manufactured by UNISTRUT CORPORATION or approved equal as determined by the designer or owner's representative.

2.02 MATERIALS

A. All channel members shall be fabricated from structural grade steel conforming to one of the following ASTM specifications: A 570 GR 33, A 653 GR 33.

A. All fittings shall be fabricated from steel conforming to one of the following ASTM specifications: A 575, A 576, A 36 or A 635.

B. Substitutions: Any substitutions of product or manufacturer must be approved by the designer or owner's representative.

2.03 FINISHES

A. Strut System components shall be finished in accordance with one of the following standards:

1. HOT-DIPPED GALVANIZED (HG) Zinc coated after all manufacturing operations are complete. Coating shall conform to ASTM A 123 or A 153.

PART 3: EXECUTION

3.01 INSTALLATION

A. Installation shall be accomplished by a fully trained manufacturer authorized installer.

B. Set Strut System components into final position true to line, level and plumb, in accordance with approved shop drawings.

C. Anchor material firmly in place. Tighten all connections to their recommended torques.

3.02 CLEANUP

A. Upon completion of this section of work, remove all protective wraps and debris. Repair any damage due to installation of the Strut System.

3.03 PROTECTION

A. During installation, it shall be the responsibility of the installer to protect this work from damage.

B. Upon completion of this scope of work, it shall become the responsibility of the general contractor to protect this work from damage during the remainder of construction on the project and until substantial completion.

END OF SECTION 05 05 29

SECTION 05 50 00

METAL FABRICATIONS

PART 1: GENERAL

1.01 SCOPE

A. The contractor will fabricate and install metal workings as necessary for the Ross Substation area as indicated in drawings.

1.02 RELATED DOCUMENTS

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

1.03 SUMMARY

A. Section includes the following:

1. Steel frames for overhead coiling doors.
2. Trench Drain Covers & Fire-Protection Plates.
3. Steel framing and supports.
4. Miscellaneous steel trim.
5. Steel weld plates and angles for casting into concrete for applications where they are not specified in other Sections.

B. Related Sections:

1. Section 08 33 23 “Overhead Coiling Doors” for installing loose lintels, anchor bolts, and other items built into unit masonry.
2. Section 04 20 00, “Concrete Masonry Units.”
3. Section 09 96 00 "High-Performance Coatings."

1.04 REFERENCES

A. Refer to the following:

1. ASCE – American Society of Civil Engineers
2. ASME – American Society of Mechanical Engineers
3. ASTM – American Society for Testing and Materials
4. MFMA – Metal Framing Manufacturers Association
5. NFPA – National Fire Protection Association

1.05 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of walls, floor slabs, and other construction contiguous with metal fabrications by field measurements before fabrication.

1.06 COORDINATION

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

B. Coordinate installation of anchorages and steel weld plates and angles for casting into concrete. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation

1.07 PERFORMANCE REQUIREMENTS

A. Uniform loading for trench drain covers: 125 lbs./sq. ft., minimum.

1.08 SUBMITTALS

A. Product Data: For each type of product indicated, included but not limited to:

1. Structural Steel: carbon-steel plates, shapes, rods and bars; black and galvanized.
2. Fasteners.
3. Shop Primers.
4. Paint products.

B. Shop Drawings: Show fabrication and installation details for metal fabrications. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items. Provide Shop Drawings for the following:

1. Steel frames for overhead doors.
2. Trench covers.
3. Miscellaneous steel trim.
4. Steel framing and supports for applications where framing and supports are not specified in other Sections.

C. Mill Certificates: Signed by manufacturers of aluminum, steel, and stainless-steel certifying that products furnished comply with requirements.

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

E. Qualification Data:

1. For engineer or designer's experience with providing delegated-design engineering

services of the kind indicated.
2. Welding Certificates.

1.09 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel in accordance with the following:

1. AWS D1.1/D1.1M-2025, "Structural Welding Code - Steel."
2. AWS D1.2/D1.2M-2014, "Structural Welding Code - Aluminum."
3. AWS D1.3/D1.3M-2018, "Structural Welding Code - Sheet Steel."
4. AWS D1.6/D1.6M-2017, "Structural Welding Code - Stainless Steel."

PART 2: PRODUCTS

2.01 METALS

A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

B. Steel Plates, Shapes, and Bars: ASTM A36/A36M-19.

C. Stainless Steel Sheet, Strip, and Plate: ASTM A240/A240M-22a or ASTM A666-15, Type 304.FIRE-RATED DOOR ASSEMBLY.

D. Stainless Steel Bars and Shapes: ASTM A276-13a, Type 304.

E. Rolled-Steel Floor Plate: ASTM A786/A786M-15(2021), rolled from plate complying with ASTM A36/A36M-19 or ASTM A283/A283M-03, Grade C or D.

F. Steel Tubing: ASTM A500/A500M-03a, cold-formed steel tubing.

G. Steel Pipe: ASTM A53/A53M-22, Standard Weight (Schedule 40) unless otherwise indicated.

H. Cast Iron: Either gray iron, ASTM A48/A48M-22, or malleable iron, ASTM A47/A47M-99(2022), unless otherwise indicated.

I. Aluminum Plate and Sheet: ASTM B209/B209M-21a, Alloy 6061-T6.

J. Aluminum Extrusions: ASTM B221-12, Alloy 6063-T6.

K. Aluminum-Alloy Rolled Tread Plate: ASTM B632/B632M-18, Alloy 6061-T6.

L. Aluminum Castings: ASTM B26/B26M-18e1, Alloy 443.0-F.

M. Bronze Extrusions: ASTM B455-10, Alloy UNS No. C38500 (extruded architectural bronze).

N. Bronze Castings: ASTM B584-22, Alloy UNS No. C83600 (leaded red brass) or UNS No. C84400 (leaded semi-red brass).

O. Nickel Silver Extrusions: ASTM B151/B151M-20, Alloy UNS No. C74500.

P. Nickel Silver Castings: ASTM B584-22, Alloy UNS No. C97600 (20 percent leaded nickel bronze).

2.02 FASTENERS

A. General: Since the substrate to which most construction components will be attached for this project is natural rock, the most appropriate type of anchorage is the use of Post-Installed Adhesive Anchors. Products used shall have obtained an ICC Evaluation Services Report (ESR) showing they comply with ICC-ES Acceptance Criteria for Post-Installed Adhesive Anchors in Concrete Elements, (AC308). Consult with manufacturer's technical representative, on site, to determine the types of anchors to be used for various loads and conditions.

1. Basis-of-Design Products:
   a. Hilti HIT-HY 200 (ESR-3187)
2. Alternative Manufacturers:
   a. Sika Corp.
   b. Conspec Materials Inc.
   c. DeWalt

B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A307-21, Grade A; with hex nuts, ASTM A563/A563M-21ae1; and, where indicated, flat washers.

C. High-Strength Bolts, Nuts, and Washers: ASTM F3125-15, Grade A325, Type 3, heavy-hex steel structural bolts; ASTM A563/A563M-21ae1, Grade DH3, (Class 10S3) heavy-hex carbon-steel nuts; and where indicated, flat washers.

D. Stainless Steel Bolts and Nuts: Regular hexagon-head annealed stainless steel bolts, ASTM F593-17; with hex nuts, ASTM F594-22; and, where indicated, flat washers; Alloy Group 1 (A1).

E. Anchor Bolts: ASTM F1554-20, Grade 36, of dimensions indicated; with nuts, ASTM A563/A563M-21ae1; and, where indicated, flat washers.

1. Hot-dip galvanize or provide mechanically deposited, zinc coating where item being fastened is indicated to be galvanized.

F. Eyebolts: ASTM A489-18e1.

G. Machine Screws: ASME B18.6.3-2024.

H. Lag Screws: ASME B18.2.1-2012 (R2021).

I. Wood Screws: Flat head, ASME B18.6.1-1981 (R2016).

J. Plain Washers: Round, ASME B18.22.1-1981 (R2017).

K. Lock Washers: Helical, spring type, ASME B18.21.1-2009 (R2016).

L. Anchors, General: Capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing in accordance with ASTM E488/E488M-22, conducted by a qualified independent testing agency.

M. Cast-in-Place Anchors in Concrete: Either threaded or wedge type unless otherwise indicated; galvanized ferrous castings, either ASTM A47/A47M-99(2022)e1 malleable iron or ASTM A27/A27M-20 cast steel. Provide bolts, washers, and shims as needed, all hot-dip galvanized per ASTM F2329/F2329M-15.

N. Post-Installed Anchors: See paragraph “A” above.

O. Slotted-Channel Inserts: Cold-formed, hot-dip galvanized-steel box channels (struts) complying with MFMA-4, 1-5/8 by 7/8 inches or 1 5/8 by 1 5/8 inches by length indicated with anchor straps or studs not less than 3 inches long at not more than 8 inches O.C. Provide with temporary filler and tee-head bolts, complete with washers and nuts, all zinc-plated to comply with ASTM B633-19, Class Fe/Zn 5, as needed for fastening to inserts.

2.03 MISCELLANEOUS MATERIALS

A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

B. Shop Primers: Provide primers that comply with Section 09 96 00 "High-Performance Coatings."

C. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.

1. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.

D. Epoxy Zinc-Rich Primer: Complying with MPI#20 and compatible with topcoat.

E. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.

F. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M-97(2018).

G. Nonshrink, Metallic Grout: Factory-packaged, ferrous-aggregate grout complying with ASTM C1107/C1107M-20, specifically recommended by manufacturer for heavy-duty loading applications.

H. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C1107/C1107M-20. Provide grout specifically recommended by manufacturer for interior and exterior applications.

2.04 FABRICATION, GENERAL

A. Shop Assembly: Preassemble items in the shop to the greatest extent possible. Use connections that maintain structural value of joined pieces. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

D. Form exposed work with accurate angles and surfaces and straight edges.

E. Weld corners and seams continuously to comply with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) fasteners unless otherwise indicated. Locate joints where least conspicuous.

G. Fabricate seams and other connections that are exposed to moisture in a manner to exclude water. Provide weep holes where water may accumulate.

H. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.

I. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated

loads.

J. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, 1/8 by 1-1/2 inches, with a minimum 6-inch embedment and 2-inch hook, not less than 8 inches from ends and corners of units and 24 inches O. C., unless otherwise indicated.

2.05 TRENCH DRAIN COVERS & FIRE-PROTECTION PLATES

A. Fabricate using galvanized bar grating of thickness as shown and spaced to provide uniform loading of 125 lbs./sq. ft., minimum.

B. Where fire-rated walls cross a trench, cove trench with a wall bearing plate and fire-protection plates as indicated on drawings.

1. Plates shall be constructed of ½ inch thick hot-dip galvanized steel plate conforming to ASTM A36/A36M-19.
2. Plate(s) shall be coated with weldable primer and intumescent paint on both sides.
3. At Contractor's option, the wall bearing plate and the fire protection plates can be a single piece of plate or can be divided into three separate pieces. If divided the gap between plates shall be a maximum of 1/8 inch wide.
4. Plates shall be fastened to concrete with 3/8" dia. x 4" long carbon steel mechanical galvanized concrete screws at 12 inches O.C. and 3 inches maximum from the end of the plate.
5. Wall bearing plate shall be 10 inches wide and centered on the wall. Only one screw on each side of the trench channel is required for the bearing plate.
6. Wall bearing plate shall have 1/2 inch by 6 inch headed studs to match the layers and spacing of the CMU wall vertical reinforcement.
7. Fire-protection plates shall extend a minimum of 4 feet on both sides of the wall.
8. Fire-protection plate shall be wide enough to allow fasteners to be spaced a minimum of 3 inches from edge of concrete on both sides of trench. Field measurement of trench width is required.

2.06 MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.

B. Fabricate units from steel shapes, plates, and bars of welded construction unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction.

1. Fabricate units from slotted channel framing where indicated.
2. Furnish inserts for units installed after concrete is placed.

C. Galvanize miscellaneous framing and supports where indicated.

D. Prime miscellaneous framing and supports with primer specified in Section 09 96 00 "High-Performance Coatings" where indicated.

2.07 MISCELLANEOUS STEEL TRIM

A. Unless otherwise indicated, fabricate units from steel shapes, plates, and bars of profiles shown with continuously welded joints and smooth exposed edges. Miter corners and use concealed field splices where possible.

B. Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work.

1. Provide with integrally welded steel strap anchors for embedding in concrete or masonry construction.

C. Prime miscellaneous steel trim with primer specified in Section 09 96 00 "High-Performance Coatings."

2.08 LOOSE STEEL LINTELS

A. Fabricate loose steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated. Fabricate in single lengths for each opening unless otherwise indicated. Weld adjoining members together to form a single unit where indicated.

B. Size loose lintels to provide bearing length at each side of openings equal to 1/12 of clear span but not less than 8 inches unless otherwise indicated.

C. Galvanize loose steel lintels where indicated.

2.09 STEEL WELD PLATES AND ANGLES

A. Provide steel weld plates and angles not specified in other Sections, for items supported from concrete construction as needed to complete the Work. Provide each unit with no fewer than two integrally welded steel strap anchors for embedding in concrete.

2.10 GENERAL FINISH REQUIREMENTS

A. Finish metal fabrications after assembly.

B. Finish exposed surfaces to remove tool and die marks and stretch lines, and to blend into surrounding surface.

C. All items listed in Article 1.03.A above, except fire-protection trench drain cover plates, shall be hot-dipped galvanized after fabrication.

2.11 STEEL AND IRON FINISHES

A. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A153/A153M-16a for steel and iron hardware and with ASTM A123/A123M-15 for other steel and iron products.

1. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.

B. Shop prime iron and steel items not indicated to be galvanized unless they are to be embedded in concrete, sprayed-on fireproofing, or masonry, or unless otherwise indicated.

1. Shop prime in accordance with Section 09 96 00, "High-Performance Coatings."

C. Preparation for Shop Priming: Prepare surfaces to comply with SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."

1. Items Indicated to Receive Primers Specified in Section 09 96 00 "High-Performance Coatings": SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
2. Other Steel Items: SSPC-SP 3, "Power Tool Cleaning."

D. Shop Priming: Apply shop primer to comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

PART 3 – EXECUTION

3.01 INSTALLATION, GENERAL

A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

C. Field Welding: Comply with the following requirements:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.

4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag screws, wood screws, and other connectors.

E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

3.02 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.

3.03 ADJUSTING AND CLEANING

A. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A780/A780M-20.

3.04 REPAIRS

A. Touchup Painting:

1. Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
   a. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.

END OF SECTION 05 50 00

SECTION 07 84 00

FIRESTOPPING

PART 1: GENERAL

1.01 SCOPE

A. The contractor will provide firestopping as necessary for the Ross Substation area as indicated in drawings.

1.02 RELATED DOCUMENTS

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

1.03 DEFINITIONS

A. Firestopping: Material or combination of materials used to retain integrity of fire-rated construction by maintaining an effective barrier against the spread of flame, smoke, and hot gases through penetrations in, or construction joints between, fire rated wall and floor assemblies.

1.04 SUMMARY

A. Only tested firestop systems shall be used in specific locations as follows:

1. Penetrations for the passage of duct, cable, cable tray, conduit, piping, electrical busways and raceways through fire-rated vertical barriers (walls and partitions), and horizontal barriers (floor/ceiling assemblies).
2. Penetration and construction gap smoke-stopping in smoke assemblies.
3. Openings between structurally separate sections of wall or floors.
4. Gaps between the top of walls and ceilings or roof assemblies.
5. Expansion joints in walls and floors.
6. Openings and penetrations in fire-rated partitions or walls containing fire doors.
7. Openings around structural members which penetrate floors or walls.
8. Trench drain openings at fire rated walls.

B. Related Sections: Coordinate work of this section with work of other sections as required to properly execute the work and as necessary to maintain satisfactory progress of the work of other sections, including:

1. Section 03 30 00 – “Cast In Place Concrete.”
2. Section 04 20 00 – “Concrete Masonry Units.”
3. Section 05 50 00 – “Metal Fabrications” for fire-protection plates covering trench drains.
4. Section 09 96 00 – “High Performance Coatings” for coating of fire-protection

plates.

1.05 REFERENCES

A. Refer to the following:

1. ASTM – American Society for Testing and Materials
2. IFC – International Firestop Council
3. UL – Underwriters Laboratories

1.06 SUBMITTALS

A. Product Data: Manufacturer's specifications and technical data for each material including the composition and limitations, documentation of qualified tested firestop systems to be used and manufacturer's installation instructions.

B. Manufacturer's engineering judgment identification number and document details when no qualified tested system is available for an application. Engineering judgment must include both project name and contractor’s name who will install firestop system as described in document.

C. Material safety data sheets provided with products delivered to jobsite.

D. Product Certificates: Signed by manufacturers of through-penetration firestop system products certifying that products furnished comply with requirements.

E. Product Test Reports: From a qualified testing agency indicating the through-penetration firestop system complies with requirements, based on comprehensive testing of current products.

1.07 QUALITY ASSURANCE

A. Source Limitations: Obtain through-penetration firestop systems, for each kind of penetration and construction condition indicated, from a single manufacturer. Firestopping materials for each application shall be compatible.

B. Installer Qualifications: An experienced installer who has completed through-penetration firestop systems similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

C. Firestop system installation must meet the requirements of ASTM E814-13a(2017), UL 1479 or UL 2079 tested assemblies that provide a fire rating equal to that of construction being penetrated.

D. Fire-Test-Response Characteristics: Provide through-penetration firestop systems and

fire resistive joint systems that comply with specified requirements of tested systems and the following requirements:

1. Firestopping tests are performed by a qualified testing and inspecting agency. A qualified testing and inspecting agency is UL or another NRTL performing testing and follow-up inspection services for firestop systems acceptable to authorities having jurisdiction.
2. Through-penetration firestop systems are identical to those tested per ASTM E 814. Provide rated systems complying with the following requirements:
   a. Through-penetration firestop system products bear classification marking of qualified testing and inspecting agency.
   b. Through-penetration firestop systems correspond to those indicated by reference to through-penetration firestop system designations listed by UL in "Fire Resistance Directory.

E. Proposed firestop materials and methods shall conform to applicable governing codes having local jurisdiction.

F. Firestop systems do not reestablish the structural integrity of load bearing partitions/assemblies or support live loads and traffic. The installer shall consult the engineer prior to penetrating any load bearing assembly.

G. For those firestop applications that exist for which no qualified tested system is available through a manufacturer, an engineering judgment derived from similar qualified tested system designs or other tests will be submitted for review and approval prior to installation. Engineering judgment documents must follow the requirements set forth by the IFC.

1.08 INSTALLER QUALIFICATIONS

A. Engage an experienced Installer who is certified, licensed, or otherwise qualified by the firestopping manufacturer as having been provided with the necessary training to install manufacturer's products per specified requirements. A supplier's willingness to sell its firestopping products to the Contractor or to an Installer engaged by the Contractor does not in itself confer qualification on the buyer.

B. The work is to be done by a contractor with at least one of the following qualifications:
   - FM 4991 Approved Contractor
   - UL Approved Contractor
   - Hilti Accredited Firestop Specialty Contractor

C. Firm with not less than 3 years' experience with firestop installation.

D. Successfully completed not less than 3 comparable scale projects using similar systems.

1.09 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials undamaged in manufacturer's clearly labeled, unopened containers,

identified with brand, type, and UL label where applicable.

B. Do not use damaged or expired materials.

C. Coordinate delivery of materials with scheduled installation date to allow minimum storage time at the jobsite.

D. Store materials under cover and protect from weather and damage in compliance with manufacturer's requirements, including temperature restrictions.

E. Comply with recommended procedures, precautions or remedies described in material safety data sheets as applicable.

1.10 PROJECT CONDITIONS

A. Do not use materials that contain flammable solvents.

B. Schedule installation of firestopping after completion of penetrating item installation but prior to covering or concealing of openings.

C. Verify existing conditions and substrates before starting work. Correct unsatisfactory conditions before proceeding.

D. Environmental Limitations: Do not proceed with installation of firestop materials when substrates are wet or when ambient or substrate temperatures exceed the manufacturer's recommended limitations for installation printed on product label and product data sheet.

E. During installation, provide masking and drop cloths to prevent firestopping materials from contaminating any adjacent surfaces.

F. Ventilate through-penetration firestop systems per manufacturer's written instructions by natural means or, where this is inadequate, forced-air circulation.

PART 2: PRODUCTS

2.01 FIRESTOPPING, GENERAL

A. Provide firestopping composed of components that are compatible with each other, the substrates forming openings, and the items, if any, penetrating the firestopping under conditions of service and application, as demonstrated by the firestopping manufacturer based on testing and field experience.

B. Provide components for each firestopping system that are needed to install fill material. Use only components specified by the firestopping manufacturer and approved by the qualified testing agency for the designated fire-resistance-rated systems.

C. Firestopping Materials are either “cast-in-place” (integral with concrete placement) or “post installed.” Provide cast-in-place firestop devices prior to concrete placement.

2.02 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with through penetration firestop systems (XHEZ), joint systems (XHBN), and perimeter firestop systems (XHDG) listed in Volume 2 of the UL Fire Resistance Directory; provide products of the following manufacturers as identified below:

1. 3M Fire Protection Products
2. Hilti, Inc.
3. Isolatek International
4. Nelson Thermal Insulation and Firestopping
5. RectorSeal Corporation
6. Specified Technologies, Inc.

B. Basis-of-Design Manufacturer:

1. Hilti, Inc.

2.03 MATERIALS

A. Use only firestop products that have been UL 1479, ASTM E 814 or UL 2079 tested for specific fire-rated construction conditions conforming to construction assembly type, penetrating item type, annular space requirements, and fire-rating involved for each separate instance.

B. Pre-installed firestop devices for use with noncombustible and combustible pipes (closed and open systems), conduit, and/or cable bundles penetrating concrete floors and/or gypsum walls, the following products are acceptable:
1. Hilti CP 680-M Cast-In Place Firestop Device for use with noncombustible penetrants.
2. Hilti CP 653 Speed Sleeve for use with cable penetrations.

C. Sealants, caulking materials, or foams for use with non-combustible items including steel pipe, copper pipe, rigid steel conduit and electrical metallic tubing (EMT), the following products are acceptable:

1. Hilti FS-ONE Intumescent Firestop Sealant
2. Hilti CP 604 Self-leveling Firestop Sealant
3. Hilti CP 620 Fire Foam
4. Hilti CP 606 Flexible Firestop Sealant
5. Hilti CP 601s Elastomeric Firestop Sealant

D. Sealants or caulking materials for use with sheet metal ducts, the following products are acceptable:

1. Hilti CP 601s Elastomeric Firestop Sealant
2. Hilti CP 606 Flexible Firestop Sealant
3. Hilti FS-ONE Intumescent Firestop Sealant

E. Sealants, caulking or spray materials for use with fire-rated construction joints and other gaps, the following products are acceptable:

1. Hilti CFS-SP WB Firestop Joint Spray
2. Hilti CP 601s Elastomeric Firestop Sealant
3. Hilti CP 606 Flexible Firestop Sealant
4. Hilti CP 604 Self-leveling Firestop Sealant

F. Pre-formed mineral wool designed to fit flutes of metal profile deck and gap between top of wall and metal profile deck; as a backer for spray material.

1. Hilti CP 777 Speed Plugs
2. Hilti CP 767 Speed Strips

G. Intumescent sealants, caulking materials for use with combustible items (penetrants consumed by high heat and flame) including insulated metal pipe, PVC jacketed, flexible cable or cable bundles and plastic pipe, the following products are acceptable:

1. Hilti FS-ONE Intumescent Firestop Sealant

H. Foams, intumescent sealants, or caulking materials for use with flexible cable or cable bundles, the following products are acceptable:

1. Hilti FS-ONE Intumescent Firestop Sealant
2. Hilti CP 620 Fire Foam
3. Hilti CP 601s Elastomeric Firestop Sealant
4. Hilti CP 606 Flexible Firestop Sealant

I. Non-curing, re-penetrable intumescent putty or foam materials for use with flexible cable or cable bundles, the following products are acceptable:

1. Hilti CP 618 Firestop Putty Stick
2. Hilti CP 658T Firestop Plug

J. Wall-opening protective materials for use with UL listed metallic and specified nonmetallic outlet boxes, the following products are acceptable:

1. Hilti CP 617 Firestop Putty Pad

K. Firestop collar or wrap devices attached to assembly around combustible plastic pipe (closed and open piping systems), the following products are acceptable:

1. Hilti CP 643N Firestop Collar
2. Hilti CP 644 Firestop Collar

3. Hilti CP 648E/648S Wrap Strips

L. Materials used for large openings and complex penetrations made to accommodate cable trays and bundles, multiple steel and copper pipes, electrical busways in raceways, the following products are acceptable:

1. Hilti CP 637 Firestop Mortar
2. Hilti FS 657 FIRE BLOCK
3. Hilti CP 620 Fire Foam
4. Hilti CP 675T Firestop Board

M. Non curing, re-penetrable materials used for large size/complex penetrations made to accommodate cable trays and bundles, multiple steel and copper pipes, electrical busways in raceways, the following products are acceptable:

1. Hilti FS 657 FIRE BLOCK
2. Hilti CP 675T Firestop Board

N. Sealants or caulking materials used for openings between structurally separate sections of wall and floors, the following products are acceptable:

1. Hilti CFS-SP WB Firestop Joint Spray
2. Hilti CP 601s Elastomeric Firestop Sealant
3. Hilti CP 606 Flexible Firestop Sealant
4. Hilti CP 604 Self-Leveling Firestop Sealant

O. For blank openings made in fire-rated wall or floor assemblies, where future penetration of pipes, conduits, or cables is expected, the following products are acceptable:

1. Hilti FS 657 FIRE BLOCK
2. Hilti CP 658T Firestop Plug

P. For trench drain covers to enclose drain openings passing under fire-rated walls, coat drain covers with intumescent paint providing a minimum 2-hour fire rating. See Section 09 96 00 “High Performance Coatings.”

Q. Provide a firestop system with a "F" Rating as determined by UL 1479 or ASTM E814-13a(2017) which is equal to the time rating of construction being penetrated.

R. Provide a firestop system with an Assembly Rating as determined by UL 2079 which is equal to the time rating of construction joint assembly.

PART 3 – EXECUTION

3.01 PREPARATION

A. Verification of Conditions: Examine areas and conditions under which work is to be performed and identify conditions detrimental to proper or timely completion.

1. Verify penetrations are properly sized and in suitable condition for application of materials.
2. Surfaces to which firestop materials will be applied shall be free of dirt, grease, oil, rust, laitance, release agents, water repellents, and any other substances that may affect proper adhesion.
3. Provide masking and temporary covering to prevent soiling of adjacent surfaces by firestopping materials.
4. Prime substrates where recommended by through-penetration firestop system manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.
5. Comply with manufacturer's recommendations for temperature and humidity conditions before, during and after installation of firestopping.
6. Do not proceed until unsatisfactory conditions have been corrected.

3.02 COORDINATION

A. Coordinate construction of openings, penetrations and construction joints to ensure that the firestop systems are installed according to specified requirements.

B. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate through-penetration firestop systems. Coordinate construction and sizing of joints to ensure that fire-resistive joint systems are installed according to specified requirements.

C. Coordinate firestopping with other trades so that obstructions are not placed in the way prior to the installation of the firestop systems.

D. Do not cover up through-penetration firestop and joint system installations that will become concealed behind other construction until each installation has been examined by the building inspector.

3.03 INSTALLATION

A. Regulatory Requirements: Install firestop materials in accordance with UL Fire Resistance Directory or Intertek listings.

B. Manufacturer's Instructions: Comply with manufacturer's instructions for installation of through-penetration and construction joint materials.

1. Seal all holes or voids made by penetrations to ensure an air and water-resistant seal.
2. Consult with mechanical engineer, project manager, and damper manufacturer prior to installation of UL firestop systems that might hamper the performance of fire dampers as it pertains to duct work.
3. Protect materials from damage on surfaces subjected to traffic.

C. Fire-rated walls crossing drain trenches: cover trench drains with 6-foot long, ½" thick galvanized steel fire-protection plates coated with intumescent paint. See Section 05 50 00 "Metal Fabrications" and Section 09 96 00 "High Performance Coatings."

3.04 FIELD QUALITY CONTROL

A. Examine sealed penetration areas to ensure proper installation before concealing or enclosing areas.

B. Keep areas of work accessible until inspection by applicable code authorities.

C. Inspection of through-penetration firestopping shall be performed in accordance with ASTM E2174-20a, "Standard Practice for On-Site Inspection of Installed Firestops" or another recognized standard.

D. Perform under this section patching and repairing of firestopping caused by cutting or penetrating of existing firestop systems already installed by other trades.

3.05 IDENTIFICATION & DOCUMENTATION

A. Identify through-penetration firestop systems with pressure-sensitive, self-adhesive, preprinted vinyl labels. Attach labels permanently to surfaces of penetrated construction on both sides of each firestop system installation where labels will be visible to anyone seeking to remove penetrating items or firestop systems. Include the following information on labels:

1. The words: "Warning -Through Penetration Firestop System-Do Not Disturb. Notify Building Management of Any Damage."
2. Contractor's Name, address, and phone number.
3. Through-Penetration firestop system designation of applicable testing and inspecting agency.
4. Date of Installation.
5. Through-Penetration firestop system manufacturer's name.
6. Installer's Name.

3.06 ADJUSTING AND CLEANING

A. Remove equipment, materials and debris, leaving the area undamaged, and in clean condition.

B. Clean all surfaces adjacent to sealed holes and joints to be free of excess firestop materials and soiling as work progresses.

END OF SECTION 07 84 00

SECTION 07 92 00

JOINT SEALANTS

PART 1: GENERAL

1.01 SCOPE

A. The contractor will seal control and expansion joints and joints between CMU walls and cavern walls and ceiling in the Ross Substation area as indicated on drawings.

1.02 RELATED DOCUMENTS

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

1.03 SUMMARY

A. This Section includes joint sealants for the following applications, including those specified by reference to this Section:

1. Interior joints in the following vertical surfaces and horizontal nontraffic surfaces:
   a Control and expansion joints on exposed surfaces of CMU walls.
   b Perimeter joints of openings where indicated.
   c Perimeter joints between wall surfaces and frames of doors and other openings.
   d Other joints as indicated.

2. Joints in the following horizontal surfaces:
   a Control and expansion joints in cast-in-place concrete slabs and housekeeping pads.

B. Related Sections:
   1. Section 07 84 00 "Firestopping" for fire-resistant penetration and building joint-sealant systems.
   2. Section 08 80 00 "Glazing" for glazing sealants.

1.04 REFERENCES

A. Refer to the following:

1. ASTM – American Society for Testing and Materials

1.05 DEFINITIONS

A. Joint Sealant: A flexible material used to seal gaps or joints between different materials

to prevent air, water, and other substances from entering the joint, protecting the structure's integrity and allowing movement and stress in the bonded materials.

1.06 SUBMITTALS

A. Product Data: For each type of product.

B. Product Certificates: For each type of joint sealant and accessory, signed by product Manufacturer.

C. Product Test Reports: For each kind of joint sealant, for tests performed by a qualified testing agency.

D. Field-Adhesion-Test Reports: For each sealant application tested.

E. Warranties: Special warranties specified in this Section.

1.07 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized Installer who is approved or licensed for installation of elastomeric sealants required for this Project.

B. Source Limitations: Obtain each type of joint sealant through one source from a single manufacturer.

C. Product Testing: Provide "Product Test Reports" from a qualified testing agency.

1. Testing Agency Qualifications: An independent testing agency qualified according to ASTM C1021-08(2019) to conduct the testing indicated, as documented according to ASTM E548-94e1.
2. Test elastomeric joint sealants for compliance with requirements specified by reference to ASTM C920-18, and where applicable, to other standard test methods.
3. Test other joint sealants for compliance with requirements indicated by referencing standard specifications and test methods.

1.08 PROJECT CONDITIONS

A. Do not proceed with the installation of joint sealants under the following conditions:

1. When ambient and substrate temperature conditions are outside the limits permitted by the joint sealant manufacturer or are below 40 deg F.
2. Where joint widths are outside the limits allowed by the joint-sealant manufacturer for applications indicated.
3. When joint substrates are wet.
4. Contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

1.09 WARRANTY

A. Special Installer's Warranty: Installer's standard form in which Installer agrees to repair or replace elastomeric joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.

B. Special warranties specified in this Article exclude deterioration or failure of elastomeric joint sealants from the following:

1. Movement of the structure resulting in stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression caused by structural settlement or errors attributable to design or construction.
2. Disintegration of joint substrates from natural causes exceeding design specifications.
3. Mechanical damage caused by individuals, tools, or other outside agents.
4. Changes in sealant appearance caused by the accumulation of dirt or other atmospheric contaminants.

PART 2: PRODUCTS

2.01 JOINT SEALANTS, GENERAL

A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by the joint-sealant manufacturer, based on testing and field experience.

B. Colors of Exposed Joint Sealants: As selected by Owner’s Representative during design from manufacturer's full range.

2.02 SILICONE JOINT SEALANTS

A. Silicone, S, NS, 100/50, NT: Single-component, non-sag, plus 100 percent and minus 50 percent movement capability, non-traffic-use, neutral-curing silicone joint sealant; ASTM C920-18, Type S, Grade NS, Class 100/50, Use NT.

1. Products: Subject to compliance with requirements, provide one of the following:
   a. Dow Corning Corporation: 790
   b. Pecora Corporation: 864
   c. Tremco Corporation: Spectrem 2
   d. Approved equal

2.03 URETHANE JOINT SEALANTS

A. Urethane, S, NS, 25, NT: Single-component, non-sag, non-traffic-use, plus 25 percent and minus 25 percent movement capability, urethane joint sealant; ASTM C920-18, Type S, Grade NS, Class 25, Use NT.

1. Products: Subject to compliance with requirements, provide one of the following:
   a. Pecora Corporation: Dynatrol I-XL
   b. Tremco Inc.: Dymonic
   c. Sonneborn, Division of ChemRex, Inc: NP-1
   d. Approved equal.

2.04 MILDEW-RESISTANT JOINT SEALANTS

A. Mildew-Resistant Joint Sealants: Formulated for prolonged exposure to humidity with fungicide to prevent mold and mildew growth.

B. Silicone, Mildew Resistant, Acid Curing, S, NS, 25, NT: Mildew-resistant, single-component, non-sag, plus 25 percent and minus 25 percent movement capability, non-traffic-use, acid-curing silicone joint sealant; ASTM C920-18, Type S, Grade NS, Class 25, Use NT.

1. Products: Subject to compliance with requirements, provide one of the following:
   a. Dow Corning Corp: 786 Mildew Resistant
   b. Approved equal.

2.05 LATEX JOINT SEALANTS

A. Acrylic Latex: Acrylic latex or siliconized acrylic latex, ASTM C834-17, Type OP, Grade NF.

1. Products: Subject to compliance with requirements, provide one of the following:
   a. Pecora Corporation: AC-20+
   b. Tremco Inc.: Tremflex 834
   c. Sonneborn, Division of ChemRex, Inc.: Sonolac
   d. Approved equal.

2.06 JOINT-SEALANT BACKING

A. Sealant Backing Material, General: Non-staining; compatible with joint substrates, sealants, primers, and other joint fillers; and approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product:
   a. Closed cell polyethylene rod.

B. Cylindrical Sealant Backings: ASTM C1330-18, Type C (closed-cell material with a surface skin), and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.

2.07 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by the joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way and formulated to promote optimum adhesion of sealants to joint substrates.

C. Masking Tape: Non-staining, non-absorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting performance of the Work.

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

3.02 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:

1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
2. Clean porous-joint substrate surfaces by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following:
   a. Concrete
   b. Masonry

3. Remove laitance and form-release agents from concrete.
4. Clean nonporous surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include the following:
    a. Metal
    b. Glass

B. Joint Priming: Prime joint substrates where recommended by the joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

C. Masking Tape: Use masking tape where required to prevent contact of sealant with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove the tape immediately after tooling without disturbing joint seal.

3.03 INSTALLATION OF JOINT SEALANTS

A. General: Comply with the joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.

B. Sealant Installation Standard: Comply with recommendations in ASTM C1193-16 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. Install sealant backings of type indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

1. Do not leave gaps between ends of sealant backings.
2. Do not stretch, twist, puncture, or tear sealant backings.
3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.

D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.

E. Install sealants using proven techniques that comply with the following and at the same time backings are installed:

1. Place sealants so they directly contact and fully wet joint substrates.
2. Completely fill recesses in each joint configuration.
3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

F. Tooling of Non-sag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.

1. Remove excess sealant from surfaces adjacent to joints.
2. Use tooling agents that are approved in writing by the sealant manufacturer and that do not discolor sealants or adjacent surfaces.
3. Provide concave joint configuration per Figure 5A in ASTM C1193-16, unless otherwise indicated.

3.04 CLEANING

A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.05 PROTECTION

A. Protect joint sealants during and after the curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

3.06 FIELD QUALITY CONTROL

A. Field-Adhesion Testing: Field test joint-sealant adhesion to joint substrates as follows:

1. Extent of Testing: Test completed and cured sealant joints as follows:
   a. Perform 2 tests for the first 1000 feet (300 m) of joint length for each kind of sealant and joint substrate.

2. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C1193-16 or Method A, Tail Procedure, in ASTM C1521-19(2020).
   a. For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.

3. Inspect tested joints and report on the following:
   a. Whether sealants filled joint cavities and are free of voids.
   b. Whether sealant dimensions and configurations comply with specified requirements.

c. Whether sealants in joints connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. Compare these results to determine if adhesion complies with sealant manufacturer's field-adhesion hand-pull test criteria.

4. Record test results in a field-adhesion-test log. Include dates when sealants were installed, names of persons who installed sealants, test dates, test locations, whether joints were primed, adhesion results and percent elongations, sealant material, sealant configuration, and sealant dimensions.

5. Repair sealants pulled from test area by applying new sealants following same procedures used originally to seal joints. Ensure that original sealant surfaces are clean and that new sealant contacts original sealant.

B. Evaluation of Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.

END OF SECTION 07 92 00

SECTION 08 11 13

STEEL DOORS AND FRAMES

PART 1: GENERAL

1.01 SCOPE

A. The contractor will install steel entry doors for controlled access to the Ross Substation area as indicated in drawings.

1.02 RELATED DOCUMENTS

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

1.03 SUMMARY

A. Section includes the following door types:

1. Hollow Metal Doors.
2. Steel Door Frames.
3. Fire-rated door and frame assemblies.

B. Related Sections:

1. Section 04 20 00 “Concrete Masonry Units” for installing anchors and grouting frames in masonry construction.
2. Section 08 71 00 "Door Hardware" for door hardware for hollow-metal doors.
3. Section 08 80 00 “Glazing” for door glass lites.
4. Section 09 96 00 “High Performance Coatings.”

1.04 REFERENCES

A. Refer to the following:

1. ANSI – American National Standards Institute
2. ASTM – American Society for Testing and Materials
3. BHMA – Builders Hardware Manufacturers Association
4. DHI – Door Hardware Institute
5. NFPA – National Fire Protection Association
6. NAAMM-HMMA – National Association of Architectural Metal Manufacturers/ Hollow Metal Manufacturers Association
7. SDI – Steel Door Institute

1.05 Definitions

A. Minimum Thickness: Minimum thickness of base metal without coatings according to NAAMM-HMMA 803 or SDI A250.8.

1.06 COORDINATION

A. Coordinate anchorage installation for hollow-metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation. Coordinate installation with CMU wall construction.

B. Coordinate selection of primer coatings on all hollow metal items so that they are compatible with finished coatings. See Section 09 90 00 “High Performance Coatings.”

1.07 PREINSTALLATION MEETINGS

A. Pre-installation Conference: Conduct conference at Project site.

1.08 SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, core descriptions, fire-resistance ratings, and finishes.

B. Shop Drawings: Include the following:

1. Elevations of each door type.
2. Details of doors, including vertical- and horizontal-edge details and metal thicknesses.
3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
4. Locations of reinforcement and preparations for hardware.
5. Details of each different wall opening condition.
6. Details of anchorages, joints, field splices, and connections.
7. Details of accessories.
8. Details of moldings, removable stops, and glazing.
9. Details of conduit and preparations for power, signal, and control systems.

C. Samples for Initial Selection: For units with factory-applied color finishes.

D. Schedule: Provide a schedule of hollow-metal work prepared by or under the supervision of the supplier, using the same reference numbers for details and openings as those on Drawings. Coordinate with final Door Hardware Schedule.

E. Product Test Reports: For each type of hollow-metal door and frame assembly, for tests performed by a qualified testing agency.

F. Oversize Construction Certification: For assemblies required to be fire rated and exceeding limitations of labeled assemblies.

1.09 DELIVERY, STORAGE, AND HANDLING

A. Deliver hollow-metal work palletized, packaged, or crated to provide protection during transit and Project-site storage. Do not use non-vented plastic.

1. Provide additional protection to prevent damage to factory-finished units.

B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.

C. Store hollow-metal work vertically under cover at Project site with head up. Place on minimum 4-inch-high wood blocking. Provide a minimum of 1/4-inch space between each stacked door to permit air circulation.

PART 2: PRODUCTS

2.01 MANUFACTURERS

A. Subject to compliance with requirements, provide products by one of the following:

1. Amweld International, LLC.
2. Ceco Door; ASSA ABLOY.
3. Curries Company; ASSA ABLOY.
4. Custom Metal Products.
5. Deansteel Manufacturing Company, Inc.
6. Fleming Door Products Ltd.; Assa Abloy Group Company.
7. Republic Doors and Frames.
8. Steelcraft; an Ingersoll-Rand company.
9. West Central Mfg. Inc.
10. Approved equal.

B. Source Limitations: Obtain hollow-metal work from single source from single manufacturer.

2.02 REGULATORY REQUIREMENTS

A. Steel Door and Frame Standard: Comply with SDI A250.8-2023 and NAAMM-HMMA 850-14, unless more stringent requirements are indicated.

B. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at as close to neutral pressure as possible according to NFPA 252 or UL 10B.

1. Oversize Fire-Rated Door Assemblies: For units exceeding sizes of tested assemblies, provide certification by a qualified testing agency that doors comply with standard construction requirements for tested and labeled fire-rated door assemblies except for size.
2. Smoke- and Draft-Control Assemblies: Provide assemblies with gaskets listed and labeled for smoke and draft control by a qualified testing agency, based on testing according to UL 1784 and installed in compliance with NFPA 105.
3. Temperature-Rise Limit: At vertical exit enclosures and exit passageways, provide doors that have a maximum transmitted temperature end point of not more than 450 deg F above ambient after 30 minutes of standard fire-test exposure.

C. Fire-Rated, Door-Light Assemblies: Provide narrow door light assemblies that comply with NFPA 80 and are listed and labeled by a testing and inspecting agency for fire-protection ratings indicated, based on testing according to NFPA 257 or UL 9. Comply with NAAMM-HMMA 850-18 and SDI 118-21 requirements.

2.03 INTERIOR DOORS AND FRAMES

A. Construct interior doors and frames to comply with the standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.

B. Extra Heavy-Duty Doors and Frames: SDI A250.8, Level 3. At locations indicated in the Door and Frame Schedule.

1. Physical Performance: Level B according to SDI A250.4.
2. Doors:
   a. Fire Rating: 1-1/2 hours.
   b. Type: As indicated in the Door and Frame Schedule.
   c. Thickness: 1-3/4 inches.
   d. Face: Metallic-coated steel sheet, minimum thickness of 0.053 inch, with minimum A60 (ZF180) coating.
   e. Edge Construction: Continuously welded with no visible seam.
   f. Core: Polystyrene.

3. Frames:
   a. Materials: Metallic-coated steel sheet, minimum thickness of 0.053 inch, with minimum A60 (ZF180) coating.
   b. Construction: Full profile welded.

4. Exposed Finish: Prime.

C. Jamb Anchors:

1. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, not less than 0.042 inch thick, with corrugated or perforated straps not less than 2 inches wide by 10 inches long; or wire anchors not less than 0.177 inch thick.

2. Post-installed Expansion Type for In-Place Concrete or Masonry: Minimum 3/8-inch-diameter bolts with expansion shields or inserts. Provide pipe spacer from frame to wall, with throat reinforcement plate, welded to frame at each anchor location.

D. Floor Anchors: Formed from same material as frames, minimum thickness of 0.042 inch, and as follows:

1. Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.
2. Separate Topping Concrete Slabs: Adjustable-type anchors with extension clips, allowing not less than 2-inch (51-mm) height adjustment. Terminate bottom of frames at finish floor surface.

2.04 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A1008/A1008M-21a, Commercial Steel (CS), Type B; suitable for exposed applications.

B. Hot-Rolled Steel Sheet: ASTM A1011/A1011M-13, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.

C. Metallic-Coated Steel Sheet: ASTM A653/A653M-20, Commercial Steel (CS), Type B.

D. Frame Anchors: ASTM A879/A879M-22, Commercial Steel (CS), 04Z (12G) coating designation; mill phosphatized.

1. For anchors built into exterior walls, steel sheet complying with ASTM A1008/A1008M-21a or ASTM A1011/A1011M-13, hot-dip galvanized according to ASTM A153/A153M-16a, Class B.

E. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A153/A153M-16a.

F. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hollow-metal frames of type indicated.

G. Grout: ASTM C476-23, except with a maximum slump of 4 inches, as measured according to ASTM C143/C143M-12.

H. Mineral-Fiber Insulation: ASTM C665-17, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively; passing ASTM E136-22 for combustion characteristics.

I. Glazing in Fire Rated Hollow Metal Doors:

1. Manufacturers:
   a. Bendheim, LTD.

b. FireLite
c. Guardian Industries Corporation
d. Interpane Glass Company
e. Nippon Electric Glass Co., Ltd.
f. Pilkington Group
g. Schott North America

2. Basis-of-Design Manufacturer; Schott North America.
3. Product: Pyran Platinum F.
   a. Rating : 90 minutes.
   b. Thickness: 5 mm.
   c. Size: 6 inches x 16 inches.
   d. Minimum Depth of Glazing Channel: ½ inch.
   e. Clear, no amber tint.

J. Bituminous Coating: Cold-applied asphalt mastic, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

2.05 FABRICATION

A. Fabricate hollow-metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for metal thickness. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.

B. Hollow-Metal Doors:

1. Fire Door Cores: As required to provide fire-protection ratings indicated.
2. Vertical Edges for Single-Acting Doors: Bevel edges 1/8 inch in 2 inches.
3. Top Edge Closures: Close the top edges of doors with flush closures of same material as face sheets.
4. Bottom Edge Closures: Close bottom edges of doors where required for attachment of weather stripping with end closures or channels of same material as face sheets.
5. Install stainless-steel kick plates on push side of doors.
6. Astragals: Provide overlapping astragal on one leaf of pairs of doors where required by NFPA 80 for fire-performance rating or where indicated. Extend a minimum of 3/4 inch beyond edge of door on which astragal is mounted or as required to comply with published listing of qualified testing agency.

C. Hollow-Metal Frames: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of the same thickness metal as frames.

1. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.

2. Grout Guards: Weld guards to frame at back of hardware mortises in frames to be grouted.
3. Floor Anchors: Weld anchors to bottoms of jambs with at least four spot welds per anchor.
4. Jamb Anchors: Provide number and spacing of anchors as follows:
    a. Masonry Type: Locate anchors not more than 16 inches from top and bottom of frame. Space anchors not more than 32 inches O.C., to match coursing, and as follows:
        1) Two anchors per jamb up to 60 inches high.
        2) Three anchors per jamb from 60 to 90 inches high.
        3) Four anchors per jamb from 90 to 120 inches high.
        4) Four anchors per jamb plus one additional anchor per jamb for each 24 inches or fraction thereof above 120 inches high.

    b. Post-installed Expansion Type: Locate anchors not more than 6 inches from top and bottom of frame. Space anchors not more than 26 inches O.C.

5. Head Anchors: Two anchors per head for frames more than 42 inches wide and mounted in metal-stud partitions.
6. Door Silencers: Except on weather-stripped frames, drill stops to receive door silencers as follows. Keep holes clear during construction.
    a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
    b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.

7. Terminated Stops: Terminate stops 4 inches above finish floor with a 45 - degree angle cut, and close open end of stop with steel sheet closure. Cover opening in extension of frame with welded-steel filler plate, with welds ground smooth and flush with frame.

D. Fabricate concealed stiffeners and edge channels from either cold- or hot-rolled steel sheet.

E. Hardware Preparation: Factory prepare hollow-metal work to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to SDI A250.6, the Door Hardware Schedule, and templates.

1. Reinforce doors and frames to receive non-templated, mortised, and surface-mounted door hardware.
2. Comply with applicable requirements in SDI A250.6 and BHMA A156.115 for preparation of hollow-metal work for hardware.

2.06 STEEL FINISHES

A. Prime Finish: Clean, pretreat, and apply manufacturer's standard primer. Ensure that the factory primer is compatible with finish coats. Refer to Section 099600, High Performance Coatings.

1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with SDI A250.10; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

2.07 ACCESSORIES

A. Grout Guards: Formed from same material as frames, not less than 0.016 inch thick.

PART 3 – EXECUTION

3.01 EXAMINATION

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

B. Examine roughing-in for embedded and built-in anchors to verify actual locations before frame installation.

C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

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

3.02 PREPARATION

A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.

B. Drill and tap doors and frames to receive non-templated, mortised, and surface-mounted door hardware.

3.03 INSTALLATION

A. General: Install hollow-metal work plumb, rigid, properly aligned, and securely fastened in place. Comply with Drawings and manufacturer's written instructions.

B. Hollow-Metal Frames: Install hollow-metal frames for doors, of size and profile indicated. Comply with SDI A250.11 or NAAMM-HMMA 840-24 as required by standards specified.

1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.

a. At fire-rated openings, install frames according to NFPA 80.
b. Where frames are fabricated in sections because of shipping or handling limitations, field-splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.
c. Install frames with removable stops located on secure side of opening.
d. Install door silencers in frames before grouting.
e. Remove temporary braces necessary for installation only after frames have been properly set and secured.
f. Check plumb, square, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
g. Field-apply bituminous coating to backs of frames that will be filled with grout containing anti-freezing agents.

2. Floor Anchors: Provide floor anchors for each jamb that extends to floor, and secure with post-installed expansion anchors.
   a. Floor anchors may be set with power-actuated fasteners instead of post-installed expansion anchors if so indicated and approved on Shop Drawings.

3. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout.
4. Concrete Walls: Solidly fill space between frames and concrete with mineral-fiber Insulation.
5. In-Place Concrete or Masonry Construction: Secure frames in place with post-installed expansion anchors. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
6. Installation Tolerances: Adjust hollow-metal door frames for squareness, alignment, twist, and plumb to the following tolerances:
   a. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
   b. b. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
   c. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
   d. Plumbness: Plus or minus 1/16 inch, measured at jambs at floor.

C. Hollow-Metal Doors: Fit hollow-metal doors accurately in frames, within clearances specified below. Shim as necessary.

1. Fire-Rated Doors: Install doors with clearances according to NFPA 80.
2. Smoke-Control Doors: Install doors and gaskets according to NFPA 105.

D. Glazing: Comply with installation requirements in Section 088000 "Glazing" and with hollow metal manufacturer's written instructions.

1. Secure stops with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches O.C. and not more than 2 inches O.C. from each corner.

3.04 ADJUSTING AND CLEANING

A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow-metal work that is warped, bowed, or otherwise unacceptable.

B. Remove grout and other bonding material from hollow-metal work immediately after installation.

C. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.

D. Metallic-Coated Surface Touchup: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.

E. Factory-Finish Touchup: Clean abraded areas and repair with same material used for factory finish according to manufacturer's written instructions.

F. Touchup Painting: Cleaning and touchup painting of abraded areas of paint are specified in painting Sections.

3.05 FIELD QUALITY CONTROL

A. Perform tests and inspections. The Contractor is responsible for testing and inspection of door installations.

END OF SECTION 08 11 13

SECTION 08 33 23

OVERHEAD COILING DOORS

PART 1: GENERAL

1.01 SCOPE

A. The contractor will design and install a service door in the east wall of the Ross Substation area as indicated in drawings.

1.02 RELATED DOCUMENTS

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

1.03 SUMMARY

A. Section includes the following:

1. Fire-rated manually operated overhead coiling doors.
2. Factory finishing of overhead coiling doors.

B. Related Sections:

1. Section 05 50 00 “Metal Fabrications” for door opening jamb and head members.
2. Section 09 96 00 “High Performance Coatings” for field finishing or miscellaneous steel and hood enclosing metal slats.

1.04 REFERENCES

A. Refer to the following:

1. ASCE – American Society of Civil Engineers
2. ASTM – American Society for Testing and Materials
3. NFPA – National Fire Protection Association

1.05 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design overhead coiling doors using performance requirements and design criteria indicated.

B. Structural Performance, Exterior Doors: Exterior overhead coiling doors shall withstand the wind loads, the effects of gravity loads, and loads and stresses within limits and under conditions indicated according to SEI/ASCE 7.

1. Mechanically Induced Wind (Air) Loads: Uniform pressure (velocity pressure) of 32 lbf/sq. ft., acting inward and outward.
2. Deflection Limits: Design overhead coiling doors to withstand design wind load without evidencing permanent deformation or disengagement of door components.

C. Operability under Wind Load: Design overhead coiling doors to remain operable under uniform pressure (velocity pressure) of 32 lbf/sq. ft. wind load, acting inward and outward.

D. Seismic Performance: Overhead coiling doors shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1. Component Importance Factor: 1.0.

E. Operation Cycles: Provide overhead coiling door components and operators capable of operating for not less than number of cycles indicated for each door. One operation cycle is complete when a door is opened from the closed position to the fully open position and returned to the closed position.

1.06 SUBMITTALS

A. Product Data: For each type and size of overhead coiling door and accessory.

1. Include construction details, material descriptions, dimensions of individual components, profiles for slats, and finishes.
2. Include rated capacities, operating characteristics, and furnished accessories.
3. Include description of manual closing device and testing and resetting instructions.
4. For fire-rated doors, description of fire-release system including testing and resetting instructions.

B. Shop Drawings: For door installation and special components not dimensioned or detailed in manufacturers' product data include the following:

1. Plans, elevations, sections, and mounting details.
2. Details of equipment assemblies, dimensions, required clearances, method of field assembly, components, and location and size of each field connection.
3. Points of attachment and their corresponding static and dynamic loads imposed on structure.
4. Show locations of controls, locking devices, detectors or replaceable fusible links, and other accessories.

C. Samples for Initial Selection: Manufacturer's finish charts showing full range of colors and textures available for units with factory-applied finishes.

1. Include sample of factory-applied polyester gray finish paint over epoxy primer on steel substrate, at least 4 x 4 inches.

D. Delegated-Design Submittal: For overhead coiling doors indicated to comply with performance requirements and design criteria, including analysis data.

1. Summary of forces and loads on walls and jambs.

E. Installer's Qualification Data.

F. Oversize Construction Certification: For assemblies required to be fire rated and exceeding limitations of labeled assemblies.

G. Close-out Submittals: Maintenance Data for overhead coiling doors to include in maintenance manuals.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver door materials palletized, packaged, or crated to provide protection during transit and Project-site storage. Do not use non-vented plastic.

1. Provide additional protection to prevent damage to factory-finished units.

1.08 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturers for both installation and maintenance of units required for this Project.

B. Source Limitations: Obtain overhead coiling doors and accessories from single source from single manufacturer.
1. Obtain operators and controls from overhead coiling door manufacturer.

C. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at as close to neutral pressure as possible according to NFPA 252 or UL 10B, UL 1784.

1. Temperature-Rise Limit: At exit passageways, provide doors that have a maximum transmitted temperature end point of not more than 450 deg F (250 deg C) above ambient after 30 minutes of standard fire-test exposure.
2. Smoke Control: In corridors and smoke barriers, provide doors that are listed and labeled with the letter "S" on the fire-rating label by a qualified testing agency for smoke- and draft-control based on testing according to UL 1784; with maximum air-leakage rate of 3.0 cfm/sq. ft. of door opening at 0.10-inch wg for both ambient and elevated temperature tests.

D. Regulatory Requirements:

1. Comply with applicable requirements of the laws, codes, ordinances and regulations

of federal, state and municipal authorities.
2. Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines.
3. Listed by the ICC Evaluation Service in accordance with the applicable sections of the Building Code.

E. Testing: Provide documentation from a certified testing agency that the fire door's self-closing governor mechanism and fire door operator have been tested for a minimum of 50,000 cycles and 500 self-closing trip tests.

F. Manufacturer Requirements: Door manufacturer shall have been in the business of and have experience in manufacturing the type of product covered under this specification section as well as giving credible service for a minimum of five (5) years.

1.09 WARRANTY

G. Furnish a written guarantee that the helical spring and counterbalance mechanism are free from defects in material and workmanship for not less than two years after completion and acceptance of the project.

PART 2: PRODUCTS

2.01 MANUFACTURERS, GENERAL

A. Subject to compliance with requirements, provide products by one of the following:

1. Alpine Overhead Doors, Inc.
2. C.H.I. Overhead Doors
3. Cookson Company
4. Cornell Iron Works, Inc.
5. McKeon Rolling Steel Door Company, Inc.
6. Overhead Door Corporation
7. Raynor
8. Wayne-Dalton Corp.

2.02 FIRE-RATED DOOR ASSEMBLY

A. Fire-Rated Service Door: Overhead fire-rated coiling door formed with curtain of interlocking metal slats.

1. Basis-of-Design Manufacturer and Model
   a. Cornell Model ERD 11

B. Size and Quantity:

1. 8'-0" W x 10'-0" H (Quantity 1)

C. Operation Cycles: Door components and operators capable of operating for not less than 10,000 operations. One operation cycle is complete when a door is opened from the closed position to the fully open position and returned to the closed position.

D. Fire Rating: 1-1/2 hours with smoke control.

E. Door Curtain Material: No. 5F, minimum 18gauge, grade 40, ASTM A653/a653M-20 galvanized steel zinc coating.

F. Door Curtain Slats: Flat profile slats 3-1/4-inch center-to-center height.

1. Vision Panels: Approximately 10- by 1-5/8-inch openings spaced approximately 2 inches apart and beginning 12 inches from end guides; in two rows of slats; installed with fire-rated vision-panel glazing.

G. Curtain Jamb Guides: Galvanized steel with exposed finish matching curtain slats. Mount jamb guides directly to CMU wall.

H. Hood: Match curtain material and finish.

1. Shape: Round
2. Mounting: Face of wall

I. Manual Door Operator:

1. Type: Chain-hoist
2. Usage Classification: Light duty, not to exceed 20 cycles per day.
3. Operator Location: Top of hood
4. Chain Length: Extend to 3 feet above finished floor.
5. Safety: Listed according to UL 325 by a qualified testing agency for commercial or industrial use.

J. Curtain Accessories: Equip door with smoke seals, UL listed.

K. Door Finish:

1. Factory Finish: Manufacturer's epoxy primer (.2 mils DFT) and factory-applied polyester Sterling Gray finish coat, minimum 2.5 mils cured film thickness. ASTM D-3363 pencil hardness, H or better.

2.03 DOOR CURTAIN MATERIALS AND CONSTRUCTION

A. Door Curtains: Fabricate overhead coiling-door curtain of interlocking metal slats, designed to withstand wind loading indicated, in a continuous length for width of door without splices. Unless otherwise indicated, provide slats of thickness and mechanical properties recommended by door manufacturer for performance, size, and type of door indicated, and as follows:

1. Steel Door Curtain Slats: Zinc-coated (galvanized), cold-rolled structural steel sheet; complying with ASTM A653/A653M-20, with G90 (Z275) zinc coating; nominal sheet thickness (coated) of 0.028 inch and as required to meet requirements.

B. Endlocks and Windlocks for Service Doors: Malleable-iron casings galvanized after fabrication, secured to curtain slats with galvanized rivets or high-strength nylon. Provide locks on not less than alternate curtain slats for curtain alignment and resistance against lateral movement.

C. Bottom Bar for Service Doors: Consisting of two angles, each not less than 1-1/2 by 1-1/2 by 1/8 inch thick; fabricated from manufacturer's standard hot-dip galvanized steel, stainless steel, or aluminum extrusions to match curtain slats and finish.

D. Curtain Jamb Guides: Manufacturer's standard angles or channels and angles of same material and finish as curtain slats unless otherwise indicated, with sufficient depth and strength to retain curtain, to allow curtain to operate smoothly, and to withstand loading. Slot bolt holes for guide adjustment. Provide removable stops on guides to prevent overtravel of curtain, and a continuous bar for holding windlocks.

2.04 HOODS

A. General: Form sheet metal hood to entirely enclose coiled curtain and operating mechanism at opening head. Contour to fit end brackets to which hood is attached. Roll and reinforce top and bottom edges for stiffness. Form closed ends for surface-mounted hoods. Equip hood with intermediate support brackets as required to prevent sagging.

1. Galvanized Steel: Nominal 0.028-inch-thick, hot-dip galvanized steel sheet with G90 (Z275) zinc coating, complying with ASTM A653/A653M-20.
2. Include automatic drop baffle on fire-rated doors to guard against passage of smoke or flame.

2.05 CURTAIN ACCESSORIES

A. Smoke Seals: Equip each fire-rated door with replaceable smoke-seal perimeter gaskets or brushes for smoke and draft control as required for door listing and labeling by a qualified testing agency.

B. Automatic-Closing Device for Fire-Rated Doors: Equip each fire-rated door with an automatic closing device or holder-release mechanism and governor unit complying with NFPA 80 and an easily tested and reset release mechanism. Automatic-closing device shall be designed for activation by the following:

1. Building fire detection, smoke detection, and alarm systems.

2.06 COUNTERBALANCING MECHANISM

A. General: Counterbalance doors by means of manufacturer's standard mechanism with an adjustable-tension, steel helical torsion spring mounted around a steel shaft and contained in a spring barrel connected to top of curtain with barrel rings. Use grease-sealed bearings or self-lubricating graphite bearings for rotating members.

B. Counterbalance Barrel: Fabricate spring barrel of manufacturer's standard hot-formed, structural-quality, seamless or welded carbon-steel pipe, of sufficient diameter and wall thickness to support rolled-up curtain without distortion of slats and to limit barrel deflection to not more than 0.03 in./ft. of span under full load.

C. Counterbalance Spring: One or more oil-tempered, heat-treated steel helical torsion springs. Size springs to counterbalance weight of curtain, with uniform adjustment accessible from outside barrel. Secure ends of springs to barrel and shaft with cast-steel barrel plugs.

1. Fire-Rated Doors: Equip with auxiliary counterbalance spring and prevent tension release from main counterbalance spring when automatic closing device operates.

D. Torsion Rod for Counterbalance Shaft: Fabricate of manufacturer's standard cold-rolled steel, sized to hold fixed spring ends and carry torsional load.

E. Brackets: Manufacturer's standard mounting brackets of either cast iron or cold-rolled steel plate.

2.07 MANUAL CHAIN-HOIST DOOR OPERATOR

A. Provide door operators which consist of an endless steel hand chain, chain-pocket wheel, guard, and a geared reduction unit with a maximum lifting force of 25 lbf. Required pull for operation cannot exceed. Chain must extend to within 3 feet of floor.

B. Provide chain hoists with a mechanism allowing the curtain to be stopped at any point in its upward or downward travel and to remain in that position until moved to the fully open or closed position. Provide hand chains of galvanized steel. Ensure that the yield point of the chain is at least three times the required hand-chain pull.

C. Provide chain sprocket wheels of cast iron conforming to ASTM A48/A48M-22.

2.08 GENERAL FINISH REQUIREMENTS

A. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.09 GALVANIZED-STEEL FINISHES

A. Factory Finish: See 2.03.A.1, above.

PART 3 – EXECUTION

3.01 EXAMINATION

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

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

3.02 INSTALLATION

A. Install overhead coiling doors and operating equipment complete with necessary hardware, anchors, inserts, hangers, and equipment supports; according to manufacturer's written instructions and as specified.

B. Install overhead coiling doors, hoods, controls, and operators at the mounting locations indicated for each door.

C. Accessibility: Install overhead coiling doors operator along accessible routes in compliance with regulatory requirements for accessibility. Install Chain-hoist operator and chain on the right side of the overhead coiling door.

D. Fire-Rated Doors: Install according to NFPA 80.

E. Smoke-Control Doors: Install according to NFPA 80 and NFPA 105.

3.03 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

1. Perform installation and startup checks according to manufacturer's written instructions.
2. Test and adjust controls and safety devices. Replace damaged and malfunctioning controls and equipment.
3. Test door closing when activated by detector or alarm-connected fire-release system. Reset door-closing mechanism after successful test.

3.04 ADJUSTING

A. Adjust hardware and moving parts to function smoothly so that doors operate easily, free of warp, twist, or distortion.

1. Adjust exterior doors and components to be weather-resistant.

B. Lubricate bearings and sliding parts as recommended by manufacturer.

C. Adjust seals to provide tight fit around entire perimeter.

3.05 MAINTENANCE SERVICE

A. Initial Maintenance Service: Beginning at Substantial Completion, maintenance service shall include 12 months' full maintenance by skilled employees of coiling-door Installer. Include quarterly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for door operation. Parts and supplies shall be manufacturers' authorized replacement parts and supplies.

1. Perform maintenance, including emergency callback service, during normal working hours.
2. Include 24-hour-per-day, seven-day-per-week, emergency callback service.

3.06 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain overhead coiling doors.

END OF SECTION 05 50 00

SECTION 08 71 00

DOOR HARDWARE

PART 1: GENERAL

1.01 SCOPE

A. The contractor will furnish and install door hardware on steel entry doors to control access to the Ross Substation area as indicated in drawings.

1.02 RELATED DOCUMENTS

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

1.03 SUMMARY

A. Section includes the following:

1. UL listed door hardware for 1 ½ -hour fire rated steel doors specified herein, listed in the hardware schedule and/or required by the drawings. Underwriters' requirements shall have precedence over specifications where conflicts exist.
2. Access Control components and or systems specified within this section.

B. Where items of hardware are not definitely or correctly specified and is required for the intended service, such omission, error or other discrepancy should be directed to the Owner’s Representative prior to the bid date for clarification. Otherwise furnish such items in the type and quantity established by this specification for the appropriate service intended.

C. Related Sections:

1. Section 08 11 13 "Steel Doors and Frames"

1.04 REFERENCES

A. Refer to the following:

1. ANSI – American National Standards Institute
2. BHMA – Builders Hardware Manufacturers Association
3. DHI – Door Hardware Institute
4. NFPA – National Fire Protection Association
5. UL – Underwriter’s Laboratory

1.05 SUBMITTALS

A. Products other than those designated herein must be approved as substitutions prior to the submittal of Door Hardware.

B. Door Hardware Schedule: Vertical format conforming to DHI “Sequence and Format for the Hardware Schedule.” Format shall be 8-1/2 by 11-inch page size. Organize Schedule into headings, indicating quantity and complete designations of every item required for each door opening. The schedule shall include:

1. Cover sheet indicating name and location of Project; name of Contractor; name, address and phone number of hardware supplier, name of hardware consultant preparing the schedule; date of submittal or revised submittal.
2. Explanation of abbreviations, symbols, etc. used in schedule.
3. Numerical door index, indicating the hardware set/ group number for each door.
4. Door number, location, size, handing, and fire rating.
5. Door configuration (single, pair, etc.)
6. Door and frame material(s), handing.
7. Degree of swing.
8. Manufacturer.
9. Product name and catalog number of each item.
10. Function, type, style, size, handing, finish, and complete model number of each item.
11. Mounting heights.
12. Key set identification.
13. Fastenings and other pertinent information.
14. System Description of Operation: Include description of component functions including, but not limited to, the following situations: normal secured/unsecured state of door; authorized access; authorized egress; unauthorized access; unauthorized egress.

C. Indicate unsuitable or in-compatible items, and proposed substitutions in the hardware schedule.

D. Manufacturer's Technical Product Data / Catalog Cut Sheets: Clearly marked for each hardware item, including installation details, material descriptions, dimensions of individual components and profiles, and finishes. The format shall be 8-1/2 by 11-inch page size.

E. Furnish with first submittal, a list of required lead times for all hardware items.

F. Keying Schedule: In accordance with Owner's final keying instructions for locks. Conform to DHI “Keying Systems and Nomenclature.” The format shall be 8-1/2 by 11-inch page size.

G. Operation and Maintenance Data: Provide complete operating and maintenance instructions listing routine maintenance procedures, possible breakdowns and repairs, and troubleshooting guides.

H. Qualification Data: For firms and persons specified in the “Quality Assurance" Article.

I. Warranties: Special warranties specified in this Section.

1.06 QUALITY ASSURANCE

A. Obtain each type and variety of door hardware (hinges, latch & locksets, exit devices, closers, etc.) from a single manufacturer, unless otherwise indicated.

B. Hardware supplier shall be factory trained and certified by the manufacture to provide and support all locks and system components.

C. Installation of hardware shall be performed or directly supervised and inspected by a skilled installer certified by the manufacturer of locksets, door closers, and exit devices used on the project.

D. Manufacturers, Hardware Supplier, and Installer shall have no less than five years’ experience in the provision of Door Hardware for projects similar in size, complexity and type to this Project.

E. Hardware Schedule and Keying Schedule submittals shall be prepared by a Hardware Consultant holding the credentials of Architectural Hardware Consultant (AHC) issued by the Door and Hardware Institute. The Hardware Consultant shall have no less than five years’ experience in the scheduling of Door Hardware for projects similar in size, complexity and type to this Project; and shall be available, at no additional cost, during the course of the Work to consult with the Contractor and Owner regarding door hardware and keying.

F. Check the specified hardware for suitability and adaptability to the details and surrounding conditions.

G. Review drawings from related trades as required to verify compatibility with specified hardware.

H. Pre-Submittal Conference: Conduct coordination conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier(s), Installer(s), and Contractor(s) to review proper methods and the procedures for receiving, handling, and installing door hardware.

1. Prior to installation of door hardware, conduct a project specific training meeting to instruct the installing contractors' personnel on the proper installation and adjustment of their respective products. Product training to be attended by installers of door hardware for hollow metal doors. Training will include the use of installation manuals, hardware schedules, templates and physical product samples as required.
2. Review sequence of operation narratives for each unique access-controlled opening.
3. Review and finalize construction schedule and verify availability of materials.
4. Review the required inspecting, testing, commissioning, and demonstration

procedures.

I. Hardware supplier shall participate when reasonably requested to meet with the contractor and or architect to inspect any claim for incorrect or non-functioning materials; following such inspection, the hardware supplier shall provide a written statement documenting the cause and proposed remedy for any unresolved items.

1.07 REGULATORY REQUIREMENTS

A. Comply with all applicable provisions of the standards referenced within section 1.04 of this specification.

B. Fire-Rated Door Assemblies: Provide door hardware for assemblies complying with all applicable regulations, listed and labeled by a testing and inspecting agency.

1. At rated doors with panic exit devices, provide devices labeled as “Fire Exit Device.”
2. Provide documentation for all hardware to be furnished on labeled fire doors indicating compliance with positive pressure fire testing UL 10C.

C. Latching and locking doors that are hand-activated and that are in a path of travel shall be operable with a single effort by panic bars; from the egress side shall require the use of a key to open the door.

1. All hand-activated hardware shall be mounted between 34 inches and 48 inches above the finished floor.

D. Door closing devices shall comply with the following maximum opening-force requirements:

1. Interior Hinged Doors: 5 lbf applied perpendicular to door at latch.
2. Fire Rated Doors: 5 lbf applied perpendicular to door at latch. To ensure latching, may be increased to the minimum force allowable by the appropriate administrative authority, not to exceed 15 lbf.

E. Where door closers are provided, adjust the sweep speed so that from an open position of 90 degrees, the time required to move the door to a position of 12 degrees from the latch is 5 seconds minimum.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Hardware supplier shall deliver hardware to the job site unless otherwise specified.

B. Each article of hardware shall be delivered in the manufacturer's original cartons or containers and shall be clearly marked or labeled with set and door number to be readily identifiable with the approved hardware schedule.

C. Manufacturer's printed installation instructions, fasteners, and special tools shall be included in each package.

D. The Contractor shall receive all hardware and provide secure and proper storage of all hardware items to avoid delays caused by lost or damaged hardware. The Contractor shall report shortages to the owner's representative and hardware supplier immediately after receipt of material at the job site.

E. Coordinate with related trades under the direction of the contractor for delivery of hardware items necessary for factory installation.

F. Deliver all master keys by restricted, receipted delivery directly from the manufacturer to the Owner.

1.09 COORDINATION

A. Provide hardware templates to the parties involved for doors, frames, and other work specified to be factory prepared for door hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.

B. When required by door or frame fabricator, furnish physical samples of each mortised and recessed hardware item required.

C. Coordinate layout and installation of recessed pivots and closers.

D. Pre-Installation Meeting: Schedule a hardware pre-installation meeting at job site to review and discuss the installation of doors, frames, hinges, locksets, door closers, exit devices, overhead stops, and electromechanical door hardware.

1. Attendees shall be notified 7 days in advance of the meeting.
2. Attendees shall include Owner's Representative, Contractor, representative personnel of firms involved in the provision and installation of said items, and any other effected subcontractors or suppliers.
3. All attendees shall be prepared to distribute installation manuals, hardware schedules, templates, and physical hardware samples.

E. Keying Conference: Arrange conference with Owner's Representative and Manufacturer's/ Hardware Supplier's Architectural Hardware Consultant to establish keying requirements. Incorporate keying conference decisions into Keying Schedule.

1.10 WARRANTY

A. All hardware items shall be warranted against defects in material and workmanship as set forth in Division One General Requirements.

B. In addition to, and not precluding other warranty requirements in the Contract

Documents, the following hardware items shall carry extended minimum warranties as indicated:

1. Hinges: Ten years from the date of Substantial Completion.
2. Locks: Five years from the date of Substantial Completion.
3. Exit Devices: Three years from the date of Substantial Completion.
4. Door Closers: Ten years from the date of Substantial Completion.

C. Repair, replace, or otherwise correct deficient materials and workmanship without additional cost to owner

1.11 MAINTENANCE

A. Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

PART 2: PRODUCTS

2.01 MANUFACTURERS

A. Subject to compliance with requirements, provide products from approved manufacturers. Manufacturers include, but are not limited to the following for each type of hardware:

1. Butt Hinges: Ives, Stanley, Hager, McKinney.
2. Cylinders and Keying: Match Facility.
3. Locksets and Latchsets: Sargent, Schlage, Corbin.
4. Exit Devices: Sargent, Von Duprin, Corbin.
5. Flush Bolts and Door Coordinators: Architectural Builders Hardware, Ives, Rockwood, Door Controls, Hager.
6. Surface Door Closers: LCN 4000 Series, Norton 7500 Series, Sargent.
7. Overhead Holders and Stops: Architectural Builders Hardware, Glynn-Johnson, Rixson, Sargent.
8. Architectural Door Trim: Architectural Builders Hardware, Ives, Rockwood, Trimco.
9. Auxiliary Hardware: Ives, Rockwood, Trimco.
10. Door Bottoms, Metal Thresholds, Weatherstripping and Gaskets: National Guard Products, Pemko, NGP, Reese, Zero.

2.02 MATERIALS AND FABRICATION

A. Requirements for grade, materials, size, and other distinctive qualities of each type of door hardware are indicated herein. Furnish items in type, size or weight, in accordance with manufacturer's standards, appropriate for the conditions of installation and service, unless otherwise indicated.

B. Fire exit hardware shall be rated, listed, and labeled as such.

C. Products named or identified by make or model number, or other designation and described herein are base products. Base products establish the standards of type, in-service performance, physical properties, appearance, warranty, cost, and other characteristics required by the Project.

2.03 FASTENERS

A. Combination machine screws and expansion shields shall be used for attaching hardware to concrete or masonry.

B. All exposed fasteners shall be concealed or Phillips head, unless otherwise specified, and shall match the finish of the adjacent hardware.

C. All fasteners shall be non-ferrous or stainless steel. Furnish correct fasteners to accommodate environmental conditions.

D. Where Torx tamper resistant fasteners have been specified for a specific hardware group, provide Torx head fasteners with center pin on ALL exposed fasteners.

E. Coordinate required reinforcements for doors and frames. Seek approval of the Owner's Representative prior to furnishing through-bolts. Furnish through-bolts as required for materials not readily reinforced.

2.04 BUTT HINGES

A. Butt hinges shall meet ANSI/BHMA A156.1 requirements.

B. Hinge dimensions shall conform to ANSI/BHMA A156.7.

C. Unless otherwise specified, butt hinges for substation doors shall be provided with the following:

1. Base Metal shall be steel plated for fire-rated doors
2. Furnish 3 hinges per door leaf for doors up to 90 inches in height. 1 additional hinge for every 30 inch on doors over 90 inches.
3. Hinge size shall be 4 ½ inches x 4 ½ inches.
4. Provide in minimum hinge width sufficient to clear trim when door swings 180 degrees, whether or not shown on Drawings to swing 180 degrees.
5. Provide heavyweight hinges with 4 antifriction ball bearings per hinge.
6. Hinge locations and spacing shall be according to manufacturer's recommendation.
7. Screws: Use flat head machine screws for hollow metal doors.
8. Hinges for reverse bevel doors with locks shall have pins that are made non-removable when the door is in the closed position by means of a set screw in the hinge pin barrel.

2.05 CYLINDERS AND KEYING

A. Lock cylinders shall meet ANSI/BHMA A156.5 requirements.

1. Tumbler type, constructed from brass or bronze, stainless steel, or nickel silver.
2. Grade 1 permanent cores; face finished to match lockset.
3. Core Type: Interchangeable. 300 Series Cores / KSP KM-300 SFIC 6 pin core cylinders.

B. Keying system shall meet ANSI/BHMA A156.28 requirements.

1. Match Owner's Existing Master/Grandmaster (300 Master Key) System: Change keys and a master key operate cylinders.
   a. Provide two cylinder change keys and two master keys per cylinder. Actual cut keys to be determined by owner.

2. Existing System:
   a. Master key or grand master key locks to Owner's existing system.

3. Provide one extra key blank for each lock. Incorporate decisions made in keying conference.

C. Provide a temporary keying system for interim use during construction.

D. Keys: Brass.

1. Stamping: Permanently inscribe each key with a visual key control number and include the following notation:
   a. Notation: (Information to be furnished by Owner)

2. The inscription "Do Not Duplicate" shall be stamped on all keys.

2.06 LOCKSETS AND LATCHSETS

A. Mortise Locks and Latches shall meet ANSI/BHMA A156.13 Grade 1 requirements.

B. Operating trim shall be Keyed Trim with finger pull-plate. (Example: Yale 217-SB.) Operation: Entrance by trim when latch is retracted by key. Key removable only when locked.

C. Lock Throw: Comply with requirements for length of latch bolts to comply with labeled fire door requirements.

D. Lock backset shall be 2-3/4 inches unless otherwise indicated.

E. Provide guarded latch bolts for all locksets and latch bolts with sufficient throw to maintain fire rating of both single and paired door assemblies.

F. Provide curved-lip strike with dust box for each latch or lock bolt, with lip extended to protect frame, finished to match door hardware set, unless otherwise indicated.

2.07 EXIT DEVICES

A. Exit devices and exit device accessories shall meet ANSI/BHMA A156.3, Grade 1 requirements.

B. Provide wide style, Push-Pad type exit devices. (Example: Corbin ED5000-M110 Series.)

C. Obtain exit devices from a single manufacturer, although several may be indicated as offering products complying with requirements.

D. All exit devices should be provided with flush end caps to reduce potential damage from impact.

E. All exit devices shall be U.L. listed for accident hazard. Exit devices for use on fire doors shall also be U.L. listed for fire exit hardware.

F. Provide optional strikes, special length rods, and adapter plates to accommodate door and frame conditions. Provide narrow style series devices in lieu of wide stile series devices where optional strikes will not accommodate door and frame conditions.

G. Coordinate with related trades to ensure adequate clearance and reinforcement is provided in doors and frames. Provide through bolts as required.

H. Panic Exit Devices: Listed and labeled by a testing and inspecting agency, for panic protection, based on testing according to UL 305.

I. Fire Exit Devices: Complying with NFPA 80 that are listed and labeled by a testing and inspecting agency, for rim type fire and panic protection, based on testing according to UL 305 and NFPA 252.

J. Outside Trim: Design, material and finish to match locksets, unless otherwise indicated.

K. Provide interchangeable core cylinders when used in conjunction with exit devices. Cylinder keyway shall match locksets furnished on this project.

L. Adjustable strikes shall be provided for rim type and vertical rod devices.

M. Fire Exit Removable Mullions: Where indicated, provide removable mullions for use with fire exit devices complying with NFPA 80 that are listed and labeled by a testing and inspecting agency, for fire and panic protection, based on testing according to UL 305 and NFPA 252. Mullions shall be used only with exit devices for which they have been tested.

2.08 FLUSH BOLTS AND STRIKES

A. Manual flush bolts shall meet BHMA A156.16 requirements.

1. Bottom bolt shall have 12-inch-long operating rod. Top bolt operating rod shall be determined by door height, assuring the operator is located less than 72 inches above the floor.

B. Provide automatic flush bolts where required to maintain fire door listing and or egress requirements on pairs of doors.

C. Provide non-locking dust proof strikes for bottom bolts. Dust proof strikes shall meet BHMA A156.16.

2.09 COORDINATORS

A. Door coordinators shall meet ANSI/BHMA A156.3 requirements.

B. Provide coordinators at all pairs of doors having automatic flush bolts and closers on the inactive leaf, and for pairs of doors having vertical rod/mortise exit device combinations with overlapping astragals.

C. Door coordinators shall be flat bar type; stop mounted with all necessary filler bars and mounting brackets to accommodate required hardware.

D. Provide carry bar at each pair of doors equipped with an overlapping astragal, except when automatic or self-latching bolts are used.

2.10 CLOSERS

A. Door closing devices shall meet ANSI/BHMA A156.4, Grade 1 requirements.

B. Obtain door closers from a single manufacturer, although several may be indicated as offering products complying with requirements.

C. Closers shall use high strength cast iron cylinders, forged main arms, and 1 piece forged steel pistons.

D. Arm selection shall follow the requirements of the manufacturer's recommendations with brackets, drop plates and miscellaneous accessories provided as necessary. Provide extra heavy-duty arm (EDA / HD) when closer is to be installed using parallel arm mounting.

E. Provide closers with arms designed to permit openings of doors as far as job conditions will permit; unless otherwise indicated closers with arms restricting opening of door will not be acceptable.

F. Provide closers size adjusted in accordance with ANSI/BHMA A156.4; sized as required to ensure fire rated doors will consistently close and latch doors under existing

conditions. Size all other door closers to allow for reduced opening force not to exceed 5 lbs.

G. Closers for fire-rated doors shall be provided with temperature stabilizing fluid that complies with standards UL10C.

H. Unless otherwise specified, all door closers shall have full covers and separate adjusting valves for sweeps, latch, and backcheck.

I. Pressure Relief Valve (PRV) are not acceptable.

J. Closers shall be furnished complete with all mounting brackets and cover plates as required by door and frame conditions, and by adjacent hardware.

K. Door closers shall be provided with a powder-coat finish to provide superior protection against the effects of weathering. Powder-coat finish shall successfully pass a 100-hour salt spray test.

L. Install closers on the room side of substation doors.

2.11 OVERHEAD HOLDERS AND STOPS

A. Overhead holders and stops shall meet ANSI/BHMA A156.8 requirements.

B. Unless otherwise specified, furnish GJ900 series overhead stop for doors equipped with regular arm surface type closers that swing more than 140 degrees before striking a wall, for doors that open against equipment, casework, sidelights, or other objects that would make wall bumpers inappropriate, and as specified in hardware groups.

C. Do not provide hold open function for labeled fire rated doors.

D. Overhead door holders and stops shall be adjustable from 90 to 110 degrees dead stop or hold open position, as applicable.

E. Overhead doorstops shall have shock absorbers providing 5 to 7 degrees compression before dead stop.

2.12 KICK PLATES, ASTRAGALS, EDGES, PUSH/PULL PLATES AND BARS

A. Door trim shall meet ANSI/BHMA A156.6 requirements.

B. Furnish protective plates as specified in hardware groups.

C. Door Protection Plates: Kick, mop, and armor plates shall be 0.050-inch-thick brass, bronze, or stainless steel depending on finish indicated. Plates shall have beveled edges and shall be provided with countersunk mounting holes and No. 6 oval head screw

fasteners. Width of kick and armor plates shall be 2 inches less than the door width for single doors and 1 inch less for pairs of doors. Width of mop plates shall be 1 inch less than the door width. Unless otherwise indicated, height shall be 10 inches for kick and mop plates, and 34 inches for armor plates.

1. At fire rated doors, provide UL labeled protection plates in sizes, types, fasteners and materials only in accordance with door manufacturer's listings for respective ratings.

D. Door Edging and Astragals: Fabricated from 18 gauge cold-rolled steel or 304 stainless-steel as indicated; factory prepared for all mortise hardware; countersunk screw mounting.

1. At fire rated doors, provide UL labeled edge protection in sizes, types, fasteners and materials only in accordance with door manufacturer's listings for respective ratings.

E. Push and pull plates shall be 0.050-inch-thick brass, bronze, or stainless steel depending on finish indicated. Plates shall have beveled edges and shall be furnished with countersunk mounting holes and No. 6 oval head screw fasteners. Pull plates shall also be furnished with flat head through bolts for pull grip.

F. Push and pull bars and grip handles shall be brass, bronze, or stainless steel depending on BHMA finish indicated.

2.13 AUXILIARY HARDWARE

A. Auxiliary hardware shall meet ANSI/BHMA A156.16 requirements.

B. Door Stops: Stops shall be of heavy-duty construction, provided in finish indicated. Wall bumpers shall have no visible fasteners. Where wall stops are not applicable, furnish overhead stops.

C. Floor stops shall be of height required by floor conditions. Furnish floor stops only where specifically specified.

D. Do not provide hold open function for labeled fire rated doors.

E. Silencers: Gray rubber, non-marring configured for metal or wood frames as scheduled. Provide 3 per single door and 2 per pair of doors. Silencers shall be tamper-resistant once installed in door frame.

2.14 DOOR BOTTOMS

A. Door bottoms shall be of aluminum or extruded bronze of the type and finish indicated and shall provide proper clearance and an effective seal with specified thresholds.

B. Door bottom shall have a vinyl, neoprene, silicone rubber, polyurethane or brush seal as indicated.

C. The door bottom shall inhibit the flow of air through the unit when the door is in the closed position.

2.15 METAL THRESHOLDS

A. Thresholds shall meet ANSI/BHMA A156.21 requirements.

B. Thresholds shall be heavy-gauge aluminum or bronze of the configuration and finish indicated and shall provide an effective seal with door bottom.

C. Provide thresholds at doors where indicated. Provide fire door thresholds in accordance with applicable regulatory requirements.

2.16 GASKETING

A. Gasketing shall meet ANSI/BHMA A156.22 requirements.

B. Provide intumescent and other required edge sealing systems as required by individual fire door listings to comply with positive pressure standards UL 10C.

C. Shall be a compression type product (Zero 188 or equivalent) for use with steel doors; labeled for use on smoke/draft-control and fire-rated doors where required.

D. Provide gasketing for all meeting edges on pairs of fire doors. Gasketing shall be compatible with astragal design provided by door supplier as required for specific fire door listings.

2.17 FINISHES

A. Unless otherwise indicated, finishes shall conform to those identified in ANSI/BHMA A156.18.

B. Unless otherwise indicated in the hardware groups or herein, hardware finishes shall be applied over base metals as specified in the following finish schedule:

1.	Butt Hinges	630 (US32D - Satin Stainless Steel)
2.	Flush Bolts	626 (US26D - Satin Chromium)
3.	Exit Devices	626 (US26D - Satin Chromium)
4.	Locks and Latches	626 (US26D - Satin Chromium)
5.	Pulls and Push Plates/Bars	630 (US32D - Satin Stainless Steel)
6.	Coordinators	600 (Prime painted or mill alum.)
7.	Closers	689 (Powder Coat Aluminum)
8.	Protective Plates	630 (US32D - Satin Stainless Steel)

9.	Overhead Stops	630 (US32D - Satin Stainless Steel)
10.	Wall Stops and Holders	630 (US32D - Satin Stainless Steel)
11.	Thresholds	628 (Mill Aluminum)
12.	Weather-strip, Sweeps Drip Caps	Aluminum Anodized
13.	Miscellaneous	626 (US26D - Satin Chromium)

PART 3 – EXECUTION

3.01 EXAMINATION

A. Prior to installation of hardware, installer shall examine door frame installation to ensure frames have been set square and plumb. Installers shall examine doors, door frames, and adjacent walls, floor, and ceiling for conditions, which would adversely affect proper operation, function, and performance of door assemblies.

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

3.02 INSTALLATION

A. Steel doors shall be factory prepared for hardware per ANSI/BHMA A156.115.

B. Installation shall be in accordance with DHI A115.IG.

C. Hardware for fire door assemblies shall be installed conforming with NFPA 80, and all other applicable building codes and regulations.

D. Hardware for smoke door assemblies shall be installed conforming with NFPA 105, and all other applicable building codes and regulations.

E. Install each door hardware item according to manufacturer's printed instructions, utilizing templates and proper fasteners provided by manufacturer.

F. Use only fasteners supplied by or approved by the manufacturer for each respective item of hardware.

G. Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.

H. Unless otherwise specified, locate all hardware in accordance with the recommended locations for builders' hardware for standard doors and frames as published by the Door and Hardware Institute.

I. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in other Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.

J. Install hardware on UL labeled openings in accordance with manufacturer's requirements to maintain the label.

K. Apply self-adhesive gasketing on frame stop at head & latch side and on rabbet of frame at hinge side.

L. Install hardware in accordance with supplemental "S" label instructions on all fire rated openings.

M. Install wall stops to contact lever handles or pulls. Do not mount wall stops on casework, or equipment.

3.03 DOOR CLOSING DEVICES

A. Surface closers on doors opening to or from halls and corridors shall be mounted on the room side of the door.

B. Door closing devices with adjustable spring power shall be adjusted for proper door operation, and compliance with all applicable codes and regulations.

C. Cutting of gasketing to accommodate closer installation is not acceptable.

3.04 THRESHOLDS

A. Unless otherwise specified or detailed, install thresholds with the bevel in vertical alignment with the outside door face. Notch and closely fit thresholds to frame profile. Set thresholds in full bed of sealant.

B. Thresholds shall be secured with a minimum of 3 fasteners per single door width and 6 fasteners per double door width with a maximum spacing of 12 inches; with a minimum of 1 inch thread engagement into the floor or anchoring device used. Thresholds over 6 inches in width shall be secured with a double row of fasteners.

3.05 ASTRAGALS

A. Unless otherwise indicated install overlapping astragals as follows:

1. At out-swing pairs of doors, mount astragal on active leaf.

3.06 HARDWARE LOCATIONS

A. Unless otherwise indicated install hardware as follows:

1. Bottom Hinge: 10 inches from door bottom to bottom of hinge.
2. Top Hinge: 5 inches from door top to top of hinge.

3. Center Hinge(s) or Pivot(s): Spaced equidistantly between top and bottom hinges/ pivots.
4. Lockset / Latchset: 38 inches from finished floor to center of lever.
5. Exit Device: 38 inches from finished floor to device centerline.
6. Deadlock: 32 inches from finished floor to center key cylinder / thumb turn.
7. Push Plate/ Pull Plate: 42 inches from finished floor to center of pull.
8. Wall Bumper: Centered at point on wall where lever, or other operating trim, first makes contact with wall.

3.07 ADJUSTING

A. Where necessary, adjust doors and hardware as required to eliminate binding between strike and latchbolt. Doors should not rattle.

B. Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended.

C. Engage a factory-authorized service representative to adjust door closing devices, compensating for final operation of heating and ventilating equipment, and to comply with referenced accessibility requirements.

D. Deliver to the owner 1 complete set of installation and adjustment instructions, and tools as furnished with the hardware.

E. Follow-up Adjustment: Approximately 6 months after the date of Substantial Completion, Installer shall perform the following:

1. Examine and readjust each item of door hardware as necessary to ensure the function of door hardware.
2. Consult with and instruct Owner's personnel on recommended maintenance procedures.
3. Replace door hardware items that have deteriorated or failed due to faulty design, materials, or installation of door hardware unit.

3.08 FIELD QUALITY CONTROL

A. Perform tests and inspections. Contractor is responsible for testing and inspection of door installations.

B. Independent door and hardware inspection:

1. After installation has been completed, the hardware supplier and manufacturer’s representative for locksets, door closers, exit devices, and overhead stops (Architectural Hardware Consultant) shall check the project and verify compliance with installation instructions, adjustment of all hardware items, and proper

application according to the approved hardware schedule. The hardware supplier shall submit a list of all hardware that has not been installed correctly.

2. Independent Architectural Hardware Consultant shall inspect door hardware and prepare written report whether installed work complies with or deviates from requirements, whether door hardware is properly installed and adjusted, and prepare a specific list of any deficiencies, a copy of which shall be provided to owner's representative.
3. The Contractor shall correct all deficiencies noted in above report.
4. The Independent Architectural Hardware Consultant shall re-inspect door hardware and prepare a report certifying correction of deficiencies and compliance with requirements.

3.09 Hardware Sets

A. Hardware finish shall be satin stainless-steel (US32D), satin chromium plated (US26D), satin nickel plated (US15), satin aluminum (US28) or aluminum powder coated.

Door 8A - East Wall, Access Door
3'-0"W x 7'-0"H x 1 ¾" Thick
1 ½ Hour Fire-Rated Hollow Metal Door and Frame
Door Opens OUT (LHRB)

Set: 1.0

Hinges (heavy weight)
Fire Exit Device x Nightlatch
Cylinder and Core
Door Closer x Stop Arm x Special Rust Inhibitor
Threshold
Gasketing
Door Bottom
Kick Plate

Operation:
Door normally closed and secured. From outside, key retracts latch allowing authorized entry. From inside, always-free egress using panic bar.

Door 8C - West Wall, Double Access Door
6'-0"W x 7'-0"H x 1 ¾" Thick
1 ½ Hour Fire-Rated Hollow Metal Doors and Frame
Doors Open OUT (Left Leaf: RHRB, Right Leaf: LHRB)

Set: 2.0

Left Leaf:
Hinges (heavy weight)
Fire Exit Device x Nightlatch
Cylinder and Core
Door Closer x Stop Arm x Special Rust Inhibitor
Astragal
Gasketing
Kick Plate

Right Leaf:
- Hinges (heavy weight)
- Door Closer x Stop Arm x Special Rust Inhibitor
- Flushbolt
- Gasketing
- Kick Plate

Operation:
Door normally closed and secured. From outside, key retracts latch allowing authorized entry. Left door leaf always-free egress using panic bar. Right door leaf held closed, secured by flushbolt.

END OF SECTION 08 71 00

SECTION 08 80 00

GLAZING

PART 1: GENERAL

1.01 SCOPE

A. The contractor will provide glass Lites in fire rated access doors for the Ross Substation area as indicated in drawings.

1.02 RELATED DOCUMENTS

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

1.03 SUMMARY

A. Section includes glazing for the following products and applications, including those specified in other Sections where glazing requirements are specified by reference to this Section:

1. Doors.

B. Related Sections:

1. Section 08 11 13, “Steel Doors and Frames” for hollow metal doors.

1.04 DEFINITIONS

A. Glass Manufacturers: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.

B. Glass Thicknesses: Indicated by thickness designations in millimeters according to ASTM C1036-21.

1.05 REFERENCES

C. Refer to the following:

1. AAMA – American Architectural Manufacturers Association
2. ASTM – American Society for Testing and Materials
3. GANA – Glass Association of North America
4. NFPA – National Fire Protection Association
5. SGCC – Safety Glazing Certification Council

1.06 PERFORMANCE REQUIREMENTS

D. General: Installed glazing systems shall withstand normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, or installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.

1.07 SUBMITTALS

A. Product Data: For each glass product and glazing material indicated.

B. Product Certificates: For glass and glazing products, from manufacturer.

1.08 QUALITY ASSURANCE

A. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below, unless more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.

1. GANA Publications: GANA's "Glazing Manual."

B. Safety Glazing Labeling: Where safety glazing labeling is indicated, permanently mark glazing with certification label of the SGCC. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.

C. Fire-Protection-Rated Glazing Labeling: Permanently mark fire-protection-rated glazing with certification label of a testing agency. Label shall indicate manufacturer's name, test standard, whether glazing is for use in fire doors or other openings, whether or not glazing passes hose-stream test, whether or not glazing has a temperature rise rating of 450 deg F, and the fire-resistance rating in minutes.

1.09 WARRANTY

A. Manufacturer's Special Warranty on Glass:

1. Warranty Period: 10 years from date of Substantial Completion.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Protect glazing materials according to manufacturer's written instructions. Prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

PART 2: PRODUCTS

2.01 GLASS PRODUCTS, GENERAL

A. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass Lites in thicknesses as needed to comply with the requirements indicated.

B. Strength: Where float glass is indicated, provide annealed float glass, Kind HS heat-treated float glass, or Kind FT heat-treated float glass as needed to comply with "Performance Requirements" Article. Where heat-strengthened glass is indicated, provide Kind HS heat treated float glass or Kind FT heat-treated float glass as needed to comply with "Performance Requirements" Article. Where fully tempered glass is indicated, provide Kind FT heat-treated float glass.

2.02 MANUFACTURERS

A. Manufacturers/Fabricators: Subject to compliance with requirements, provide products from the following:

1. Bendheim, LTD.
2. FireLite
3. Guardian Industries Corporation
4. Interpane Glass Company
5. Nippon Electric Glass Co., Ltd.
6. Pilkington Group
7. Schott North America

2.03 PRIMARY FLOAT GLASS

A. Float Glass: ASTM C1036-21, Type I (transparent glass, flat), Quality Q3 (glazing select); class as indicated.

2.04 HEAT-TREATED FLOAT GLASS

A. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed, unless otherwise indicated.

B. Heat-Treated Float Glass: ASTM C1048-18; Type I (transparent glass, flat); Quality Q3 (glazing select); class, kind, and condition as indicated.

2.05 WIRED GLASS

A. Polished Wired Glass: ASTM C1036-21, Type II, Class 1 (clear), Form 1, Quality-Q6,

complying with ANSI Z97.1, Class C.

1. Mesh: M2 (square).

2.06 GLAZING SEALANTS

A. General:

1. Compatibility: Provide glazing sealants that are compatible with one another and with other materials they will contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
3. Sealants used inside the weatherproofing system, shall have a VOC content of not more than 250 g/L when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
4. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range.

B. Glazing Sealant: Neutral-curing silicone glazing sealant complying with ASTM C 920, Type S, Grade NS, Class 25, Use NT.

C. Glazing Sealants for Fire-Rated Glazing Products: Products that are approved by testing agencies that listed and labeled fire-resistant glazing products with which they are used for applications and fire-protection ratings indicated.

2.07 GLAZING TAPES

A. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based, 100 percent solids elastomeric tape; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; and complying with ASTM C 1281 and AAMA 800 for products indicated below:

1. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.

2.08 MISCELLANEOUS GLAZING MATERIALS

A. General: Provide products of material, size, and shape complying with referenced glazing standard, requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.

B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.

C. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.

D. Spacers: Elastomeric blocks or continuous extrusions of hardness required by glass manufacturer to maintain glass Lites in place for installation indicated.

E. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).

F. Cylindrical Glazing Sealant Backing: ASTM C1330-18, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.

G. Perimeter Insulation for Fire-Resistive Glazing: Product that is approved by testing agency that listed and labeled fire-resistant glazing product with which it is used for application and fire protection rating indicated.

2.09 FABRICATION OF GLAZING UNITS

A. Fabricate glazing units in sizes required to fit openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.

B. Clean-cut or flat-grind vertical edges of butt-glazed monolithic lites to produce square edges with slight chamfers at junctions of edges and faces.

2.10 FIRE-RATED GLAZING PRODUCTS

A. Fire-Protection-Rated Glazing, General: Listed and labeled by a testing agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 252 for door assemblies and NFPA 257 for window assemblies.

B. Laminated Ceramic Glazing: Laminated glass made from 2 plies of clear, ceramic flat glass; 5/16-inch total nominal thickness; complying with testing requirements in 16 CFR 1201 for Category II materials.

1. Products: Subject to compliance with requirements, provide the following:
   a Nippon Electric Glass Co., Ltd. (distributed by Technical Glass Products); FireLite Plus.
   b Schott North America, Inc.; Laminated Pyran Crystal.
   c Vetrotech Saint-Gobain; SGG Keralite FR-L.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Examine framing, glazing channels, and stops, with Installer present, for compliance with the following:

1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
2. Minimum required face and edge clearances.
3. Effective sealing between joints of glass-framing members.

3.02 PREPARATION

A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.

3.03 GLAZING, GENERAL

A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.

B. Adjust glazing channel dimensions as required by Project conditions during installation to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.

C. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance.

D. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.

E. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.

F. Do not exceed edge pressures stipulated by glass manufacturers for installing glass Lites.

G. Provide edge blocking where indicated or needed to prevent glass Lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications."

H. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.

3.04 TAPE GLAZING

A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude sLitely above sightline of stops.

B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.

C. Cover vertical framing joints by applying tapes to heads and sills first and then to jambs. Cover horizontal framing joints by applying tapes to jambs and then to heads and sills.

D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.

E. Apply heel bead of elastomeric sealant.

F. Center glass lites in openings on setting blocks and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.

G. Apply cap bead of elastomeric sealant over exposed edge of tape.

3.05 SEALANT GLAZING (WET)

A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.

B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.

C. Tool exposed surfaces of sealants to provide a substantial wash away from glass.

3.06 CLEANING AND PROTECTION

A. Protect exterior glass from damage immediately after installation by attaching crossed streamers to framing held away from glass. Do not apply markers to glass surface. Remove nonpermanent labels and clean surfaces.

B. Protect glass from contact with contaminating substances resulting from construction operations. If, despite such protection, contaminating substances do come into contact

with glass, remove substances immediately as recommended in writing by glass manufacturer.

C. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains; remove as recommended in writing by glass manufacturer.

D. Remove and replace glass that is broken, chipped, cracked, or abraded or that is damaged from natural causes, accidents, and vandalism, during construction period.

E. Wash glass on both exposed surfaces in each area of Project not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.

3.07 GLAZING SCHEDULE

A. Clear Glass:

1. GL-1: ¼" Clear Tempered Safety Glass.

B. Fire-Rated Glass:

1. GL-2: Polished wired glass.
   a. Thickness: 6.0 mm.

2. GL-3: "FireLite Plus" - fire rated, safety-rated, laminated glass ceramic;
   a. 90 min. (Doors)
   b. Thickness: 6 mm.
   c. Maximum Exposed Glass Area: 100 sq. in.

END OF SECTION 08 80 00

SECTION 09 96 00

HIGH PERFORMANCE COATINGS

PART 1: GENERAL

1.01 SCOPE

A. The contractor will provide finishes as necessary for the Ross Substation area as indicated in drawings.

1.02 RELATED DOCUMENTS

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

1.03 DEFINITIONS

A. High Performance Coatings: Specialized protective primer, paint, and other coatings designed for demanding applications where superior durability, chemical resistance, and other enhanced properties are required.

1.04 SUMMARY

A. Section includes surface preparation and the application of high-performance coating systems on the following surfaces:

1. Interior Substrates:
    a Concrete, vertical (wall) and horizontal (ceiling) flat surfaces.
    b Vaulted ceiling spaces with sprayed-on concrete surfaces.
    c Concrete masonry units (CMUs).
    d Steel (hollow metal, sheet steel, structural shapes).
    e Galvanized steel fire-protection plates.

B. Related Sections:

1. Section 05 50 00, “Metal Fabrications” for coatings on ferrous metal items.
2. Section 08 11 13, "Steel Doors and Frames" for shop priming followed by finished coatings specified in this Section.
3. Section 08 33 23, “Overhead Coiling Doors” for shop priming of miscellaneous steel at head and jambs, followed by finished coatings specified in this Section. (Painting of door slats to be performed in factory).

1.05 REFERENCES

A. Refer to the following:

1. MPI – Master Painters Institute
2. SSPC – Steel Structures Painting Council

1.06 SUBMITTALS

A. Product Data: For each type of product. Include preparation requirements and application instructions.

B. Samples for Initial Selection: For each type of topcoat product indicated.

C. Samples for Verification: For each type of coating system and in each color and gloss of topcoat indicated.

1. Submit Samples on rigid backing, 8 inches square.
2. Apply coats on Samples in steps to show each coat required for system.
3. Label each coat of each Sample.
4. Label each Sample for location and application area.

D. Product List: For each product indicated, include the following:

1. Cross-reference to coating system and locations of application areas. Use same designations indicated on Drawings and in schedules. Include color designations.
2. Printout of current "MPI Approved Products List" for each product category specified in Part 2, with the proposed product highlighted.
3. VOC content.

E. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Coatings: 5 percent, but not less than 1 gal. of each material and color applied.

1.07 QUALITY ASSURANCE

A. Source Limitations: Obtain each type and variety of high-performance coating from a single manufacturer, unless otherwise indicated. Coating materials for each application shall be compatible.

B. Mockups: Apply mockups of each coating system indicated to verify preliminary selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. The owner’s representative will select one surface to represent surfaces and conditions for application of each coating system.
   a. Wall and Ceiling Surfaces: Provide samples of at least 100 sq. ft.
   b. Other Items: Owner’s representative will designate items or areas required.

2. Final approval of color selections will be based on mockups.
    a. If preliminary color selections are not approved, apply additional mockups of additional colors selected by the owner's representative at no added cost to Owner.

C. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless owner's representative specifically approves such deviations in writing.

D. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F (7 deg C).

1. Maintain containers in clean condition, free of foreign materials and residue.
2. Remove rags and waste from storage areas daily.

1.09 PROJECT CONDITIONS

A. Apply coatings only when temperature of surfaces to be coated and ambient air temperatures are between 50 and 95 deg F (10 and 35 deg C).

B. Do not apply coatings when relative humidity exceeds 85 percent; at temperatures less than 5 deg F (3 deg C) above the dew point; or to damp or wet surfaces.

PART 2: PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by the following:

1. Benjamin Moore & Co.
2. Diamond Vogel Paints
3. Hilti, Inc.
4. Hirshfield's, Inc.
5. PPG Paints
6. Sherwin-Williams Co.
7. Tnemec Inc.

B. Basis-of-Design Manufacturer:

1. Tnemec, Inc.
2. Sherwin-Williams Co.

C. Products: Subject to compliance with requirements, provide product listed in the Interior High-Performance Coating Schedule for the coating category indicated.

2.02 HIGH-PERFORMANCE COATINGS, GENERAL

A. MPI Standards: Provide products that comply with MPI standards indicated and that are listed in its "MPI Approved Products List" and meets or exceeds the quality of the Basis-of-Design Product.

B. Material Compatibility:

1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
2. For each coat in a paint system, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.
3. Products shall be of same manufacturer for each coat in a coating system.

C. Colors: As selected by the owner’s representative during design from manufacturer's full range.

2.03 SOURCE QUALITY CONTROL

A. Testing of Coating Materials: Owner reserves the right to invoke the following procedure:

1. The owner may engage the services of a qualified testing agency to sample coating materials. The Contractor will be notified in advance and may be present when samples are taken. If coating materials have already been delivered to Project site, samples may be taken at Project site. Samples will be identified, sealed, and certified by the testing agency.
2. Testing agency will perform tests for compliance with product requirements.
3. The Owner may direct the Contractor to stop applying coatings if test results show materials being used do not comply with product requirements. The Contractor shall remove noncomplying coating materials from Project site, pay for testing, and recoat surfaces coated with rejected materials. The Contractor will be required to remove rejected materials from previously coated surfaces if, upon recoating with complying materials, the two coatings are incompatible.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:

1. Concrete: 12 percent.
2. Masonry (Clay and CMUs): 12 percent.

C. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.

D. Proceed with coating application only after unsatisfactory conditions have been corrected.

1. Application of coating indicates acceptance of surfaces and conditions.

3.02 PREPARATION

A. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.

1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.

B. Clean substrates of substances that could impair bond of coatings, including dust, dirt, oil, grease, and incompatible paints and encapsulants.

1. Remove incompatible primers and re-rime substrate with compatible primers or apply tie coat as required to produce coating systems indicated.

C. Concrete and Masonry Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces to be coated exceeds that permitted in manufacturer's written instructions.

1. Clean surfaces with pressurized water. Use pressure range of 1500 to 4000 psi at 6 to 12 inches.

D. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and areas where shop paint is abraded. Paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.

E. Bare steel substrates: Remove grease and oil residue. Comply with SSPC-SP10 to prepare bare steel surfaces.

F. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied coatings or comply with SSPC-SP16.

3.03 APPLICATION

A. Apply high-performance coatings according to manufacturer's written instructions and to recommendations in "MPI Manual."

1. Use applicators and techniques suited for coating and substrate indicated.
2. Coat surfaces behind movable equipment and furniture, the same as similar exposed surfaces. Before final installation, coat surfaces behind permanently fixed equipment or furniture with prime coat only.
3. Coat front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
4. Do not apply coatings over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
5. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.

B. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of the same material are to be applied. Tint undercoats to match color of finish coat but provide sufficient difference in shade of undercoats to distinguish each separate coat.

C. If undercoats or other conditions show through final coat, apply additional coats until cured film has a uniform coating finish, color, and appearance.

D. Apply coatings to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Produce sharp lines and color breaks.

3.04 FIELD QUALITY CONTROL

A. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test coatings for dry film thickness.

1. The Contractor shall touch up and restore coated surfaces damaged by testing.
2. If test results show that dry film thickness of applied coating does not comply with coating manufacturer's written recommendations, the Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with coating manufacturer's written recommendations.

3.05 CLEANING AND PROTECTION

A. At the end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

B. After completing coating application, clean spattered surfaces. Remove spattered coatings by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect the work of other trades against damage from coating operation. Correct damage to the work of other trades by cleaning, repairing, replacing, and recoating, as approved by the owner's representative, and leave in an undamaged condition.

D. At completion of construction activities of other trades, touch up and restore damaged or defaced coated surfaces.

3.06 INTERIOR HIGH-PERFORMANCE COATING SCHEDULE

A. Concrete Substrates, Vertical Surfaces and Flat Ceilings:

1. Two-Component, Pigmented Polyurethane
   a. Prime Coat and Intermediate Coat: Waterborne Epoxy Amine Adduct
      1) Tnemec: Enviro-Pox, Series 287
      2) Dry Film Thickness; 3 mils.
   b. Topcoat: Two Component, Pigmented Waterborne Acrylic Polyurethane
      1) Tnemec: Endura-Shield, Series 1081, Semi-Gloss
      2) Dry Film Thickness: 3 mils.

B. Concrete Substrates, Vaulted Surfaces with Sprayed-on Concrete (Allow concrete to cure 28 days).

1. Inorganic Hybrid Water-Based Epoxy
   a. Prime Coat (Spray-Applied):
      1) Tnemec Typoxy Series 27WB
      2) Dry Film Thickness: 3 mils, minimum.
   b. b. Topcoat: Same material as A., 1., above.
      1) Dry Film Thickness: 3 mils, minimum.

C. CMU Substrates:

1. Two-Component, Pigmented Polyurethane
   a. Block Filler: Inorganic Hybrid Water-Based Two-Component Epoxy
      1) Tnemec: Epoxoblock WB, Series 1254.
      2) Roller applied, 80 to 100 SF per gallon.
   b. Intermediate Coat: Modified Polyamine Epoxy.
      1) Tnemec: Tneme-Glaze, Series 280
      2) Dry Film Thickness: 6 to 8 mils.
   c. Topcoat: Two Component, Pigmented Waterborne Acrylic Polyurethane
      1) Tnemec: Endura-Shield, Series 1081, Semi-Gloss
      2) Dry Film Thickness: 3 mils.

D. Steel Substrates (HM doors, miscellaneous steel, galvanized steel):

1. Two-Component, Pigmented Polyurethane
   a. Topcoat: Two Component, Pigmented Waterborne Acrylic Polyurethane
      1) Tnemec: Endura-Shield, Series 1081, Semi-Gloss
      2) Dry Film Thickness: 3 mils.

E. Steel Substrates (galvanized steel fire-protection plates):

1. Two-Component, Pigmented Polyurethane
   a. Prime Coat: Two-component, corrosion inhibitive epoxy primer
      1) Sherwin-Williams: Macropoxy® 4600
      2) Dry Film Thickness: 3 mils.
   b. Intermediate coat: Two-component, thick film epoxy intumescent coating
      1) Sherwin-Williams: FIRETEX® M90/03
      2) Dry Film Thickness: 5 to 10 mils.
   c. Topcoat: Two-component, high-solids acrylic polyurethane
      1) Sherwin-Williams: Acrolon™ 7300
      2) Dry Film Thickness: 3 mils.

END OF SECTION 09 96 00

SECTION 23 05 10

MECHANICAL DEMOLITION

PART 1: GENERAL

1.01 SCOPE

A. The Contractor will perform mechanical demolition as necessary to perform work required to complete this project as indicated on drawings.

1.02 RELATED DOCUMENTS

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

1.03 SUMMARY

A. Section includes the following:

1. Mechanical demolition.

B. Related Sections:

PART 2: PRODUCTS

2.01 MATERIALS AND EQUIPMENT

A. Materials and equipment for patching and extending work: As specified in individual sections.

PART 3: EXECUTION

3.01 EXAMINATION

A. Verify field measurements and ductwork arrangements are as shown on Drawings.

B. Verify that ductwork and equipment to be removed serve only abandoned facilities.

C. Demolition drawings are based on casual field observation.

D. Report discrepancies to Owner Representative before disturbing existing installation.

E. Beginning of demolition means the installer accepts existing conditions.

3.02 PREPARATION

A. Coordinate service outages with Owner. Notify Owner Representative 48 hours prior to any outage.

B. Provide temporary connections to maintain existing systems in service during construction.

3.03 DEMOLITION AND EXTENSION OF EXISTING MECHANICAL WORK

A. Remove, relocate, and extend existing installations to accommodate new construction.

B. Maintain access to existing mechanical installations which remain active. Modify installation or provide access panel as appropriate.

C. Extend existing installations using materials and methods as specified.

3.04 CLEANING AND REPAIR

A. Clean and repair existing materials and equipment which remain or are to be reused.

END OF SECTION 23 05 10

SECTION 23 05 13

COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

PART 1: GENERAL

1.01 SCOPE

A. The Contractor will furnish and install an electric motor for the ventilation system fan to maintain air flow through the Ross Substation area as indicated on drawings.

1.02 RELATED DOCUMENTS

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

1.03 SUMMARY

A. Section includes the following:

1. General requirements for single-phase and polyphase, general-purpose, horizontal, small and medium, squirrel-cage induction motors for use on ac power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

B. Related Sections:

1. Section 23 34 13 “Axial HVAC Fans”

1.04 REFERENCES

A. Refer to the following:

1. IEEE – Institute of Electrical and Electronics Engineers
2. NEMA – National Electrical Manufacturer’s Association
3. NFPA – National Fire Protection Association

1.05 SUBMITTALS

A. Product Data:

1. Inclusive of the following for each motor:
   a. Manufacturer’s name and model.
   b. Horsepower rating.
   c. Service factor.

d. Synchronous speed and rated speed.
e. Voltage, phase, Hertz.
f. Full load amperage.
g. Locked rotor amperage.
h. NEMA frame size.
i. Full load efficiency.
j. Full load power factor.
k. Enclosure type.
l. Bearings type and rated life.
m. Connection diagram.

B. Close-out Submittals:

1. Operation and Maintenance Data.

1.06 COORDINATION

A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:

1. Motor controllers.
2. Torque, speed, and horsepower requirements of the load.
3. Ratings and characteristics of supply circuit and required control sequence.
4. Ambient and environmental conditions of installation location.

PART 2: PRODUCTS

2.01 MANUFACTURERS

A. High Efficiency Motors:

1. Baldor
2. Century “E-Plus”
3. Dayton
4. Gould
5. Louis Allis “Pacemaker”
6. Marathon “Blue Chip”
7. Spartan
8. US Motor
9. Westinghouse Mac II

2.02 GENERAL MOTOR REQUIREMENTS

A. Comply with NEMA MG 1 unless otherwise indicated.

B. Comply with IEEE 841 for severe-duty motors.

2.03 POLYPHASE MOTORS

A. Description: NEMA MG 1, Design B, medium induction motor.

B. Rotor: Squirrel cage, 1750 RPM unless otherwise specified.

C. Efficiency: Energy efficient, as defined in NEMA MG 1.

D. Service Factor: Minimum 1.15 for open motors, suitable for continuous operation at project altitude and ambient temperature conditions without operating in excess of nameplate rated horsepower and NEMA temperature ratings at 1.0 service factor.

E. Voltage Requirements: 480 Volt, 3-phase, 60 Hertz.

F. Torque Characteristics: Sufficient to start load from rest; accelerate load to full running speed within rated time limit; and operate without abrupt loss of speed when actual line voltage is plus or minus 10 (ten) percent of nameplate voltage.

G. Inverter Duty: All motors shall be inverter duty rated per NEMA MG-1, Part 31.

H. Temperature Rise: Match insulation rating.

I. Insulation: Class H

J. Code Letter Designation:

1. Motors 15 HP and Larger: NEMA starting Code F or Code G.
2. Motors Smaller than 15HP: Manufacturer's standard starting characteristic.

K. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.

L. Enclosure: TEFC. Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T.

2.04 POLYPHASE MOTORS WITH ADDITIONAL REQUIREMENTS

A. Motors Used with Reduced-Voltage and Multispeed Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal-box, suited to control method.

B. Motors Used with Variable Frequency Controllers: Ratings, characteristics, and features coordinated with and approved by controller manufacturer.

1. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse-width modulated inverters.
2. Energy- and Premium-Efficient Motors: Class B temperature rise; Class F

insulation.
3. Inverter-Duty Motors: Class F temperature rise; Class H insulation.
4. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.
5. Motor shaft electrical grounding device will be provided. Grounding devices will be removable and replaceable.

C. Severe-Duty Motors: Comply with IEEE 841, with 1.15 minimum service factor.

PART 3: EXECUTION

3.01 EXAMINATION

A. Prior to making electrical connections, check all electrical equipment furnished under other Sections of the Specifications for the specified voltages and directions of rotation.

B. Verify that the electrical installation and related work performed under other sections of the specifications satisfy the requirements for the performance of the work in accordance with the drawings in this section and as specified in this section.

3.02 INSTALLATION

A. Motor Mounting and Wiring shall be done in accordance with the manufacturer's instruction.

B. Starter or VFD shall be installed in accordance with the details and locations shown on the drawing and in accordance with the manufacturer's instruction.

C. Motor Rotation: Verified as correct by Electrical Contractor and by subcontractor installing driven equipment.

3.03 FIELD TESTS

A. Testing shall be performed on electrical equipment and systems to ensure that equipment and systems are operational and within applicable standards and manufacturer's tolerances. Testing should verify that equipment and systems are installed in accordance with design specifications.

B. Qualified technicians who are trained and regularly employed for testing services shall do all testing.

C. In addition to other tests which may be required, perform operational tests to include the following:

1. Demonstrate proper interlock and control circuit operation, including BMS system control provision.

2. Demonstrate manual trip operation of overload relay, fire alarm shut down and other safety circuitry.

D. Tests shall be performed in accordance with the equipment manufacturers' start-up and field test instructions and made jointly with all affected trades.

E. Should the tests reveal any defects, promptly correct such defects and rerun the tests until the entire installation is satisfactory in all respects.

END OF SECTION 23 05 13

SECTION 23 31 13

METAL DUCTS

PART 1: GENERAL

1.01 SCOPE

A. The Contractor will design and install ventilation system ductwork to maintain the temperature in the Ross Substation area as indicated on drawings.

1.02 RELATED DOCUMENTS

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

1.03 SUMMARY

A. Section includes the following duct work types:

1. Single-wall rectangular ducts and fittings.
2. Single-wall round ducts and fittings.
3. Sheet metal materials.
4. Sealants and gaskets.
5. Hangers and supports.

B. Related Sections:

1. Section 05 05 20 “Hanger Support Anchors.”
2. Section 05 05 29 “Unistrut Support Systems.”
3. Section 23 33 00 "Air Duct Accessories" for dampers, sound-control devices, duct mounting access doors and panels, turning vanes, and flexible ducts.

1.04 REFERENCES

A. Refer to the following:

1. ANSI - American National Standards Institute
2. ASHRAE – American Society of Heating, Refrigerating, and Air-Conditioning Engineers
3. ASTM – American Society for Testing and Materials
4. AWS – American Welding Society
5. NADCA – National Air Duct Cleaners Association
6. SMACNA – Sheet Metal and Air Conditioning Contractors National Association

1.05 PERFORMANCE REQUIREMENTS

A. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

B. The Contractor shall verify that ductwork can be installed in the available space prior to fabrication. Contact the Engineer if conflicts exist.

C. Delegated Duct Design: Duct construction, including sheet metal thicknesses, seam and joint construction, reinforcements, and hangers and supports, shall comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and performance requirements and design criteria indicated in "Duct Schedule" Article.

D. Structural Performance: Duct hangers and supports shall withstand the effects of gravity loads and stresses within limits and under conditions described in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

1.06 SUBMITTALS

A. Product Data: For each type of the following products:

1. Liners and adhesives
2. Sealants and gaskets
3. Duct Fittings: Include:
    a. Descriptive literature.
    b. Dimensioned drawings of fittings, generic by type, with variable dimensions expressed as function of diameter or axis.
    c. Bill of materials keyed to layout drawing.

B. Shop Drawings:

1. Fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work.
2. Factory- and shop-fabricated ducts and fittings.
3. Duct layout indicating sizes, configuration, liner material, and static-pressure classes.
4. Elevation of top of ducts.
5. Dimensions of main duct runs from building grid lines.
6. Fittings
7. Reinforcement and spacing
8. Seam and joint construction
9. Penetrations through fire-rated and other partitions.
10. Equipment installation based on equipment being used on Project.
11. Locations for duct accessories, including dampers, turning vanes, and access doors and panels.
12. Hangers and supports, including methods for duct and building attachment and vibration isolation.

C. Delegated-Design Submittal:

1. Sheet metal thicknesses.
2. Joint and seam construction and sealing.
3. Reinforcement details and spacing.
4. Materials, fabrication, assembly, and spacing of hangers and supports.
5. Design Calculations: Calculations shall include analysis data for selecting hangers and supports.

D. Welding certificates.

E. Field quality-control reports.

1.07 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel," for hangers and supports.
2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum," for aluminum supports.
3. AWS D9.1M/D9.1, "Sheet Metal Welding Code," for duct joint and seam welding.

PART 2: PRODUCTS

2.01 SINGLE-WALL RECTANGULAR DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.

B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-1, "Rectangular Duct/Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Duct/Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

D. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.02 SINGLE-WALL ROUND DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Lindab Inc.
   b. McGill AirFlow LLC.
   c. SEMCO Incorporated
   d. Sheet Metal Connectors, Inc.
   e. Spiral Manufacturing Co., Inc.
   f. Approved equal.

B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Round Duct Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

1. Transverse Joints in Ducts Larger Than 60 Inches in Diameter: Flanged.

C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Round Duct Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

1. Fabricate round ducts larger than 90 inches in diameter with butt-welded longitudinal seams.
2. Fabricate flat-oval ducts larger than 72 inches in width (major dimension) with butt-welded longitudinal seams.

D. Tees and Laterals: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.03 SHEET METAL MATERIALS

A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

B. Galvanized Sheet Steel: Comply with ASTM A653/A653M-20.

1. Galvanized Coating Designation: G90 (Z275).
2. Finishes for Surfaces Exposed to View: Mill phosphatized.

C. Aluminum Sheets: Comply with ASTM B209/B209M-21a Alloy 3003, H14 temper; with mill finish for concealed ducts, and standard, one-side bright finish for duct surfaces exposed to view.

D. Reinforcement Shapes and Plates: ASTM A36/A36M-19, steel plates, shapes, and bars; black and galvanized.

1. Where black- and galvanized-steel shapes and plates are used to reinforce aluminum ducts, isolate the different metals with butyl rubber, neoprene, or EPDM gasket materials.

E. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

1. Secure transversely oriented liner edges facing the airstream with metal nosings that have either channel or "Z" profiles or are integrally formed from duct wall. Fabricate edge facings at the following locations:
   a. Fan discharges.
   b. Intervals of lined duct preceding unlined duct.
   c. Upstream edges of transverse joints in ducts where air velocities are higher than 2500 fpm or where indicated.

2. Terminate inner ducts with buildouts attached to fire-damper sleeves, dampers, turning vane assemblies, or other devices. Fabricated buildouts (metal hat sections) or other buildout means are optional; when used, secure buildouts to duct walls with bolts, screws, rivets, or welds.

2.04 SEALANT AND GASKETS

A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.

B. Two-Part Tape Sealing System:

1. Tape: Woven cotton fiber impregnated with mineral gypsum and modified acrylic/silicone activator to react exothermically with tape to form hard, durable, airtight seal.
2. Tape Width: 6 inches.
3. Sealant: Modified styrene acrylic.
4. Water resistant.
5. Mold and mildew resistant.

6. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
7. Service: Indoor and outdoor.
8. Service Temperature: Minus 40 to plus 200 deg F (Minus 40 to plus 93 deg C).
9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum.
10. For indoor applications, sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

C. Water-Based Joint and Seam Sealant:

1. Application Method: Brush on.
2. Solids Content: Minimum 65 percent.
3. Shore A Hardness: Minimum 20.
4. Water resistant.
5. Mold and mildew resistant.
6. VOC: Maximum 75 g/L (less water).
7. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
8. Service: Indoor or outdoor.
9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.

D. Flanged Joint Sealant: Comply with ASTM C 920.

1. General: Single-component, acid-curing, silicone, elastomeric.
2. Type: S
3. Grade: NS
4. Class: 25
5. Use: O
6. For indoor applications, sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

E. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.

F. Round Duct Joint O-Ring Seals:

1. Seals shall provide maximum leakage class of 3 cfm/100 sq. ft. at 1-inch wg and shall be rated for 10-inch wg static-pressure class, positive or negative.
2. EPDM O-ring to seal in concave bead in coupling or fitting spigot.
3. Double-lipped, EPDM O-ring seal, mechanically fastened to factory-fabricated couplings and fitting spigots.

2.05 HANGERS AND SUPPORTS

A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.

B. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.

C. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards – Metal and Flexible," Table 5-1 (Table 5-1M), "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct."

D. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A603-19.

E. Steel Cable End Connections: Cadmium-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.

F. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

G. Trapeze and Riser Supports:

1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.
2. Supports for Aluminum Ducts: Aluminum or galvanized steel coated with zinc chromate.

PART 3 – EXECUTION

3.01 DUCT INSTALLATION - GENERAL

A. Develop drawing plans, schematics, and diagrams that indicate general location and arrangement of duct system. Indicate duct locations, configurations, and arrangements used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and Coordination Drawings.

B. Install ducts according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.

C. Install round ducts in maximum practical lengths.

D. Install ducts with fewest possible joints.

E. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.

F. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.

G. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.

H. Install ducts with a clearance of 1 inch.

I. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.

J. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of the same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches.

K. Where ducts pass through fire-rated interior partitions and exterior walls, install fire dampers. Comply with requirements in Section 23 33 00 "Air Duct Accessories" for fire and smoke dampers.

L. Protect duct interiors from moisture, construction debris and dust, and other foreign materials.

3.02 INSTALLATION OF EXPOSED DUCTWORK

A. Protect ducts exposed in finished spaces from being dented, scratched, or damaged.

B. Trim duct sealants flush with metal. Create a smooth and uniform exposed bead. Do not use a two-part tape sealing system.

C. Grind welds to provide smooth surface free of burrs, sharp edges, and weld-splatter. When welding stainless steel with a No. 3 or 4 finish, grind the welds flush, polish the exposed welds, and treat the welds to remove discoloration caused by welding.

D. Maintain consistency, symmetry, and uniformity in the arrangement and fabrication of fittings, hangers and supports, duct accessories, and air outlets.

E. Repair or replace damaged sections and finished work that does not comply with these requirements.

3.03 DUCT SEALING

A. Seal ducts for duct static-pressure, seal classes, and leakage classes specified in "Duct Schedule" Article according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

B. Seal ducts to the following seal classes according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

1. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
2. Exhaust Ducts: Seal Class C.

3.04 HANGER AND SUPPORT INSTALLATION

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 5, "Hangers and Supports."

B. Fastener Systems: Refer to Section 23 22 00 “Hanger Support Anchors” for fastener systems installation guidelines.

C. Hanger Spacing: As indicated in drawings. If not indicated, comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1 (Table 5-1M), "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches of each elbow and within 48 inches of each branch intersection.

D. Hangers Exposed to View: Threaded rod and angle or channel supports.

E. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.05 CONNECTIONS

A. Make connections to equipment with flexible connectors complying with Section 23 33 00 "Air Duct Accessories."

B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.06 DUCT CLEANING

A. Clean duct system(s) before testing, adjusting, and balancing.

B. Use service openings for entry and inspection.

1. Create new openings and install access panels appropriate for duct static-pressure class if required for cleaning access. Comply with Section 23 33 00 "Air Duct Accessories" for access panels and doors.

C. Clean the following components by removing surface contaminants and deposits:

1. Air outlets and inlets (registers, grilles, and diffusers).
2. Exhaust fans including fan housings, plenums, scrolls, blades or vanes, shafts, baffles, dampers, and drive assemblies.
3. Dedicated exhaust and ventilation components.

D. Mechanical Cleaning Methodology:

1. Clean metal duct systems using mechanical cleaning methods that extract contaminants from within duct systems and remove contaminants from building.

2. Use vacuum-collection devices that are operated continuously during cleaning. Connect vacuum device to downstream end of duct sections so areas being cleaned are under negative pressure.
3. Use mechanical agitation to dislodge debris adhered to interior duct surfaces without damaging integrity of metal ducts, duct liner, or duct accessories.
4. Provide drainage and cleanup for wash-down procedures.
5. Antimicrobial Agents and Coatings: Apply EPA-registered antimicrobial agents if fungus is present. Apply antimicrobial agents according to manufacturer's written instructions after removal of surface deposits and debris.

3.07 FIELD QUALITY CONTROL

A. Perform tests and inspections. The Contractor is responsible for testing and inspection of the duct system.

B. Leakage Tests:

1. Comply with SMACNA's "HVAC Air Duct Leakage Test Manual." Submit a test report for each test.
2. All exhaust ducts should be tested. Test representative duct sections totaling no less than 100 percent of total installed duct area.
3. Disassemble, reassemble, and seal segments of systems to accommodate leakage testing and for compliance with test requirements.
4. Conduct tests at static pressures equal to maximum design pressure of system or section being tested. If static-pressure classes are not indicated, test system at maximum system design pressure. Do not pressurize systems above maximum design operating pressure.
5. Give seven days' advance notice for testing.

C. Duct System Cleanliness Tests:

1. Visually inspect the duct system to ensure that no visible contaminants are present.

D. The duct system will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

3.08 DUCT SCHEDULE

A. Fabricate ducts with galvanized sheet steel except as otherwise indicated.

B. Exhaust Ducts:

1. Ducts Connected to Fans Exhausting (ASHRAE 62.1, Class 1 and 2) Air:
   a. Pressure Class: Negative 3-inch wg (750 Pa).
   b. Minimum SMACNA Seal Class: B or C if negative pressure, and A if positive pressure.

c. SMACNA Leakage Class for Rectangular: 12.
d. SMACNA Leakage Class for Round and Flat Oval: 6.

C. Elbow Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards – Metal and Flexible," Figure 4-2, "Rectangular Elbows."
   a. Velocity 1000 fpm (5 m/s) or Lower:
      1) Radius Type RE 1 with a minimum 0.5 radius-to-diameter ratio.
      2) Mitered Type RE 4 without vanes.

   b. Velocity 1000 to 1500 fpm (5 to 7.6 m/s):
      1) Radius Type RE 1 with a minimum 1.0 radius-to-diameter ratio.
      2) Radius Type RE 3 with a minimum 0.5 radius-to-diameter ratio and two vanes.
      3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."

   c. Velocity 1500 fpm (7.6 m/s) or Higher:
      1) Radius Type RE 1 with a minimum 1.5 radius-to-diameter ratio.
      2) Radius Type RE 3 with a minimum 1.0 radius-to-diameter ratio and two vanes.
      3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."

2. Round Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "Round Duct Elbows."
   a. Minimum Radius-to-Diameter Ratio and Elbow Segments: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 3-1, "Mitered Elbows." Elbows with less than 90-degree change of direction have proportionately fewer segments.
      1) Velocity 1000 fpm or Lower: 0.5 radius-to-diameter ratio and three segments for 90-degree elbow.
      2) Velocity 1000 to 1500 fpm: 1.0 radius-to-diameter ratio and four segments for 90-degree elbow.
      3) Velocity 1500 fpm or Higher: 1.5 radius-to-diameter ratio and five segments for 90-degree elbow.
      4) Radius-to Diameter Ratio: 1.5.

   b. Round Elbows, 12 Inches and Smaller in Diameter: Stamped or pleated.

   c. Round Elbows, 14 Inches and Larger in Diameter: Welded.

END OF SECTION 23 31 13

SECTION 23 33 00

AIR DUCT ACCESSORIES

PART 1: GENERAL

1.01 SCOPE

A. The contractor will design and install ventilation system ductwork, dampers, and accessories to maintain the temperature in the Ross Substation area as indicated on drawings.

1.02 RELATED DOCUMENTS

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

1.03 SUMMARY

A. Section includes:

1. Fire dampers.
2. Smoke dampers.
3. Combination fire/smoke dampers.
4. Flange connectors.
5. Turning vanes.
6. Remote damper operators.
7. Duct mounted access doors.
8. Flexible Connectors.
9. Duct accessory hardware.

B. Related Sections:

1. Section 23 31 13 "Metal Ducts" for ductwork materials and fittings for rectangular ducts, round ducts, hangers and supports.

1.04 REFERENCES

A. Refer to the following:

1. ASTM – American Society for Testing and Materials
2. AMCA – Air Movement and Control Association
3. NEMA – National Electrical Manufacturers Association
4. NFPA – National Fire Protection Association
5. SMACNA – Sheet Metal and Air Conditioning Contractors National Association

1.05 SUBMITTALS

A. Product Data: For each type of product.

1. For duct silencers, include pressure drop and dynamic insertion loss data. Include breakout noise calculations for high transmission loss casings.
2. Shop Drawings: For duct accessories. Include plans, elevations, sections, details and attachments to other work.
3. Detail duct accessories fabrication and installation in ducts and other construction. Include dimensions, weights, loads, and required clearances, and method of field assembly into duct systems and other construction. Include the following:
   a. Special fittings.
   b. Combination fire/smoke-damper installations, including sleeves; and duct-mounted access doors and remote damper operators.
   c. Duct security bars.

B. Source quality-control reports.

C. CLOSEOUT SUBMITTALS: Operation and Maintenance Data for air duct accessories to include in operation and maintenance manuals.

1.06 QUALITY ASSURANCE

A. Comply with NFPA 80, “Standard for Fire Doors and Other Opening Protectives,” NFPA 90A, "Standard for the Installation of Air Conditioning and Ventilating Systems," and with NFPA 90B, "Standard for the Installation of Warm Air Heating and Air Conditioning Systems."

B. Comply with AMCA 500-D testing for damper rating.

1.07 MAINTENANCE MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Fusible Links: Furnish quantity equal to 10 percent of amount installed.

PART 2: PRODUCTS

2.01 MATERIALS

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections."

B. Galvanized Sheet Steel: Comply with ASTM A653/A653M-20.

1. Galvanized Coating Designation: G90 (Z275).
2. Exposed-Surface Finish: Mill phosphatized.

C. Aluminum Sheets: Comply with ASTM B209/B209M-21a, Alloy 3003, Temper H14; with mill finish for concealed ducts and standard, 1-side bright finish for exposed ducts.

D. Extruded Aluminum: Comply with ASTM B221-12, Alloy 6063, Temper T6.

E. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.

F. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.02 CONTROL DAMPERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Air Balance Inc.; a division of Mestek, Inc.
2. American Warming and Ventilating; a division of Mestek, Inc.
3. Flexmaster U.S.A., Inc.
4. Greenheck Fan Corporation
5. McGill AirFlow LLC.
6. METALAIRE, Inc.
7. Nailor Industries Inc.
8. Pottorff; a division of PCI Industries, Inc.
9. Ruskin Company
10. Trox USA Inc.
11. Vent Products Company, Inc.

B. Low-leakage rating, with linkage outside airstream, and bearing AMCA's Certified Ratings Seal for both air performance and air leakage.

C. Frames:

1. Angle shaped.
2. 0.094-inch-0.05-inch-thick stainless steel.
3. Mitered and welded corners.

D. Blades:

1. Multiple blade with maximum blade width of 6 inches.
2. Opposed-blade design.
3. Stainless steel.

4. 0.0747-inch-thick dual skin.
5. Blade Edging: Closed-cell neoprene.

E. Blade Axles: 1/2-inch-diameter; stainless steel; blade-linkage hardware of zinc-plated steel and brass; ends sealed against blade bearings.

1. Operating Temperature Range: From minus 40 to plus 200 deg F (minus 40 to plus 93 deg C).

F. Bearings:

1. Oil-impregnated stainless-steel sleeve.
2. Dampers in ducts with pressure classes of 3-inch wg or less shall have axles the full length of damper blades and bearings at both ends of operating shaft.
3. Thrust bearings at each end of every blade.

2.03 COMBINATION FIRE AND SMOKE DAMPERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Air Balance Inc.; a division of Mestek, Inc.
2. Arrow United Industries; a division of Mestek, Inc.
3. Cesco Products; a division of Mestek, Inc.
4. Greenheck Fan Corporation
5. McGill AirFlow LLC.
6. METALAIRE, Inc.
7. Nailor Industries Inc.
8. NCA Manufacturing, Inc.
9. PHL, Inc.
10. Pottorff; a division of PCI Industries, Inc.
11. Prefco; Perfect Air Control, Inc.
12. Ruskin Company
13. Vent Products Company, Inc.
14. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

B. Type: Dynamic; rated and labeled according to UL 555 and UL 555S by an NRTL.

C. Closing rating in ducts up to 4-inch wg static pressure class and minimum 2000-fpm velocity.

D. Fire Rating: 1-1/2 and 3 hours.

E. Frame: Hat-shaped, 0.094-inch-thick, galvanized sheet steel, with welded corners and mounting flange.

F. Heat-Responsive Device: Electric resettable device and switch package, factory installed, rated.

G. Smoke Detector: Integral, factory wired for single-point connection.

H. Blades: Roll-formed, horizontal, interlocking 0.063-inch-thick, galvanized sheet steel.

I. Leakage: Class I.

J. Rated pressure and velocity to exceed design airflow conditions.

K. Mounting Sleeve: Factory-installed,0.05-inch-thick, galvanized sheet steel; length to suit wall or floor application with factory-furnished silicone calking.

L. Damper Motors: Modulating action.

M. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Section 23 05 13 "Common Motor Requirements for HVAC Equipment."

1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so that the driven load will not require motor to operate in service factor range above 1.0.
2. Permanent-Split-Capacitor or Shaded-Pole Motors: With oil-immersed and sealed gear trains.
3. Spring-Return Motors: Equip with an integral spiral-spring mechanism where indicated. Enclose entire spring mechanism in a removable housing designed for service or adjustments. Size for running torque rating of 150 in. x lbf and breakaway torque rating of 150 in. x lbf.
4. Outdoor Motors and Motors in Outdoor-Air Intakes: Equip with O-ring gaskets designed to make motors weatherproof. Equip motors with internal heaters to permit normal operation at minus 40 deg F (minus 40 deg C).
5. Nonspring-Return Motors: For dampers larger than 25 sq. ft., size motor for running torque rating of 150 in. x lbf and breakaway torque rating of 300 in. x lbf.
6. Electrical Connection: 115 V, single phase, 60 Hz.

N. Accessories:

1. Auxiliary switches for signaling fan control or position indication.
2. Momentary test switch remote mounted.

O. Screen: Include external screen on wall openings with combination fire and smoke dampers where indicated on drawings.

1. Material: Galvanized-Steel, 1/2-inch mesh, 0.047-inch wire, mill finish.
2. Frame: Removable.

2.04 FLANGE CONNECTORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Ductmate Industries, Inc.
2. Nexus PDQ; Division of Shilco Holdings Inc.
3. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

B. Description: Roll-formed, factory-fabricated, slide-on transverse flange connectors, gaskets, and components.

C. Material: Galvanized steel.

D. Gage and Shape: Match connecting ductwork.

2.05 TURNING VANES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Ductmate
2. Metalair
3. Approved equal.

B. Manufactured Turning Vanes for Metal Ducts: Curved blades of galvanized sheet steel; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.

1. Acoustic Turning Vanes: Fabricate airfoil-shaped aluminum extrusions with perforated faces and fibrous-glass fill.

C. General Requirements: Comply with SMACNA's "HVAC Duct Construction Standards – Metal and Flexible"; Figures 4-3, "Vanes and Vane Runners," and 4-4, "Vane Support in Elbows."

D. Vane Construction: Single wall for ducts up to 48 inches wide and double wall for larger dimensions.

2.06 REMOTE DAMPER OPERATORS

A. Description: Cable system designed for remote manual damper adjustment.

B. Tubing: Brass.

C. Cable: Stainless steel.

D. Wall-Box Mounting: Surface.

E. Wall-Box Cover-Plate Material: Steel Stainless steel.

2.07 DUCT-MOUNTED ACCESS DOORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. American Warming and Ventilating; a division of Mestek, Inc.
2. Cesco Products; a division of Mestek, Inc.
3. Ductmate Industries, Inc.
4. Flexmaster U.S.A., Inc.
5. Greenheck Fan Corporation
6. McGill AirFlow LLC.
7. Nailor Industries Inc.
8. Pottorff; a division of PCI Industries, Inc.
9. Ventfabrics, Inc.
10. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

B. Duct-Mounted Access Doors: Fabricate access panels according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 7-2 (7-2M), "Duct Access Doors and Panels," and 7-3, "Access Doors - Round Duct."

1. Door:
   a. Double wall, rectangular.
   b. Galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class.
   c. Vision panel.
   d. Hinges and Latches: 1-by-1-inch butt or piano hinge and cam latches.
   e. Fabricate doors airtight and suitable for duct pressure class.
2. Frame: Galvanized sheet steel, with bend-over tabs and foam gaskets.
3. Number of Hinges and Locks:
   a. Access Doors Less Than 12 Inches Square: No hinges and two sash locks.
   b. Access Doors up to 18 Inches Square: Two hinges and two sash locks.
   c. Access Doors up to 24 by 48 Inches: Three hinges and two compression latches with outside and inside handles.
   d. Access Doors Larger Than 24 by 48 Inches: Four hinges and two compression latches with outside and inside handles.

C. Pressure Relief Access Door:

1. Door and Frame Material: Galvanized sheet steel.
2. Door: Single wall with metal thickness applicable for duct pressure class.
3. Operation: Open outward for positive-pressure ducts and inward for negative-pressure ducts.
4. Factory set at 10-inch wg.
5. Doors close when pressures are within set-point range.
6. Hinge: Continuous piano.
7. Latches: Cam.
8. Seal: Neoprene or foam rubber.
9. Insulation Fill: 1-inch-thick, fibrous-glass or polystyrene-foam board.

2.08 DUCT ACCESS PANEL ASSEMBLIES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Ductmate Industries, Inc.
2. Flame Gard, Inc.
3. 3M
4. Approved equal.

B. Labeled according to UL 1978 by an NRTL.

C. Panel and Frame: Minimum thickness 0.0528-inch carbon steel.

D. Fasteners: Carbon steel. Panel fasteners shall not penetrate the duct wall.

E. Gasket: Comply with NFPA 96; grease-tight, high-temperature ceramic fiber, rated for a minimum of 2000 deg F (1093 deg C).

F. Minimum Pressure Rating: 10-inch wg, positive or negative.

2.09 FLEXIBLE CONNECTORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Ductmate Industries, Inc.
2. Duro Dyne Inc.
3. Ventfabrics, Inc.
4. Ward Industries, Inc.; a division of Hart & Cooley, Inc.
5. Approved equal.

B. Materials: Flame-retardant or noncombustible fabrics.

C. Coatings and Adhesives: Comply with UL 181, Class 1.

D. Metal-Edged Connectors: Factory fabricated with a fabric strip 5-3/4 inches wide attached to two strips of 2-3/4-inch-wide, 0.028-inch-thick, galvanized sheet steel or 0.032-inch-thick aluminum sheets. Provide metal compatible with connected ducts.

E. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.

1. Minimum Weight: 26 oz./sq. yd.
2. Tensile Strength: 480 lbf/inch in the warp and 360 lbf/inch in the filling.
3. Service Temperature: Minus 40 to plus 200 deg F (Minus 40 to plus 93 deg C).

2.10 DUCT ACCESSORY HARDWARE

A. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments and of length to suit duct-insulation thickness.

B. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

PART 3 – EXECUTION

3.01 INSTALLATION - GENERAL

A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal.

B. Install duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel and aluminum accessories in aluminum ducts.

C. Set dampers to fully open position before testing, adjusting, and balancing.

D. Install test holes at fan inlets and outlets and elsewhere as indicated.

E. Install fire and smoke dampers according to UL listing.

F. Connect ducts to duct silencers rigidly.

G. Install duct access doors on sides of ducts to allow for inspecting, adjusting, and maintaining accessories and equipment at the following locations:

1. On both sides of duct coils.
2. Upstream from duct filters.
3. At drain pans and seals.
4. Downstream from control dampers and equipment.
5. Adjacent to and close enough to fire or smoke dampers, to reset or reinstall fusible links. Access doors for access to fire or smoke dampers having fusible links shall be pressure relief access doors and shall be outward operation for access doors installed upstream from dampers and inward operation for access doors installed downstream from dampers.
6. At each change in direction and at maximum 50-foot spacing.
7. Upstream and downstream from turning vanes.
8. Upstream or downstream from duct silencers.
9. Control devices requiring inspection.
10. Elsewhere as indicated.

H. Install access doors with swing against duct static pressure.

I. Access Door Sizes:

1. One-Hand or Inspection Access: 8 by 5 inches.
2. Two-Hand Access: 12 by 6 inches.
3. Head and Hand Access: 18 by 10 inches.
4. Head and Shoulders Access: 21 by 14 inches.
5. Body Access: 25 by 14 inches.
6. Body plus Ladder Access: 25 by 17 inches.

J. Label access doors to indicate the purpose of access door.

K. Install flexible connectors to connect ducts to equipment.

L. For fans developing static pressures of 5-inch wg and more, cover flexible connectors with loaded vinyl sheet held in place with metal straps.

M. Install duct test holes where required for testing and balancing purposes.

N. Install thrust limits at centerline of thrust, symmetrical on both sides of equipment. Attach thrust limits at centerline of thrust and adjust to a maximum of 1/4-inch movement during start and stop of fans.

3.02 INSTALLATION OF EXPOSED DUCTWORK

A. Protect ducts exposed in finished spaces from being dented, scratched, or damaged.

B. Trim duct sealants flush with metal. Create a smooth and uniform exposed bead. Do not use two-part tape sealing system.

C. Grind welds to provide a smooth surface free of burrs, sharp edges, and weld splatter.

D. Maintain consistency, symmetry, and uniformity in the arrangement and fabrication of fittings, hangers and supports, duct accessories, and air outlets.

E. Repair or replace damaged sections and finished work that does not comply with these requirements.

3.03 DUCT SEALING

A. Seal ducts for duct static-pressure, seal classes, and leakage classes specified in "Duct Schedule" Article according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

B. Seal ducts to the following seal classes according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible".

1. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
2. Exhaust Ducts: Seal Class C.

3.04 HANGER AND SUPPORT INSTALLATION

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 5, "Hangers and Supports."

B. Fastener Systems: Refer to Section 03 22 00 “Hanger Support Anchors” for fastener systems installation guidelines.

C. Hanger Spacing: As indicated in drawings. If not indicated, comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1 (Table 5-1M), "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches of each elbow and within 48 inches of each branch intersection.

D. Hangers Exposed to View: Threaded rod and angle or channel supports.

E. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.05 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Operate dampers to verify the full range of movement.
2. Inspect locations of access doors and verify that the purpose of access door can be performed.
3. Operate fire, smoke, and combination fire and smoke dampers to verify full range of movement and verify that proper heat-response device is installed.
4. Inspect turning vanes for proper and secure installation.
5. Operate remote damper operators to verify the full range of movement of operator and damper.

END OF SECTION 23 33 00

SECTION 23 34 13

AXIAL HVAC FANS

PART 1: GENERAL

1.01 SCOPE

A. The Contractor will design and install a ventilation system fan to maintain air flow through the Ross Substation area as indicated on drawings.

1.02 RELATED DOCUMENTS

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

1.03 SUMMARY

A. Section includes the following fan types:

1. Mixed-flow Axial Fans.

B. Related Sections:

1. Section 05 05 20 “Hanger Support Anchors.”
2. Section 05 05 29 “Unistrut Support Systems.”
3. Section 23 05 13 “Common Motor Requirements for HVAC Equipment.”
4. Section 23 33 00 "Air Duct Accessories" for flexible connectors.

1.04 REFERENCES

A. Refer to the following:

1. AMCA – Air Movement and Control Association International
2. ASHRAE – American Society of Heating, Refrigerating, and Air-Conditioning Engineers
3. NFPA – National Fire Protection Association

1.05 PERFORMANCE REQUIREMENTS

A. AMCA Compliance:

1. Comply with AMCA performance requirements and bear the AMCA-Certified Ratings Seal.
2. Operating Limits: Classify according to AMCA 99.

B. UL Listing
   1. UL 705 Power Ventilator for Smoke Control Systems.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70 and 92, by a qualified testing agency, and marked for intended location and application.

   1. Motor Enclosure: Severe duty

1.06 SUBMITTALS

A. Product Data:

   1. Include rated capacities, furnished specialties, and accessories.
   2. Certified fan performance curves with system operating conditions indicated.
   3. Certified fan sound-power ratings.
   4. Motor ratings and electrical characteristics, plus motor and electrical accessories.
   5. Material thickness and finishes, including color charts.
   6. Dampers, including housings, linkages, and operators.
   7. Fan speed controllers.

B. Shop Drawings:

   1. Include plans, elevations, sections, and attachment details.
   2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
   3. Include diagrams for power, signal, and control wiring.
   4. Design Calculations: Calculate requirements for selecting vibration isolators and seismic restraints and for designing vibration isolation bases.
   5. Vibration Isolation Base Details: Detail fabrication, including anchorages and attachments to structure and to supported equipment. Include auxiliary motor slides and rails, and base weights.
   6. Equipment installation based on equipment being used on Project.
   7. Hangers and supports, including methods for fan and building attachment and vibration isolation.

C. Coordination Drawings:

   1. Show fan layout and relationships between components and adjacent structural and mechanical elements.
   2. Show hanger and support locations, type of support, weight on each support and vibration isolation.
   3. Indicate and certify field measurements.

D. Field quality-control reports.

E. Close-out Submittals:

1. Operation and Maintenance Data: For axial fans to include in emergency, operation, and maintenance manuals.
2. Maintenance Material: One set of belts for each belt-driven unit.

PART 2: PRODUCTS

2.01 MIXED-FLOW FANS

A. Manufacturers: Cook, Greenheck, Howden

1. Acme Engineering & Manufacturing Corporation
2. American Coolair Corporation
3. Carnes Company
4. Greenheck Fan Corporation
5. Hartzell Fan Incorporated
6. Howden American Fan Company
7. Loren Cook Company
8. PennBarry
9. Twin City Fan & Blower

B. Description: Fan wheel and housing, factory-mounted motor with belt drive or direct drive, and accessories.

C. Housings: Steel

1. Inlet and Outlet Connections: Outer mounting frame and companion flanges.
2. Guide Vane Section: Integral guide vanes downstream from fan wheel designed to straighten airflow.
3. Mixed-Flow Outlet Connection: One flanged discharge perpendicular to fan inlet.

D. Wheel Assemblies: Cast aluminum with airfoil-shaped blades mounted on cast-iron wheel plate keyed to shaft with solid-steel key.

E. Belt Drives: Factory mounted, with final alignment and belt adjustment made after installation.

1. Provide additional belts on life safety fans whereby failure of one belt will not reduce air flow.
2. Service Factor Based on Fan Motor Size: 1.5
3. Fan Shaft: Turned, ground, and polished steel designed to operate at no more than 70 percent of first critical speed at top of fan's speed range.
4. Fan Pulleys: Cast iron with split, tapered bushing; dynamically balanced at factory.
5. Bearings:
   a. Ball-Bearing Rating Life: ABMA 9, L10 of 100,000 hours.
   b. Roller-Bearing Rating Life: ABMA 11, L10 of 100,000 hours.
   c. Extend lubrication lines to outside of casing and terminate with grease fittings.

F. Accessories:

1. Mounting Clips: Horizontal ceiling clips welded to fan housing, of same material as housing.
2. Backdraft Dampers: Butterfly style, for mounting with flexible connection to the discharge of fan or direct mounted to the discharge diffuser section, of same material as housing.
3. Motor Cover: Cover with side vents to dissipate motor heat, of same material as housing.
4. Inlet Cones: Round-to-round transition, of same material as housing.
5. Outlet Cones: Round-to-round transition, of same material as housing.
6. Direct-Driven Units: Encase motor in housing outside of airstream, factory wired to disconnect switch located on outside of fan housing. Extend lubrication lines to outside of casing and terminate with grease fittings.
7. Thrust Restraints:
   a. Horizontal thrust restraint shall consist of a spring element in series with a neoprene molded cup with the same deflection as specified for the mountings or hangers.
   b. The spring element shall be designed so it can be preset for thrust at the factory and adjusted in the field to allow for a maximum of 1/4” (6mm) movement at start and stop.
   c. The assembly shall be furnished with 1 rod and angle brackets for attachment to both the equipment and the ductwork or the equipment and the structure.
   d. Horizontal restraints shall be attached at the centerline of thrust and symmetrical on either side of the unit.

G. Factory Finishes:

1. Sheet Metal Parts: Prime coat before final assembly.
2. Exterior Surfaces: Baked-enamel finish coat after assembly.
3. Coatings: Hot-dip galvanized.
   a. Apply to finished housings.
   b. Apply to fan wheels.

2.02 MOTORS

A. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency for motors specified in Section 23 05 13 "Common Motor Requirements for HVAC Equipment."

1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.

2.03 SOURCE QUALITY CONTROL

A. Sound-Power Level Ratings: Comply with AMCA 301, "Methods for Calculating Fan Sound Ratings from Laboratory Test Data." Factory test fans according to AMCA 300, "Reverberant Room Method for Sound Testing of Fans." Label fans with the AMCA-Certified Ratings Seal.

B. Fan Performance Ratings: Establish flow rate, pressure, power, air density, speed of rotation, and efficiency by factory tests and ratings according to AMCA 210/ASHRAE 51, "Laboratory Methods of Testing Fans for Certified Aerodynamic Performance Rating."

PART 3: EXECUTION

3.01 INSTALLATION

A. Install axial fans level and plumb.

B. Disassemble and reassemble units, as required for moving to the final location, according to manufacturer's written instructions.

C. Lift and support units with manufacturer's designated lifting or supporting points.

D. Equipment Mounting:

1. Where axial fan is hung with eccentric motor position, the fan shall be anchored to isolation rails. Refer to drawings for typical details.
2. Refer to drawings for thrust restraint requirements.
3. Refer to drawings for isolation hanger requirements.
4. Comply with requirements in Section 233300 "Air Duct Accessories" for flexible duct connectors.

E. Install units with clearances for service and maintenance.

3.02 ISOLATING SPRING HANGERS

A. Provide vibration hangers with a combination of steel coil-spring and 0.3" deflection neoprene insert in series; spring and insert in compression.

1. Manufacturer: Mason Industries, Kinetics Noise Control, Korfund.
2. Frame: Steel, fabricated for connection to threaded hanger rods and to allow for a maximum of 30 degrees of angular hanger-rod misalignment without binding or reducing isolation efficiency.
3. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
4. Minimum Additional Travel: 50 percent of the required deflection at rated load.
5. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
6. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

7. Elastomeric Element: Molded, oil-resistant rubber or neoprene. Steel-washer-reinforced cup to support spring and bushing projecting through bottom of frame.
8. Adjustable Vertical Stop: Steel washer with neoprene washer "up-stop" on lower threaded rod.
9. Self-centering hanger rod cap to ensure concentricity between hanger rod and support spring coil.

3.03 DUCT CONNECTIONS

A. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors. Flexible connectors are specified in Section 233300 "Air Duct Accessories."

3.04 FIELD QUALITY CONTROL

A. Perform the following tests and inspections with the assistance of a factory-authorized service representative:

1. Verify that shipping, blocking, and bracing are removed.
2. Verify that unit is secure on mountings and supporting devices and that connections to ducts and electrical components are complete. Verify that proper thermal-overload protection is installed in motors, starters, and disconnect switches.
3. Verify that cleaning and adjusting are complete.
4. Disconnect fan drive from motor, verify proper motor rotation direction, and verify fan wheel free rotation and smooth bearing operation. Reconnect fan drive system, align and adjust belts, and install belt guards.
5. Adjust belt tension.
6. Verify lubrication for bearings and other moving parts.
7. Verify that manual and automatic volume control and fire and smoke dampers in connected ductwork systems are in fully open position.
8. Disable automatic temperature-control operators, energize motor and confirm proper motor rotation and unit operation, adjust fan to indicated rpm, and measure and record motor voltage and amperage.
9. Shut unit down and reconnect automatic temperature-control operators.
10. Remove and replace malfunctioning units and retest as specified above.
11. When fans are noisy or cause vibration to ducts, verify that fan is balanced.

B. Test and adjust controls and safeties. Controls and equipment will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

3.05 ADJUSTING

A. Adjust belt tension.

B. Replace fan and motor pulleys as required to achieve design airflow.

C. Lubricate bearings.

END OF SECTION 23 34 13