

SDSTA Access Control
Critical Surface Locations
Phase 1
Lead, South Dakota

WPE # BR21016

September 17, 2021

SPECIFICATIONS

FOR

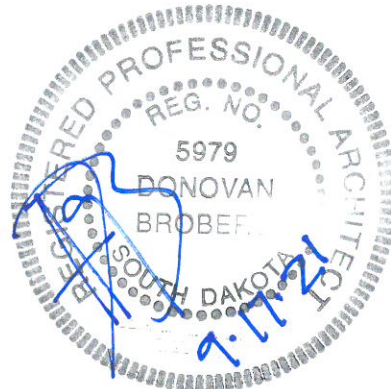
SDSTA Access Control
Critical Surface Locations
Phase 1

WPE # BR21016

Michael R. Sigman, P.E.
Electrical Engineer



Donovan Broberg, Architect



SDSTA DIVISION ONE SPECIFICATION

TABLE OF CONTENTS

SUMMARY OF WORK	2
ADMINISTRATIVE REQUIREMENTS	4
PROJECT CONSTRUCTION PROGRESS SCHEDULES	6
SUBMITTAL PROCEDURES	8
QUALITY CONTROL FOR CONSTRUCTION	13
TEMPORARY CONSTRUCTION FACILITIES AND CONTROLS	18
CLOSEOUT SUBMITTALS	22
OPERATION AND MAINTENANCE DATA	24

SUMMARY OF WORK**Part 1 General****1.1 WORK COVERED BY CONTRACT DOCUMENTS****1.1.1 Project Description**

The work includes the following items:

- Removal of existing door hardware and installation of new door hardware at defined critical surface locations on the SDSTA property.
 - 25 doors
 - 5 overhead doors
 - 2 vehicle gates
 - 2 walk gates
- Installation of power and cable networking to specified door and gate locations.
- Installation of C-CURE 9000 access control system.
- All materials/supplies and all incidental related work.

1.1.2 Location

The work is located at the Sanford Underground Research Facility. Specifically, the critical surface access control locations in this phase are located at the Yates Administration Building, Yates Education and Outreach Building, Rounds Operations Center, Ross gate, and Yates main gate.

1.2 OCCUPANCY OF PREMISES

Building/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, coordinate with the Project Manager to arrange 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.

1.4 LOCATION OF EXISTING UTILITIES

Obtain digging permits prior to start of excavation and comply with facility requirements for locating and marking underground utilities. Contact local utility locating service a minimum of 72 hours prior to excavating, to mark utilities, and within sufficient time required if

work occurs on a Monday or after a holiday. Verify existing utility locations indicated on contract drawings, within area of work.

1.4.1 Notification Prior to Excavation

Notify the Project Manager at least 5 days prior to starting excavation work.

--- End of Section ---

ADMINISTRATIVE REQUIREMENTS**Part 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 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 job-site 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 status 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 insure 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 CONFERENCE

After award of the contract but prior to commencement of any work at the site, 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 prosecution of the work. Major subcontractors who will engage in the work must also attend.

--- End of Section ---

PROJECT CONSTRUCTION PROGRESS SCHEDULES**Part 1 General****1.1 SUBMITTALS**

Construction Schedule

Monthly Schedule Updates

1.2 ACCEPTANCE

Prior to the start of work, prepare and submit a construction schedule in the form of a bar chart schedule to the Project Manager for acceptance

The acceptance of a baseline construction schedule is a condition precedent to:

- a. Starting work on the demolition or construction stage(s) of the contract.
- b. Processing Contractor's invoice(s) for construction activities.
- c. 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 a bar chart schedule and updates in hard copy and 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:

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

(b) Inexcusable Delay: Contractor Responsibility - Contractor will not receive time extension.

(c) 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 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 schedules, separate from the construction schedule on an electronic spreadsheet program and printed on (8-1/2 by 11 inch) sheets as directed by the Project Manager. In addition to schedule discussions, the Weekly Status Meeting should discuss status of submittal reviews and approvals, Requests for Information (RFIs), outstanding change orders, and other relevant project coordination issues.

--- End of Section ---

SUBMITTAL PROCEDURES**01 33 00****Part 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 spec sections and drawings.

Preconstruction Submittals

Submittals which are required prior to start of construction (work). These submittals are considered Action Submittals (See definition below).

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

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 sample taken from the job site, on portion of work during or after installation.

Certificates

Statements printed on 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. 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. Use of Submittal Exchange or equivalent is required. Include time required for review, ordering, manufacturing, fabrication, and delivery when establishing dates. Include additional time required for making corrections or revisions to submittals and additional time for handling and reviewing submittals required by those corrections.

Coordinate submittal register with list of subcontracts, the schedule of values, and Contractor's construction schedule.

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. Submittal category: Action; informational.
- d. Name of subcontractor.
- e. Description of the Work covered.
- f. Scheduled date for final release or approval.
- g. Scheduled date of fabrication.
- h. Scheduled dates for purchasing.
- i. Scheduled dates for installation.
- j. Activity or event number.

1.3 VARIATIONS

Variations from contract requirements require SDSTA approval and will be considered where advantageous to SDSTA.

1.3.1 Considering Variations

Discussion with Project Manager 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 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 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 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 SDSTA of submittals with variations.

1.4 SCHEDULING

Schedule and concurrently submit submittals covering component items forming a system or items that are interrelated. 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.

- a. 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.
- b. Re-submit register and annotate monthly by the Contractor with actual submission and approval dates. When all items on the register have been fully approved, no further re-submittal is required.
- c. 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:

- a. Submittals marked "accepted" authorize the Contractor to proceed with the work covered.
- b. Submittals marked "accepted as noted" or "accepted as noted, resubmittal not required," authorize the Contractor to proceed with the work covered provided he takes no exception to the corrections.
- c. 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.
- d. Submittals marked "not reviewed" will indicate 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 is not reviewed. Resubmit submittals 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 as required under the contract is to 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 the Contractor Quality Control (CQC) 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 be construed to change or modify any contract requirements. Before submitting samples, the Contractor is to assure 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 to 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 ---

QUALITY CONTROL FOR CONSTRUCTION**01 45 00.10 20****Part 1 General****1.1 SUBMITTALS**

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

SD-01 Preconstruction Submittals

QC Plan;

Submit a QC Plan within 15 calendar days after receipt of Notice of 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, Contractor DAILY Report (Continuation Sheet), Rework Items List, and Testing Plan and Log.

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

a. DAILY Report: By 10:00 AM the next working day after each day that work is performed;

b. Field Test Reports: One copy, within one week after the test is performed, attached to the CQC Report;

c. 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 which 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 mobilization of storage and office trailers, 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 Project Preconstruction Meeting, 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 10 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, for acceptance by the Contracting Officer, 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. APPOINTMENT LETTERS: Letters signed by an officer of the firm appointing the QC Manager and Alternate QC Manager and stating that they are responsible for managing and implementing the QC program as described in this contract. Include in this letter the QC Manager's authority to direct the removal and replacement of non-conforming work.

VI. 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.

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

VIII. 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.

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

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

XI. 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 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. Minutes of the meeting will be prepared by the QC Manager and signed by both the Contractor and the Project Manager. The Contractor shall provide a copy of the signed minutes to all attendees.

1.7 QC CERTIFICATIONS (AL, SAMPLING AND TESTING? NOT REQUIRED?)

1.7.1 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.

1.7.2 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."

1.8 COMPLETION INSPECTIONS

1.8.1 Punch-Out Inspection

Near the completion of all work or stated elsewhere in the specifications, the QC Manager shall conduct an inspection of the work and develop a punch list of items which do not conform to the approved drawings and specifications. Include in the punch list any remaining items of the "Rework Items List", which were not corrected prior to the Punch-Out inspection. The punch list shall include the estimated date by which the deficiencies will be corrected. A copy of the punch list shall be provided to the Project Manager. 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 the SDSTA that the facility is ready for the SDSTA "Pre-Final Inspection".

1.8.2 Pre-Final Inspection

The SDSTA and QC manager will perform this inspection to verify that the facility is complete and ready to be occupied. A SDSTA pre-final punch list may be developed as a result of this inspection. The QC Manager shall ensure that all items on this list are corrected prior to notifying the SDSTA that a "Final" inspection with the customer can be scheduled. Any items noted on the "Pre-Final" inspection shall be corrected in a timely manner and shall be accomplished before the contract completion date for the work or any particular increment thereof if the project is divided into increments by separate completion dates.

1.8.3 Final Acceptance Inspection

The QC Manager, the superintendent, or other Contractor management personnel and the Project Manager and SDSTA QA Rep will be in attendance at this inspection. The final acceptance inspection will be formally scheduled based upon results of the "Pre-Final Inspection".

1.9 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. Use the "remarks" section in this report to record 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.

1.9.1 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. Upon completion of work, the QC Manager shall submit a certificate attesting to the accuracy of the as-built drawings prior to submission to the SDSTA.

1.10 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 ---

TEMPORARY CONSTRUCTION FACILITIES AND CONTROLS**01 50 00****Part 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.

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 241 (2015) Standard for Safeguarding Construction, Alteration, and Demolition Operations

NFPA 70 (2017) National Electrical Code

1.2 SUBMITTALS

Submit the following in accordance with Section SUBMITTAL PROCEDURES:

Construction Site 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.

Part 2 Products**2.1 TEMPORARY TRAFFIC CONTROL****2.1.1 Barricades**

Erect and maintain temporary barricades to limit public access to hazardous areas. Whenever safe public access to paved areas such as roads, parking areas or sidewalks is prevented by construction activities or as otherwise necessary to ensure the safety of both pedestrian and vehicular traffic barricades will be required. Securely place barricades clearly visible with adequate illumination to provide sufficient visual warning of the hazard during both day and night.

2.1.2 Fencing

Provide fencing along the construction site at all open excavations and tunnels to control access by unauthorized people.

a. The safety fencing must be a high visibility orange colored, high density polyethylene grid or approved equal, a minimum of 1.2 m (48 inches) high and maximum mesh size of 50 mm (2 inches), supported and tightly secured to steel posts located on maximum 3 m (10 foot)

centers, constructed at the approved location. Install fencing to be able to restrain a force of at least 114.00 kg (250 pounds) against it.

Part 3 Execution

3.1 EMPLOYEE PARKING

Contractor employees will park privately owned vehicles in an area designated by the Project Manager. This area will be within reasonable walking distance of the construction site. 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, not create unsafe conditions, and not violate applicable codes and standards.

3.2.2 Sanitation

Provide and maintain within the construction area minimum field-type sanitary facilities approved by the Project Manager and periodically empty wastes into a municipal, district, or station sanitary sewage system, or remove waste to a commercial facility. Obtain approval from the system owner prior to discharge into any district or commercial sanitary sewer system. Any penalties and/or fines associated with improper discharge will be the responsibility of the Contractor. Coordinate with the Project Manager and follow sanitary district regulations and procedures when discharging into the sanitary sewer system. Maintain these conveniences at all times without nuisance. Include provisions for pest control and elimination of odors. SDSTA toilet facilities will not 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

a. 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 requirements of the highway authority have been met.

b. 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 person 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 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.

3.4.3 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 bulletin boards, signs, barricades, 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 topsoil and seeding as necessary.

--- End of Section ---

CLOSEOUT SUBMITTALS**01 78 00****Part 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 01 33 00 SUBMITTAL PROCEDURES:

Product Data

Spare Parts Data

Manufacturer's Instructions

Posted Instructions

As-Built Drawings

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 markup prints must be neat, legible and accurate as follows:

a. Use base colors of red, green, and blue. Color code for changes as follows:

(1) Special (Blue) - Items requiring special information, coordination, or special detailing or detailing notes.

(2) Deletions (Red) - Over-strike deleted graphic items (lines), lettering in notes and leaders.

(3) Additions (Green) - Added items, lettering in notes and leaders.

2.1.2 As-Built Drawings Content

Show on the as-built drawings, but not limited to, the following information:

- a. 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.
- b. The location and dimensions of any changes within the building structure.
- c. Layout and schematic drawings of electrical circuits and piping.
- d. Correct grade, elevations, cross section, or alignment of roads, earthwork, structures or utilities if any changes were made from contract plans.
- e. Changes in details of design 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.
- f. The topography, invert elevations and grades of drainage installed or affected as part of the project construction.
- g. Where contract drawings or specifications present options, show only the option selected for construction on the working as-built markup drawings.
- h. Systems designed or enhanced by the Contractor, such as HVAC controls, fire alarm, fire sprinkler, and irrigation systems.
- i. Actual location of anchors, construction and control joints, etc., in concrete.
- j. 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. Sweep paved areas and rake clean landscaped areas. Remove waste and surplus materials, rubbish and construction facilities from the site.

--- End of Section ---

OPERATION AND MAINTENANCE DATA**01 78 23****Part 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 a detailed description 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. 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.

1.4.2 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 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.

a. Repair requirements must inform operators how to check out, troubleshoot, repair, and replace components of the system. Include electrical and mechanical schematics and diagrams and diagnostic techniques necessary to enable operation and troubleshooting of 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.

Part 2 Products

Not Used

Part 3 Execution

3.1 TRAINING

Prior to acceptance of the work, provide comprehensive training for the access control software system and equipment specified in the technical specifications. The training must be targeted for building maintenance and security personnel. Training must include classroom or field lectures based on the system 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. 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, 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. Special maintenance and replacement sources.

--- End of Section ---

TABLE OF CONTENTS

DIVISION 01 – SDSTA TABLE OF CONTENTS

	SUMMARY OF WORK	2
	ADMINISTRATIVE REQUIREMENTS	2
	PROJECT CONSTRUCTION PROGRESS SCHEDULES	2
01 33 00	SUBMITTAL PROCEDURES	5
01 45 00.10 20	QUALITY CONTROL FOR CONSTRUCTION	5
01 50 00	TEMPORARY CONSTRUCTION FACILITIES AND CONTROLS	4
01 78 00	CLOSEOUT SUBMITTALS	2
01 78 23	OPERATION AND MAINTENANCE DATA	5

DIVISION 8 – OPENINGS

08 71 00	DOOR HARDWARE	10
----------	---------------	----

DIVISION 26 - ELECTRICAL

26 00 10	GENERAL PROVISIONS	16
26 00 50	FIRESTOPPING	4
26 05 05	SELECTIVE DEMOLITION FOR ELECTRICAL	4
26 05 19	LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES	10
26 05 26	GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS	6
26 05 29	HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS	6
26 05 33.13	CONDUIT FOR ELECTRICAL SYSTEMS	14
26 05 33.16	BOXES FOR ELECTRICAL SYSTEMS	8
26 05 53	IDENTIFICATION FOR ELECTRICAL SYSTEMS	6
26 05 83	WIRING CONNECTIONS	4
26 24 16	PANELBOARDS	10
26 27 26	WIRING DEVICES	8

SECTION 08 71 00 - DOOR HARDWARE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Mechanical door hardware for the following:
 - a. Swinging doors.
2. Cylinders for door hardware specified in other Sections.
3. Electrified door hardware.

1.2 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
- B. Keying Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For electrified door hardware.
 1. Include diagrams for power, signal, and control wiring.
 2. Include details of interface of electrified door hardware and building safety and security systems.
- C. Samples: For each exposed product in each finish specified.
- D. Door hardware schedule.
- E. Keying schedule.

1.4 INFORMATIONAL SUBMITTALS

- A. Sample warranty.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance data.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: Supplier of products and an employer of workers trained and approved by product manufacturers and of an Architectural Hardware Consultant who is available during the course of the Work to consult Contractor, Architect, and Owner about door hardware and keying.
 - 1. Scheduling Responsibility: Preparation of door hardware and keying schedule.
 - 2. Engineering Responsibility: Preparation of data for electrified door hardware, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.
- B. Architectural Hardware Consultant Qualifications: A person who is experienced in providing consulting services for door hardware installations that are comparable in material, design, and extent to that indicated for this Project and who is currently certified by DHI as an Architectural Hardware Consultant (AHC) and an Electrified Hardware Consultant (EHC).

1.7 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: Five years from date of Substantial Completion unless otherwise indicated below:

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Electrified Door Hardware: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Means of Egress Doors: Latches do not require more than 15 lbf (67 N) to release the latch. Locks do not require use of a key, tool, or special knowledge for operation.

2.2 HINGES

- A. Hinges: BHMA A156.1. Provide template-produced hinges for hinges installed on hollow-metal doors and hollow-metal frames.

2.3 SELF-CLOSING HINGES AND PIVOTS

- A. Self-Closing Hinges and Pivots: BHMA A156.17.

2.4 CONTINUOUS HINGES

- A. Continuous Hinges: BHMA A156.26; minimum 0.120-inch- (3.0-mm-) thick, hinge leaves with minimum overall width of 4 inches (102 mm); fabricated to full height of door and frame and to template screw locations; with components finished after milling and drilling are complete.
- B. Continuous, Gear-Type Hinges: Extruded-aluminum, pinless, geared hinge leaves joined by a continuous extruded-aluminum channel cap; with concealed, self-lubricating thrust bearings.

2.5 MECHANICAL LOCKS AND LATCHES

- A. Lock Functions: As indicated in door hardware schedule.
- B. Lock Throw: Comply with testing requirements for length of bolts required for labeled fire doors, and as follows:
 - 1. Bored Locks: Minimum 1/2-inch (13-mm) latchbolt throw.
 - 2. Mortise Locks: Minimum 3/4-inch (19-mm) latchbolt throw.
 - 3. Deadbolts: Minimum 1-inch (25-mm) bolt throw.
- C. Lock Backset: 2-3/4 inches (70 mm) unless otherwise indicated.
- D. Lock Trim:
 - 1. Levers: Cast.
 - 2. Escutcheons (Roses): Forged.
 - 3. Dummy Trim: Match lever lock trim and escutcheons.
- E. Strikes: Provide manufacturer's standard strike for each lock bolt or latchbolt complying with requirements indicated for applicable lock or latch and with strike box and curved lip extended to protect frame; finished to match lock or latch.
 - 1. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.
 - 2. Extra-Long-Lip Strikes: For locks used on frames with applied wood casing trim.
 - 3. Aluminum-Frame Strike Box: Manufacturer's special strike box fabricated for aluminum framing.
 - 4. Rabbet Front and Strike: Provide on locksets for rabbeted meeting stiles.
- F. Bored Locks: BHMA A156.2; Grade 1; Series 4000.
- G. Mortise Locks: BHMA A156.13; Operational Grade 1; stamped steel case with steel or brass parts; Series 1000.

2.6 AUXILIARY LOCKS

- A. Bored Auxiliary Locks: BHMA A156.36; Grade 1; with strike that suits frame.
- B. Mortise Auxiliary Locks: BHMA A156.36; Grade 1; with strike that suits frame.

- C. Narrow Stile Auxiliary Locks: BHMA A156.36; Grade 1; with strike that suits frame.

2.7 ELECTRIC STRIKES

- A. Electric Strikes: BHMA A156.31; Grade 1; with faceplate to suit lock and frame. Use Basis of Design product or approved equal.
 - 1. Recessed (standard) condition: Basis of Design product is HES 1006/1600.
 - 2. Surface (existing) condition: Basis of Design product is HES 9400/9600.

2.8 ELECTROMAGNETIC LOCKS

- A. Electromagnetic Locks: BHMA A156.23; electrically powered; with electromagnet attached to frame and armature plate attached to door; full-exterior or full-interior type, as required by application indicated.

2.9 ELECTROMECHANICAL LOCKS

- A. Electromechanical Locks: BHMA A156.25; Grade 1; motor or solenoid driven; with strike that suits frame.

2.10 SURFACE BOLTS

- A. Surface Bolts: BHMA A156.16.

2.11 MANUAL FLUSH BOLTS

- A. Manual Flush Bolts: BHMA A156.16; minimum 3/4-inch (19-mm) throw; designed for mortising into door edge.

2.12 AUTOMATIC AND SELF-LATCHING FLUSH BOLTS

- A. Automatic Flush Bolts: BHMA A156.3, Type 25; minimum 3/4-inch (19-mm) throw; with dust-proof strikes; designed for mortising into door edge.
- B. Self-Latching Flush Bolts: BHMA A156.3, Type 27; minimum 3/4-inch (19-mm) throw; with dust-proof strikes designed for mortising into door edge.

2.13 EXIT DEVICES AND AUXILIARY ITEMS

- A. Exit Devices and Auxiliary Items: BHMA A156.3.

2.14 LOCK CYLINDERS

- A. Lock Cylinders: Tumbler type, constructed from brass or bronze, stainless steel, or nickel silver.
- B. Standard Lock Cylinders: BHMA A156.5; Grade 1 permanent cores; face finished to match lockset.
 - 1. Core Type: Interchangeable. 300 Series Cores / KSP KM-300 SFIC 6 pin core cylinder

2.15 KEYING

- A. Keying System: Factory registered, complying with guidelines in BHMA A156.28, appendix. Provide one extra key blank for each lock. Incorporate decisions made in keying conference.
 - 1. Match Owner's Existing Master/Grandmaster (300 Master Key) System: Change keys and a master key operate cylinders.
 - a. Provide three cylinder change keys and five master keys.
 - 2. Existing System:
 - a. Master key or grand master key locks to Owner's existing system.
- B. 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.

2.16 KEY CONTROL SYSTEM

- A. Key Control Cabinet: BHMA A156.28; metal cabinet with baked-enamel finish; containing key-holding hooks, labels, two sets of key tags with self-locking key holders, key-gathering envelopes, and temporary and permanent markers; with key capacity of 150 percent of the number of locks.
 - 1. Wall-Mounted Cabinet: Grade 1 cabinet with hinged-panel door equipped with key-holding panels and pin-tumbler cylinder door lock.

2.17 OPERATING TRIM

- A. Operating Trim: BHMA A156.6; stainless steel unless otherwise indicated.

2.18 ACCESSORIES FOR PAIRS OF DOORS

- A. Coordinators: BHMA A156.3; consisting of active-leaf, hold-open lever and inactive-leaf release trigger; fabricated from steel with nylon-coated strike plates; with built-in, adjustable safety release; and with internal override.
- B. Carry-Open Bars: BHMA A156.3; prevent the inactive leaf from opening before the active leaf; provide polished brass or bronze carry-open bars with strike plate for inactive leaves of pairs of doors unless automatic or self-latching bolts are used.
- C. Astragals: BHMA A156.22.

2.19 SURFACE CLOSERS

- A. Surface Closers: BHMA A156.4; rack-and-pinion hydraulic type with adjustable sweep and latch speeds controlled by key-operated valves and forged-steel main arm. Comply with manufacturer's written instructions for size of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Provide factory-sized closers, adjustable to meet field conditions and requirements for opening force.

2.20 CONCEALED CLOSERS

- A. Concealed Closers: BHMA A156.4; rack-and-pinion hydraulic type with adjustable sweep and latch speeds controlled by key-operated valves. Comply with manufacturer's written instructions for size of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Provide factory-sized closers, adjustable to meet field conditions and requirements for opening force.

2.21 MECHANICAL STOPS AND HOLDERS

- A. Wall- and Floor-Mounted Stops: BHMA A156.16.

2.22 OVERHEAD STOPS AND HOLDERS

- A. Overhead Stops and Holders: BHMA A156.8.

2.23 DOOR GASKETING

- A. Door Gasketing: BHMA A156.22; with resilient or flexible seal strips that are easily replaceable and readily available from stocks maintained by manufacturer.
- B. Maximum Air Leakage: When tested according to ASTM E283 with tested pressure differential of 0.3-inch wg (75 Pa), as follows:
 - 1. Smoke-Rated Gasketing: 0.3 cfm/sq. ft. (3 cu. m per minute/sq. m) of door opening.
 - 2. Gasketing on Single Doors: 0.3 cfm/sq. ft. (3 cu. m per minute/sq. m) of door opening.
 - 3. Gasketing on Double Doors: 0.50 cfm per ft. (0.000774 cu.) m/s per m) of door opening.

2.24 THRESHOLDS

- A. Thresholds: BHMA A156.21; fabricated to full width of opening indicated.

2.25 METAL PROTECTIVE TRIM UNITS

- A. Metal Protective Trim Units: BHMA A156.6; fabricated from 0.050-inch- (1.3-mm-) thick stainless steel; with manufacturer's standard machine or self-tapping screw fasteners.

2.26 AUXILIARY DOOR HARDWARE

- A. Auxiliary Hardware: BHMA A156.16.

2.27 FINISHES

- A. Provide finishes complying with BHMA A156.18 as indicated in door hardware schedule.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Mounting Heights: Mount door hardware units at heights indicated on Drawings or to comply with the following unless otherwise indicated or required to comply with governing regulations.
 - 1. Standard Steel Doors and Frames: ANSI/SDI A250.8.
 - 2. Custom Steel Doors and Frames: HMMA 831.
 - 3. Wood Doors: DHI's "Recommended Locations for Architectural Hardware for Wood Flush Doors."
- B. Install each door hardware item to comply with manufacturer's written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work. Do not install surface-mounted items until finishes have been completed on substrates involved.
- C. Hinges: Install types and in quantities indicated in door hardware schedule, but not fewer than the number recommended by manufacturer for application indicated or one hinge for every 30 inches (750 mm) of door height, whichever is more stringent, unless other equivalent means of support for door, such as spring hinges or pivots, are provided.
- D. Intermediate Offset Pivots: Where offset pivots are indicated, provide intermediate offset pivots in quantities indicated in door hardware schedule, but not fewer than one intermediate offset pivot per door and one additional intermediate offset pivot for every 30 inches (750 mm) of door height greater than 90 inches (2286 mm).
- E. Lock Cylinders: Install construction cores to secure building and areas during construction period.

1. Replace construction cores with permanent cores as directed by Owner.
 2. Furnish permanent cores to Owner for installation.
- F. Key Control Cabinet: Tag keys and place them on markers and hooks in key control system cabinet, as determined by final keying schedule.
- G. Boxed Power Supplies: Locate power supplies as indicated or, if not indicated, in equipment room. Verify location with Architect.
1. Configuration: Provide one power supply for each door opening or least number of power supplies required to adequately serve doors with electrified door hardware.
- H. Thresholds: Set thresholds for exterior doors and other doors indicated in full bed of sealant complying with requirements specified in Section 079200 "Joint Sealants."
- I. Stops: Provide floor stops for doors unless wall or other type stops are indicated in door hardware schedule. Do not mount floor stops where they will impede traffic.
- J. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.
1. Do not notch perimeter gasketing to install other surface-applied hardware.
- K. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.
- L. Door Bottoms: Apply to bottom of door, forming seal with threshold when door is closed.
- 3.2 ADJUSTING
- A. Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

DOOR HARDWARE SCHEDULE –

1. Hardware Group 100 – Typical at Condition A
 - a. Electric Strike – surface mounted
 - b. Panic with cylinder on opposite side
 - c. Pull
 - d. Cover plates as needed to cover existing machining of door and frame
2. Hardware Group 110 – At door A300
 - a. Hardware Group 100
 - b. Closer

Hardware Groups continue on next page

3. Hardware Group 200 – Typical at Condition B
 - a. Hollow metal frame section to match cut out of existing hollow metal frame and strike;
 - b. Electric Strike – recessed and integral with partial hollow metal frame replacement
 - c. Lever lockset – storage function
 - d. Cover plates as needed to cover existing machining of door
4. Hardware Group 300 – Typical at Condition C
 - a. Electrified removeable mullion
 - b. Electric strike for access controlled door leaf
 - c. Regular strike for non-access controlled door leaf
 - d. Pull for access controlled door leaf
 - e. Cover plates as needed to cover existing machining of door
5. Hardware Group 400 – Typical at Condition D
 - a. Hinges
 - b. Hinge door stop
 - c. Electric Strike – surface mounted
 - d. Panic with cylinder on opposite side
 - e. Pull
 - f. Closer
6. Hardware Group 500 – Typical at Condition E
 - a. Remove existing 9VDC electro-mechanical mortise lockset
 - 1) Existing is compatible with Corbin Russwin Access 800 series system
 - b. Replace with 24VDC electro-mechanical mortise lockset comparable to existing quality and compatible with new access control system
7. Hardware Group 600 – at door A100
 - a. Door position switch (DS) to be provided by others
8. Hardware Group 700 – at door A240
 - a. Remove existing access control lockset
 - b. Lever lockset
 - c. Cover plates as needed to cover existing machining of door

END OF SECTION 08 71 00

SECTION 26 00 10 - GENERAL PROVISIONS

PART 1 – GENERAL

1.1 SECTION INCLUDES

- A. Quality Assurance
- B. Methods of Request for Approval
- C. Submittals
- D. Job Conditions
- E. Project Coordination
- F. Progress Meetings
- G. Definitions
- H. Drawings and Measurements
- I. Workmanship
- J. Patching Materials
- K. Equipment Clean-Up
- L. Cutting and Patching
- M. Sealing of Penetrations
- N. Excavating, Trenching and Backfilling
- O. Preparation
- P. General Installation Requirements
- Q. Existing Utilities
- R. Laying Out the Work
- S. Progress Cleaning
- T. Protection of Installed Work
- U. Demonstration and Instruction
- V. Adjusting
- W. Project Record Documents
- X. Warranty and Bonds

1.2 RELATED DOCUMENTS

- A. The attached Administrative Requirements, General Conditions, Supplementary General Conditions and Special Conditions are hereby incorporated into and shall become a part of all sections under DIVISION 26, 27 and 28 – ELECTRICAL. In certain instances where the terms of this Division of the Specifications conflict with the terms of the General Conditions, or Special Conditions, this Division of the Specifications shall govern (or the more stringent requirement shall apply).
- B. Where “Contractor” is referred to in this Specification it shall mean “Contractor, Sub-Contractor and/or Sub-Contractors under the Prime Contractor.”
- C. Section 01 30 00 - Administrative Requirements
- D. Section 01 33 00 - Submittal Procedures
- E. Section 01 45 00.00 20 - Quality Control
- F. Section 01 50 00 - Temporary Construction Facilities and Controls
- G. Section 01 78 00 - Closeout Submittals
- H. Section 01 78 23 - Operation and Maintenance Data

1.3 DESCRIPTION OF WORK

- A. The work shall include everything in this Division of the Specifications and everything indicated on the Drawings that is complementary to this Division of the Specifications. Refer to the Index of Drawings to determine what Drawings apply directly to this work.
- B. The requirements of Division 01 shall apply to all sections of Division 26, 27, and 28.

1.4 QUALITY ASSURANCE

- A. See section 01 30 00 Administrative Requirements and 01 45 00.00 20 Quality Control for additional requirements. Contractor to conform to these sections as well.
- B. Codes and Standards:
 - 1. Work, materials and manner of placing material shall conform in every respect with the latest provisions of Local, State and National Codes.
 - 2. Materials and equipment shall be new and of best quality, of the type best suited for the purpose intended, and be made by nationally recognized and substantially established manufacturers. The type and weight of material used for each purpose shall be as herein specified, and material shall conform with the requirements of the latest standard specifications of the “ASTM” for that particular material.
 - 3. Electrical materials used in this work shall be listed by the Underwriters Laboratories, Inc. where testing is provided and shall bear their label.
 - 4. Do not use materials and equipment removed from existing premises, except as specifically permitted by the Contract Documents.

5. Where the notation of NEMA is indicated the equipment shall conform to National Electrical Manufacturers Association Standard.
 6. This project is being constructed at a mining site. Contractor will need to provide personnel that are properly trained to work on this site. Contractor will need to coordinate and follow are safety procedures required by the South Dakota Science and Technology Authority on this site. All costs associated with meeting these requirements shall be part of the Contractors bid and no additional payment will be made to the Contractor for such compliance.
 7. The following list of codes, technical societies, trade organizations and governing agencies shall set the standards by which all work shall be executed:
 - a. City Electrical Ordinances
 - b. State Electrical Laws and Statutes
 - c. National Electrical Code (NEC) Current Edition
 - d. National Board of Fire Underwriters (NBFU)
 - e. National Electrical Manufacturers Association (NEMA)
 - f. Underwriters Laboratories (UL)
 - g. Electrical Testing Laboratory (ETL)
 - h. International Building Code (IBC)
 - i. International Fire Code (IFC)
- C. Fees
1. All fees, permits, licenses, etc., necessary in order to complete the electrical work for this project shall be obtained and paid by this Contractor.
- D. Alternate Equipment
1. Where items of equipment and materials are specifically identified herein by a single manufacturer's name, or as many as three manufacturer's names, model or catalog numbers, and the words "or equal and approved" do not follow the manufacturer's names, only such specific items may be used in the base bid.
- E. Equipment of Substitution:
1. Where items of equipment and materials are specifically identified herein by a single manufacturer's name, or as many as three manufacturer's names, model or catalog numbers, and the words "or equal and approved" follow the manufacturer's name, such items may be substituted until such time that the material or equipment is submitted to the Architect or Engineer for review and approval. The base bid and any alternate shall be based on materials only as specified or approved.

1.5 METHODS OF REQUEST FOR APPROVAL:

- A. Prior to the award of the contract, interested parties may request approval of substitute materials. Such requests shall be made in writing and delivered to the Architect or Engineer no later than ten (10) days prior to the receipt of bids. Any substitutions that the Architect or Engineer finds satisfactory will then be published in an addendum as "acceptable substitutions."
- B. Should the Contractor wish to use materials other than those specified or listed in Addenda they shall do so in compliance with the method as specified under "Alternate Equipment."
- C. The listing of any manufacturer as "acceptable" does not imply automatic approval. It is the sole responsibility of the Electrical Contractor to ensure that any price quotations received and submittals made are for products which meet or exceed the specifications included herein.

- D. The Contractor must judge that such items of substitution are of equal quality and character to the specified items and it is physically adaptable for installation within the allotted space with all required service clearances. This includes the following:
 - 1. Has investigated proposed product and determined that it meets or exceeds the quality level of the specified product.
 - 2. Will provide the same (or better) warranty for the substitution as for the specified product.
 - 3. Will coordinate installation and make changes to other Work which may be required for the Work to be complete with no additional cost to the Owner.
 - 4. Waives claims for additional costs or time extensions which may subsequently become apparent.
 - 5. Will reimburse Owner and Architect/Engineer for review or redesign services associated with re-approval by authorities.
- E. The cost of any changes to other trades as a result of use of the substitution material or equipment must be borne by the Contractor submitting such material or equipment.
- F. After the award of the contract, any request for a substitution must be made in writing by the Contractor (not material supplier or Sub-Contractor). Such request shall state the name of the product specified, the name of the product proposed for substitution, the reason for requesting the substitution, and any change in contract amount resulting from the substitution. No such substitution shall be made until an appropriate Contract Modification has been issued and approved.
- G. Manufactured materials hereinafter specified or shown on the Drawings shall be installed or applied in accordance with the directions of the manufacturer unless specifically designated otherwise in the Specifications or on the Drawings.
- H. Substitutions may be considered when a product becomes unavailable through no fault of the Contractor.

1.6 SUBMITTALS

- A. Submittal of Shop Drawings:
 - 1. The Contractor shall submit seven (7) hard copies or one (1) electronic copy in either standard "researchable" (no scans will be accepted) PDF format or with software to view file of all shop drawings to the Architect or Engineer.
 - 2. Major components of the system shall be submitted at one time under a protective cover with each section indexed with visible file tabs. All equipment shall be labeled per the equipment tags on the drawings, ie. Motor names, fixture types, etc.
 - 3. Shop drawings shall indicate catalog number, dimensions, voltage and current characteristics, wire sizes, construction and rough-in data of all materials to be used. Each shop drawing shall be certified as being checked and approved by the Contractor before submittal.
 - 4. Shop drawings not indicated as being approved by the Contractor will be returned without review.
 - 5. The Contractor shall provide three (3) copies of approved shop drawings to be submitted with the Operating and Maintenance Manual.
 - 6. The following wording will appear on shop drawings reviewed by the Engineer. Contractors not wishing to comply with these conditions shall not submit a bid. "This review is only for general conformance with the design concept and information given in the Contract Documents. Corrections or comments, or the lack thereof, made on the shop drawings during this review do(es)

not relieve the contractor from compliance with the requirement of the plans, specifications and applicable laws, codes and regulations. Review of a specific item shall not include review of an assembly of which the item is a component. The contractor is responsible for confirming and correlating all quantities and dimensions; selecting fabrication processes and techniques of construction; coordinating his/her work with that of all other trades; and performing his/her work in a safe and satisfactory manner. Review of submission does not constitute a change order..”

7. The Engineer is not an error checker. Where the Contractor is submitting shop drawings that differ from the specifications, the Contractor must itemize in writing, each variance from the specifications. Failure to do so will be considered an error on the Contractors part and the specified materials shall be furnished. Shop drawings submitted in error or with errors as compared to Specifications and Drawings will be the responsibility of the Contractor to correct such error later.
8. Shop drawings must only be those materials as specified or approved in published addendum. Others will be returned without review.
9. Identify variations from Contract Documents and product or system limitations which may be detrimental to successful performance of the completed Work.
10. When revised for resubmission, identify all changes made since previous submission.
11. Contractor shall also prepare all submittal documents in digital format for posting on a document exchange site such as Submittal Exchange. This shall be provided at not additional cost to the contract.

B. Guarantee:

1. The Contractor shall assume responsibility for any defects which may develop in any part of his work caused by faulty workmanship, material or equipment, and agrees to replace, repair or alter, at his expense, any such faulty workmanship, material or equipment that has been brought to his attention during a period of one year from the date of the final certificate for payment. Acceptance of the work shall not waive this guarantee.

C. Operating and Maintenance Instructions:

1. This Contractor shall furnish three (3) copies of complete catalog data, manufacturer’s literature and detailed manuals covering the operating, maintenance of equipment and parts list specified under this Division of the Specification. All such literature shall be bound in three new, standard 3-ring notebooks and shall be submitted to the Engineer. The lubrication instructions in the manufacturer’s literature shall be underlined.
2. One copy of each shop drawing shall be included in the notebooks but shall not serve in lieu of maintenance and operating instructions. Temperature control diagrams must include a description of the sequence of control.
3. The Contractor shall submit O&M Manuals to the Engineer, not the owner, for review. The Engineer will forward the manuals to the Owner.
4. This Contractor shall also supervise the initial operation as required to acquaint him thoroughly with the best practice.
5. This Contractor shall furnish the Engineer with a written statement from the Owner indicating complete acceptance of the equipment data and instruction of the operator. The Engineer will not approve the request for final payment until such statement has been submitted.
6. Provide an electronic copy of the above.

D. Test Reports:

1. Work which is required to be placed within the construction or concealed shall be carefully tested and inspected before being permanently concealed.
2. Tests shall be made in the presence of the Engineer and the Owner, and shall meet with their approval. The Contractor shall notify the Engineer at a time sufficiently prior to the performance of any test to allow time for the Engineer to be present for the test.
3. The entire system shall be subject to a test at full operating and under normal usage conditions. This shall include voltage and current checks, resistance measurements and equipment operation. Defects in the work or workmanship which appear during these tests shall be properly remedied and a test again applied and continued to a satisfactory conclusion.
4. Electricity or other energy necessary for use in testing and adjusting and or the operation period will be supplied by the Owner.
5. Instruments for making tests shall be furnished by this Contractor.
6. After testing the apparatus, the entire system shall be operated for one week under normal conditions.
7. The final test shall be performed as soon as possible after the work is entirely completed
8. Test reports submitted electronically shall be in standard PDF format or submitted with software to view the file.

1.7 JOB CONDITIONS:

A. Fees and Service Charges:

1. Permits, licenses, fees and service charges required in connection with the work shall be secured and paid for by this Contractor, and upon completion of the work he shall furnish proof of acceptance from the proper Local and State Department having jurisdiction.

B. Electrical Symbols and Abbreviations:

1. Symbols and abbreviations are as indicated in legends on the Drawings.

C. Correlation of Work:

1. This Contractor shall be responsible for close correlation of his work with that of other Contractors and shall organize his work so that it will not interfere with or delay the work of other Contractors.
2. Field verification of scale dimensions on Plans is directed since actual locations, distances and levels will be governed by actual field conditions.
3. The Electrical Sub-Contractor shall check architectural, structural, plumbing, heating and ventilating plans to avert possible installation conflicts. Should drastic changes from original Plans be necessary to resolve such conflicts, the Sub-Contractor shall notify the Prime Contractor who in turn shall notify the Architect or Engineer and secure written approval and agreement on necessary adjustments before the installation is started.
4. Discrepancies shown on different Plans, or between Plans and actual field conditions, or between Plans and Specifications, shall promptly be brought to the attention of the Architect or Engineer for a decision.
5. Where a discrepancy exists between drawing and specifications or other disciplines the worst cost case shall be provided.

6. Coordinate work of alterations and renovations to expedite completion sequentially and to accommodate occupancy requirements.
7. Verify utility requirements and characteristics of operating equipment are compatible with building utilities. Coordinate work of various sections having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.
8. Coordinate space requirements, supports, and installation of mechanical and electrical work which are indicated diagrammatically on Drawings. Follow routing shown for pipes, ducts, and conduit, as closely as practicable; place runs parallel with lines of building. Utilize spaces efficiently to maximize accessibility to other installations, for maintenance, and for repairs.
9. Coordinate completion and clean-up of work of separate sections.
10. After Owner occupancy of premises, coordinate access to site for correction of defective work and work not in accordance with Contract Documents, to minimize disruption of Owner's activities.

D. Final Inspection:

1. Upon completion of work, the Contractor shall notify the Architect or Engineer in writing and make arrangements for a final observation. The Contractor shall also submit the operating and maintenance manuals at this time. The Engineer will not schedule nor perform a final inspection without successful submittal of operating and maintenance manuals by the Contractor.
2. During the final observation, pre-final or follow-up final, the Contractor and all his Prime Sub-Contractors shall have the foreman of the project present.
3. After the final observation is made, the Contractor will receive a list of items requiring adjustment, correction, replacement, or completion.
4. The Contractor shall comply completely with all the listed requirements within a negotiated number of days of receipt of list. Should the Contractor fail to complete items on the list within this time limit, the Owner reserves the right to have the work completed by others and the cost deducted from the contract price, including change orders.
5. The Contractor shall notify in writing to the Architect and/or Engineer once all punch list items are corrected, that he is ready for a follow-up final. The written notice shall contain explanations for those known items not completed and a schedule for completing them.
6. The Architect and/or Engineer shall schedule a follow-up final to confirm completion. Repeated observation trips required of the Engineer by the Contractor's inability to complete the project satisfactorily will require the Contractor to reimburse the Engineer for all incurred costs after the follow-up final observation.

1.8 PROJECT COORDINATION

- A. Project Coordinator: Construction Manager/General Contractor.
- B. Refer to Division 01 - All Sections.
- C. This section applies to all work performed and specified under Divisions 26, 27, and 28.
- D. Cooperate with the Construction manager/General Contractor and Owner in allocation of mobilization areas of site; for field offices and sheds, for access, traffic, and parking facilities.
- E. During construction, coordinate use of site and facilities through the Construction Manager/ General Contractor

- F. Comply with specified procedures for intra-project communications, submittals, reports and records, schedules, coordination drawings, and recommendations; and resolution of ambiguities and conflicts.
- G. Comply with instructions of the Construction Manager / General Contractor for use of temporary utilities and construction facilities.
- H. Coordinate field engineering and layout work under instructions of the Construction Manager/General Contractor.
- I. Make the following types of submittals to Architect/Engineer through the Construction Manager/General Contractor.
 - 1. Requests for interpretation/information.
 - 2. Requests for substitution.
 - 3. Shop drawings, product data and samples.
 - 4. Test and inspection reports.
 - 5. Manufacturer's instructions and field reports.
 - 6. Applications for payment and change order requests.
 - 7. Progress schedules.
 - 8. Coordination drawings.
 - 9. Closeout submittals.
 - 10. As-built Record Drawings.
 - 11. Operation and Maintenance Manuals.

1.9 PROGRESS MEETINGS

- A. Attendance Required: Job superintendent, major Subcontractors and suppliers, Owner, Architect/Engineer, as appropriate to agenda topics for each meeting.

1.10 DEFINITIONS

- A. Contractor
 - 1. The term "Contractor" refers to the installation Contractor responsible for the furnishing and installation of all work indicated within this Specification.
- B. Furnish
 - 1. The term "furnish" is used to mean "purchase, supply, provide and deliver to the Project site, protect and provide interim storage and be ready for unloading, unpacking, assembly, installation, and similar operations in accordance with Manufacturer's specifications."
- C. Provide
 - 1. The terms "provide" means to "furnish and install, complete and ready for the intended use."
- D. Install

1. The term “install” is used to describe operations at project site including the actual “unloading, unpacking, rigging in place, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations”.
- E. Installer
 1. The “Installer” is the Contractor, Subcontractor and/or supplier who uses their own employees for performance of all construction
- F. If Applicable:
 1. The term “if applicable” will be that work which may be required for completed construction at applicable locations, but is not necessarily shown or described in the Contract Documents.
- G. As Necessary
 1. The term “as necessary” will be that work which is required for completed construction, but is not necessarily show or described in the Contract Documents.
- H. As Required
 1. The term “as required” will be that work which is required for completed construction and is shown on the drawings or described in the project Specification.
- I. Concealed
 1. The term “concealed” means hidden from sight, buried as in chases, furred spaces, shafts, fixed ceiling or embedded in construction.
- J. Exposed
 1. The term “exposed” means bare, open to the elements, out in the open, uncovered.
- K. Product
 1. The term “product” will mean any item of equipment, material, fixture, apparatus, appliance or accessory installed under this Division.
- L. Substantial Completion
 1. “Substantial Completion” is deemed that the project is sufficiently complete to be utilized for its intended use as stated in the body of this written Specification.
- M. Words in the singular will also mean and include the plural, wherever the context so indicates, and words in the plural will mean the singular, wherever the context so indicates.

1.11 DRAWINGS AND MEASUREMENTS

- A. The extent of the system of equipment, materials, panels, conduits, wire, fixtures and connections as shown are in general diagrammatic and not for exact locations, except in certain cases, the drawings may include details giving exact location and arrangements.
- B. The drawings are not intended to be scaled for roughing in measurements nor to serve as shop drawings.
- C. The Contractor shall consult the architectural, structural, mechanical, or equipment drawings for dimensions, obstructions, and location of equipment or other trades. Any discrepancies between

architectural, structural, mechanical, or equipment drawings and the electrical work shown on these drawings shall be reported to the Engineers for adjustment.

- D. The installation details, instructions, and recommendations of the manufacturer of the product used, or modified to obtain the best end result, shall be the basis of attaining installation of the products for usage on this project except where definite and specific instructions are set forth herein or details are shown on the plans.
- E. Outlet devices, switches, panels, cabinets, fixtures and special equipment are shown on the drawings only in a schematic manner and not necessarily in their specific location. The Contractor shall be responsible for exact locations of the outlets to form a functional and aesthetic installation either by careful review of all architectural elevations, tile patterns, surface finishes, and equipment arrangements or by consultation with the Engineers and other trades involved.
- F. This contractor's bid shall allow a minimum of 10 feet variance in location of each electrical outlet, light fixture, panelboard, motor, appliance, etc. shown on the plans.

1.12 WORKMANSHIP

- A. The installation work included in this specification shall be performed in a neat workmanlike manner by people experienced and skilled in the Electrical trade. Only the best quality workmanship will be accepted. All exposed parts of the electrical wiring systems such as exposed conduits, flush plates, cabinet trim, fixtures, etc., shall be square and true with the building construction.

1.13 PATCHING MATERIALS

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

1.14 EQUIPMENT CLEAN-UP

- A. Special care must be taken for protection of panels, switches, etc. All must be kept completely protected from weather elements, painting, etc. until the building is substantially completed. Damage from rust, paint, scratches, etc. shall be corrected as directed by the A/E.
- B. Clean all light fixtures and lamps thoroughly, just prior to final inspection. Fixture globes, enclosures, shielding, etc. shall be cleaned by an approved method.
- C. Protection of electrical equipment during painting of the building shall be the responsibility of the Painting Contractor. This shall not relieve the Electrical Contractor of the responsibility for checking to assure that adequate protection is being provided.

1.15 CUTTING AND PATCHING

- A. In existing construction this Contractor shall perform all cutting required and all necessary patching after completion to restore the surface to its original condition, unless otherwise indicated.
- B. Should the cutting of walls, floors, ceiling, partitions, etc., be required for proper installation of the work or apparatus of this Contractor, or be made necessary on account of his failure to give General Contractor proper information at the time required, such cutting shall be done at his own expense, restoring the work to its original condition.

- C. All cutting and patching done by this Contractor shall be subject to the direction and approval of the A/E. This Contractor shall not endanger the stability of the structure by cutting, digging, or otherwise, and shall not at any time cut or alter work of any other contractor without A/E's consent.

1.16 SEALING OF PENETRATIONS

- A. All penetrations for raceway, wire, etc. furnished under Division 26, 27, 28 of these specifications which penetrate fire and/or smoke walls and full height partitions (including chase walls), shall be sealed with a UL System specifically approved for the application.

1.17 EXCAVATING, TRENCHING AND BACKFILLING

- A. This Contractor shall perform all excavation to the depths required, indicated on the drawings or specified. During excavation, material suitable for backfilling shall be piled in an orderly manner a sufficient distance from trench or other excavations to prevent slides or cave ins. All excavated materials not required or usable for backfilling shall be removed from the site. Necessary grading shall be done to prevent surface water from flowing into trenches or other excavations and onto adjacent property. Furnish all pumping required to keep excavated space clear of water during construction. The A/E will inspect excavation and approve soil conditions and direct procedure if unsatisfactory conditions are discovered. Provide sheeting and shoring as may be necessary for the protection of the work and the safety of personnel. Protect bottom of excavation from frost and do not place structures or pipe on frozen ground.
- B. Except where excavations will be covered by at least 4" of concrete, this contractor shall provide electrical warning tape at least 6" below finished grade above buried conduit or wire.
- C. Backfill excavations below finished grades with similar materials to that removed in excavation, free from rubbish and other unsuitable material. Backfilling shall be done to finished grades indicated on drawings. If no finished grading is to be done in excavated areas, this Contractor shall backfill to existing grades and restore the surface to its original condition. All backfill shall be compacted in 6 inch lifts to 95% maximum density.
- D. The Contractor shall be responsible for protecting trenches and provided adequate crossovers where pedestrian and vehicular traffic occurs. Guard rails, flags, lamps, etc. shall be used for such protection.
- E. This Contractor shall be responsible for the replacement of existing street pavement, curbs, sidewalks, etc. removed or damaged by him in the course of the work unless such pavement, curbs and sidewalks are to be reconstructed under the General Contract. This Contractor shall make necessary arrangements to perform such repairs and shall pay all costs in connection therewith and include it in his bid.
- F. Prior to any excavation, effort shall be made to determine whether underground installations (i.e., sewer, telephone, water, fuel, electric lines, etc.) will be encountered, and if so, where such underground installations are located. When the excavation approaches the estimated location of such installation, the exact location shall be determined and when it is uncovered, proper supports shall be provided for the existing installation. Utility companies shall be contacted and advised of proposed work prior to the start of actual excavation.

1.18 PROJECT CONDITIONS

- A. Maintain excavations free of water. Provide, operate, and maintain pumping equipment.
- B. Protect site from puddling or running water.

- C. Ventilate enclosed areas to assist cure of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, or gases.
- D. Dust Control: Execute work by methods to minimize raising dust from construction operations. Provide positive means to prevent air-borne dust from dispersing into atmosphere.
- E. Erosion and Sediment Control: Plan and execute construction by methods to control surface drainage from cuts and fills, from borrow and waste disposal areas. Prevent erosion and sedimentation.
 - 1. Minimize amount of bare soil exposed at one time.
 - 2. Provide temporary measures such as berms, dikes, and drains, to prevent water flow.
 - 3. Construct fill and waste areas by selective placement to avoid erosive surface silts or clays.
 - 4. Periodically inspect earthwork to detect evidence of erosion and sedimentation; promptly apply corrective measures.
- F. Rodent Control: Provide methods, means, and facilities to prevent rodents from accessing or invading premises.
- G. Pollution Control: Provide methods, means, and facilities to prevent contamination of soil, water, and atmosphere from discharge of noxious, toxic substances, and pollutants produced by construction operations.
- H. Verify that existing site conditions and substrate surfaces are acceptable for subsequent work. Beginning new work means acceptance of existing conditions.
- I. Verify that demolition is complete in alterations areas and areas are ready for installation of new work.
- J. Verify that existing substrate is capable of structural support or attachment of new work being applied or attached.
- K. Verify that utility services are available, of these of the correct characteristics, and in the correct location.
- L. Prior to Cutting: Examine existing conditions prior to commencing work, including elements subject to damage or movement during cutting and patching. After uncovering existing work, assess conditions affecting performance of work. Beginning of cutting or patching means acceptance of existing conditions. Protect work of other trades.

1.19 PREPARATION

- A. Cut, move, or remove items as necessary for access to alterations and renovation work. Replace and restore at completion.
- B. Remove unsuitable materials not marked for salvage, such as rotted wood, corroded metals, and deteriorated masonry and concrete. Replace materials as specified for furnished work.
- C. Remove debris and abandoned items from area and from concealed spaces.
- D. Close openings in exterior surfaces to protect existing work and salvage items from weather and extremes of temperature and humidity. Insulate ducts and piping to prevent condensation in exposed areas.
- E. Prepare surfaces and remove surface finishes to provide for proper installation of new work and finishes.

- F. Clean substrate surfaces prior to applying next materials or substance.
- G. Seal cracks or openings of substrate prior to applying next material or substance.
- H. Apply manufacturer required or recommended substrate primer, sealer, or conditioner prior to applying any new material or substance in contact or bond.

1.20 GENERAL INSTALLATION REQUIREMENTS

- A. Install products as specified in individual sections.
- B. Make neat transitions. Patch work to match adjacent work in texture and appearance.
- C. All ceiling mounted devices (i.e. smoke detectors, speakers, light fixtures, etc.) shall be installed centered in ceiling tiles (unless otherwise noted). Coordinate with ceiling installer.

1.21 EXISTING UTILITIES

- A. The plans indicate as accurately as possible the location, type and sizes of existing underground utilities at the site. It is the Contractor's responsibility to have all utilities located prior to starting work. Contractor shall contact appropriate utility company and One Call for locating utilities prior to commencement of any work. The Owner also has underground conduit and other systems in place. Contractor shall contact the Owner prior to excavation in any area to determine any items that may be impacted by excavation.
- B. This Contractor shall protect all utilities and Owner items affected by his work, and shall repair any damage caused by his forces at no additional cost to the Owner.
- C. The Owner and the Owners' of all underground facilities shall be notified at least 5 business days prior to excavation.

1.22 LAYING OUT THE WORK

- A. Verify locations of survey control points prior to starting work.
- B. Promptly notify Architect/Engineer of any discrepancies discovered.
- C. Protect survey control points prior to starting site work; preserve permanent reference points during construction.
- D. Promptly notify Architect/Engineer the loss or destruction of any reference point or relocation required because of changes in grades or other reasons.
- E. Replace dislocated survey control points based on original survey control. Make no changes without prior written notice to Architect/Engineer.
- F. Utilize recognized engineering survey practices.
- G. Establish elevations, lines and levels. Locate and layout by instrumentation and similar appropriate means.

1. Site improvements including pavements; stakes for grading, fill and topsoil placement; utility locations, slopes, and invert elevations.
 2. Grid or axis for structures.
 3. Building foundation, column locations, ground floor elevations.
- H. Periodically verify layouts by same means.
- I. Maintain a complete and accurate log of control and survey work as it progresses.

1.23 PROGRESS CLEANING

- A. Maintain areas free of waste materials, debris, and rubbish. Maintain site in a clean and orderly condition per OSHA standards.
- B. Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces, and other closed or remote spaces, prior to enclosing the space.
- C. Broom and vacuum clean interior areas prior to start of surface finishing, and continue cleaning to eliminate dust.
- D. Collect and remove waste materials, debris, and rubbish from site periodically and dispose off-site.

1.24 PROTECTION OF INSTALLED WORK

- A. Protect installed work and provide special protection where specified in individual specification sections.
- B. Provide temporary and removable protection for installed Products. Control activity in immediate work area to prevent damage.
- C. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials.
- D. Prohibit traffic or storage upon waterproofed or roofed surfaces. If traffic or activity is necessary, obtain recommendations for protection from waterproofing or roofing material manufacturer.
- E. Prohibit traffic from landscaped area.

1.25 DEMONSTRATION AND INSTRUCTION

- A. Contractor shall complete all start-up and perform all initial testing of each system prior to scheduling or requesting to schedule training. All systems shall be completely operational before training or demonstration will occur.
- B. Demonstrate operation and maintenance of Products to Owner's personnel prior to date of final inspection.
- C. Demonstrate operation and maintenance of Products to Owner's representative at a scheduled time with the Owner.
- D. Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, maintenance, and shutdown of each item of equipment at agreed time, at equipment location.

- E. Provide a qualified person who is knowledgeable about the Project to perform demonstration and instruction of Owner Personnel.
- F. Utilize operation and maintenance manuals as basis for instruction. Review contents of manuals with Owner's personnel in detail to explain all aspects of operation and maintenance.

1.26 ADJUSTING

- A. Adjust operating Products and equipment to ensure smooth and unhindered operation.

1.27 PROJECT RECORD DOCUMENTS

- A. Maintain on site one set of the following record documents; record actual revisions to the Work:
 - 1. Drawings.
 - 2. Specifications.
 - 3. Addenda.
 - 4. Change Orders and other modifications to the Contract.
 - 5. Reviewed shop drawings, product data, and samples.
 - 6. Manufacturer's instruction for assembly, installation, and adjusting.
- B. Ensure entries are complete and accurate, enabling future reference by Owner.
- C. Record information concurrent with construction progress.
- D. Specifications: Legibly mark and record at each product section description of actual products installed, including the following:
 - 1. Manufacturer's name and product model and number.
 - 2. Changes made by Addenda and modifications.
- E. Record Drawings and Shop Drawings: Legibly mark each item to record actual construction including:
 - 1. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
 - 2. Field changes of dimension and detail.
 - 3. Details not on original Contract Documents.
- F. At completion of project Contractor shall provide a minimum of two (2) sets of As-Built Record drawings. Additional sets shall be provided if required under General Requirements.

1.28 WARRANTY AND BONDS

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

- B. Verify that documents are in proper form, contain full information, and are notarized.
- C. Co-execute submittals when required.
- D. Retain warranties and bonds until time specified for submittal.
- E. Include originals of each in operation and maintenance manuals, indexed separately on Table of Contents.
- F. Separate each warranty or bond with index tab sheets keyed to the Table of Contents listing. Provide full information, using separate typed sheets as necessary. List Sub-Contractor, Supplier, and Manufacturer, with name address, and telephone number of responsible principal.

END OF SECTION

SECTION 26 00 50 - FIRESTOPPING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Firestopping materials.
- B. Firestopping of all penetrations and interruptions to fire rated assemblies, whether indicated on drawings or not, and other openings indicated.

1.2 RELATED SECTIONS

- A. Section 26 0035 - Execution Requirements: Cutting and patching.
- B. Section 26 0519 - Low-Voltage Power Conductors and Cables.
- C. Section 26 0533.13 - Conduit For Electrical Systems.

1.3 REFERENCES

- A. ASTM E 119 - Standard Test Methods for Fire Tests of Building Construction and Materials; 1995a.
- B. ASTM E 814 - Standard Test Method for Fire Tests of Through-Penetration Fire Stops; 1994b.
- C. ITS (DIR) - Directory of Listed Products; Intertek Testing Services NA, Inc.; current edition.
- D. FM P7825 - Approval Guide; Factory Mutual Research Corporation; current edition.
- E. UL (FRD) - Fire Resistance Directory; Underwriters Laboratories Inc.; current edition.

1.4 SUBMITTALS

- A. No submittals are required for this section.

1.5 QUALITY ASSURANCE

- A. Fire Testing: Provide firestopping assemblies of designs which provide the specified fire ratings when tested in accordance with ASTM E 814 and ASTM E 119.

1.6 ENVIRONMENTAL REQUIREMENTS

- A. Comply with firestopping manufacturer's recommendations for temperature and conditions during and after installation. Maintain minimum temperature before, during, and for 3 days after installation of materials.
- B. Provide ventilation in areas where solvent-cured materials are being installed.

PART 2 PRODUCTS

2.1 FIRESTOPPING ASSEMBLIES

2.2 MATERIALS

- A. Elastomeric Silicone Firestopping: Single component silicone elastomeric compound and compatible silicone sealant; conforming to the following:
 - 1. Durability and Longevity: Permanent.
 - 2. Color: Per Manufacturer.
 - 3. Manufacturers:
 - a. 3M Product CP25WB+.
- B. Firestop Devices: Mechanical device with incombustible filler and sheet stainless steel jacket; conforming to the following:
 - 1. Durability and Longevity: Permanent .
 - 2. Manufacturers:
 - a. EZ Pathway Products; Product EZ Path.
- C. Intumescent Putty: Compound which expands on exposure to surface heat gain; conforming to the following:
 - 1. Potential Expansion: Minimum 1000 percent.
 - 2. Durability and Longevity: Permanent.
 - 3. Color: Per Manufacturer.
 - 4. Manufacturers:
 - a. 3M Product MPS+.
 - b. 3M Product MPP+.
- D. Primers, Sleeves, Forms, and Accessories: Type required for tested assembly design.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify openings are ready to receive the work of this section.

3.2 PREPARATION

- A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other matter which may affect bond of firestopping material.
- B. Remove incompatible materials which may affect bond.

3.3 INSTALLATION

- A. Install materials in manner described in fire test report and in accordance with manufacturer's instructions, completely closing openings.
- B. Do not cover installed firestopping until inspected by authority having jurisdiction.

3.4 CLEANING AND PROTECTION

- A. Clean adjacent surfaces of firestopping materials.
- B. Protect adjacent surfaces from damage by material installation.

END OF SECTION

SECTION 26 05 05 - SELECTIVE DEMOLITION FOR ELECTRICAL

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Electrical demolition.

PART 2 PRODUCTS

2.1 MATERIALS AND EQUIPMENT

- A. Materials and equipment for patching and extending work: As specified in individual sections and drawings or as required to complete work.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify field measurements and circuiting arrangements are as indicated on contract documents.
- B. Verify that abandoned wiring and equipment serve only abandoned facilities.
- C. Demolition drawings are based on casual field observation and existing record documents.
- D. Report discrepancies to Architect/Engineer before disturbing existing installation.
- E. Beginning of demolition means installer accepts existing conditions.
- F. An attempt has been made to show all relevant devices and branch circuits. The electrical contractor shall visit the site to verify devices not shown, extent of conduit, boxes etc, & routings. Only devices specifically noted on plans shall be demoed with associated cabling where noted.
- G. It is mandatory that the existing buildings remain in continuous and non-interrupted operation during remodeling/altering of the existing building. The specific area(s) being remodeled/alterd at any scheduled time are obviously exclusive of the statement. Services to existing building shall be kept on continuous operation including power, lighting, telephone, fire alarm, etc. Any absolutely necessary interruption of these services to accomplish project construction shall be held to a minimum, arranged with the Owner through the general contractor two (2) weeks in advance. Temporary services shall be furnished and installed where necessary to accomplish this purpose. Temporary systems shall be removed only after new permanent services are installed, fully operational, tested and compliant.
- H. Electrical Contractor shall refer to architectural drawings to familiarize himself with extent of alteration/remodeling work. All new conduit shall be concealed above lay-in ceilings where possible. Surface mounted raceway/wireway maybe used to new devices in finished areas where conduit cannot be concealed. Coordinate locations of surface mounted raceway at every location prior to rough-in or installation.
- I. If existing conduit is allowed to be reused it shall be supported per NEC and these specifications. Field verify the existing conditions prior to bidding.

3.2 PREPARATION

- A. Owner personnel will identify any existing conduit and electrical equipment that is to remain in place. Coordinate with Owner personnel.
- B. Services to areas not within the demolition/remodel areas shall be maintained.
- C. Coordinate service outages with owner. Temporary connections of power, telephone, and data to external buildings must be completed before modifications of those systems occur.
- D. All required service and utility outages shall be scheduled in advance, and approved by SDSTA in writing in advance.
- E. Provide temporary wiring and connections to maintain existing systems in service during construction. When work must be performed on energized equipment or circuits, use personnel experienced in such operations.
- F. Existing Electrical Services: Maintain existing systems in service.
- G. Existing Electrical Service: Maintain existing system in service throughout the project.
 - 1. Obtain permission from Owner at least 96 hours before partially or completely disabling system.
- H. Existing Telephone, Data, and Television Systems: Maintain existing systems in service.

3.3 DEMOLITION AND EXTENSION OF EXISTING ELECTRICAL WORK

- A. Perform work for removal and disposal of equipment and materials containing toxic substances regulated under the Federal Toxic Substances Control Act (TSCA) in accordance with applicable federal, state, and local regulations. Applicable equipment and materials include, but are not limited to:
 - 1. PCB-containing electrical equipment, including transformers, capacitors, and switches.
 - 2. PCB- and DEHP-containing lighting ballasts.
 - 3. Mercury-containing lamps and tubes, including fluorescent lamps, high intensity discharge (HID), arc lamps, ultra-violet, high pressure sodium, mercury vapor, ignitron tubes, neon, and incandescent.
- B. Remove, relocate, and extend existing installations to accommodate new construction.
- C. Systems to be relocated, extended, or modified include, but are not limited to (not all may apply) telephone, data, fire alarm, P/A, intercom, security, etc. All systems shall be re-tested to ensure functionality. Testing shall be by vendors for proper certifications of operation.
- D. Remove abandoned wiring to source of supply.
- E. If existing systems supporting/mounting methods are removed support/remount as required to meet the specifications for new.
- F. Remove exposed abandoned conduit, including abandoned conduit above accessible ceiling finishes. Cut conduit flush with walls and floors, and patch surfaces.

- G. Disconnect abandoned outlets and remove devices. Remove abandoned outlets if conduit servicing them is abandoned and removed. Provide blank cover for abandoned outlets that are not removed.
- H. Disconnect and remove electrical devices and equipment serving utilization equipment that has been removed.
- I. Repair adjacent construction and finishes damaged during demolition and extension work.
- J. Maintain access to existing electrical installations that remain active. Modify installation or provide access panel as appropriate.
- K. Maintain access to existing electrical installations which remain active. Modify installation or provide access panel as appropriate. For instance, if new hard ceilings are installed relocate junction boxes as required to maintain accessibility or provide access panels. Contractor shall field verify existing conditions, this shall include: conduit routing, junction box locations, surface/recessed applications, vertical height of components, seal-offs, etc. Documents will not indicate all the details of the electrical system, only main components & devices.
- L. Extend existing installations using materials and methods compatible with existing electrical installations, or as specified.
- M. Except where otherwise shown or noted on drawing - "to be retained, relocated" or hereinafter noted, all existing electrical equipment and material in areas to be remodeled/altered shall be removed where they interfere with proposed new construction and or interfere with proposed usage of space by owner as follows:
 - 1. Remove any conduits protruding above finished floor, cap and finish over with floor material to match existing.
 - 2. Remove all light fixtures, receptacles, switches, etc., as indicated, and associated wiring.
- N. Remove all surface mounted conduit/boxes and their associated wiring. Remove all concealed raceways, boxes and wiring from partitions being demolished. Remove all existing wiring/cabling from all existing concealed raceways in partitions that are to remain relating to demolished devices.
- O. In remodeled/altered areas any feeders, conduits, branch circuits, signal and telephone circuits, etc. Passing through the remodeled areas to serve (or be served from) existing adjacent, remote, or surrounding areas that are to remain, shall be retained and kept operational and shall be rerouted in all cases where they interfere with any new work or usage to be accomplished in the remodeled area.
- P. Where devices are omitted from present branch circuits, the remaining devices shall be re-wired, if needed and as required, to remain on their respective circuits and in operating condition. Re feed from nearest panel or replacement panel. Where possible, electrical contractor may use existing branch circuit conduit, but new circuit wiring will need to be pulled. If existing circuiting is not available in the area of the electrical load, provide a new circuit from the panelboard servicing the area. Where practical, contractor will be allowed to reuse existing wiring, provided that it matches required color code. If contractor elects to exercise this option, he shall warrant used wire as new
- Q. Extend existing installations using existing materials where practical, and providing new materials and methods compatible with existing electrical installations. Refer to specific notes on the drawings.

3.4 SALVAGE ITEMS

- A. Salvage items to be returned to owner shall include, but are not limited to, fire alarm equipment, clocks, clock equipment, dimmers, dimming equipment (not reused), panelboards, circuit breakers, hand dryers, and door closers.
- B. The Owner shall have salvage rights for existing equipment and wire removed and not reused. If owner does not wish to keep this equipment, it shall become Contractor's property and be removed from the site, unless otherwise specified or shown.
- C. Disposal of all electrical items (fluorescent lamps, fluorescent ballasts, HID lamps, HID ballasts, transformers, etc.) shall be done in full compliance with all applicable local, county, state, and federal requirements. This Contractor shall bear all costs (fees, permits, etc.) associated with these disposal requirements.
- D. Check with owner prior to removal of all items.
- E. Items shall not be damaged during removal.
- F. Deliver to the Owner all salvage items to be retained by owner. Deliver to owner determined site within the city limits.
- G. The Owner shall have the first choice to accept existing devices being removed. Do not relocate existing devices - provide new unless otherwise noted.
- H. Salvage items to be returned to Owner shall be as specifically noted on the drawings.
- I. All demolition materials not scheduled to be salvaged shall become the Contractor's property, and shall be removed from the site and legally disposed of by or through the contractor.

3.5 CLEANING AND REPAIR

- A. Clean and repair existing materials and equipment that remain or that are to be reused.
- B. Panelboards: Provide typed circuit directory showing revised circuiting arrangement.
- C. Electrical contractor shall be responsible for his own demolition, removal, capping, storing, abandoning, disconnecting, relocating and reconnection of existing electrical equipment and material. All cutting, patching, repairing, replacement and refinishing, shall match the existing construction as nearly as possible.

END OF SECTION

SECTION 26 05 19 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Single conductor building wire.
- B. Wiring connectors.
- C. Electrical tape.
- D. Wire pulling lubricant.

1.2 RELATED REQUIREMENTS

- A. Section 26 05 26 - Grounding and Bonding for Electrical Systems: Additional requirements for grounding conductors and grounding connectors.
- B. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.

1.3 REFERENCE STANDARDS

- A. ASTM B3 - Standard Specification for Soft or Annealed Copper Wire; 2013 (Reapproved 2018).
- B. ASTM B8 - Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft; 2011 (Reapproved 2017).
- C. ASTM B787/B787M - Standard Specification for 19 Wire Combination Unilay-Stranded Copper Conductors for Subsequent Insulation; 2004 (Reapproved 2014).
- D. ASTM D3005 - Standard Specification for Low-Temperature Resistant Vinyl Chloride Plastic Pressure-Sensitive Electrical Insulating Tape; 2017.
- E. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.
- F. NEMA WC 70 - Power Cables Rated 2000 Volts or Less for the Distribution of Electrical Energy; 2009.
- G. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems; 2017.
- H. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- I. UL 83 - Thermoplastic-Insulated Wires and Cables; Current Edition, Including All Revisions.
- J. UL 486A-486B - Wire Connectors; Current Edition, Including All Revisions.
- K. UL 486C - Splicing Wire Connectors; Current Edition, Including All Revisions.
- L. UL 486D - Sealed Wire Connector Systems; Current Edition, Including All Revisions.

- M. UL 510 - Polyvinyl Chloride, Polyethylene, and Rubber Insulating Tape; Current Edition, Including All Revisions.
- N. UL 1569 - Metal-Clad Cables; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate sizes of raceways, boxes, and equipment enclosures installed under other sections with the actual conductors to be installed, including adjustments for conductor sizes increased for voltage drop.
 - 2. Coordinate with electrical equipment installed under other sections to provide terminations suitable for use with the conductors to be installed.
 - 3. Notify Architect/Engineer of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.5 SUBMITTALS

- A. No submittals are required for this specification section.

1.6 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.
- B. Products: Furnish products listed and classified by Underwriters Laboratories inc. as suitable for the purpose specified and indicated.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store conductors and cables in accordance with manufacturer's instructions.

1.8 FIELD CONDITIONS

- A. Do not install or otherwise handle thermoplastic-insulated conductors at temperatures lower than 14 degrees F (-10 degrees C), unless otherwise permitted by manufacturer's instructions. When installation below this temperature is unavoidable, notify Architect and obtain direction before proceeding with work.

PART 2 PRODUCTS

2.1 CONDUCTOR AND CABLE APPLICATIONS

- A. Do not use conductors and cables for applications other than as permitted by NFPA 70 and product listing.
- B. Provide single conductor building wire installed in suitable raceway unless otherwise indicated, permitted, or required.

- C. Nonmetallic-sheathed cable is not permitted.
- D. Underground feeder and branch-circuit cable is not permitted.
- E. Service entrance cable is not permitted.
- F. Armored cable is not permitted.
- G. Metal-clad cable is not permitted.

2.2 CONDUCTOR AND CABLE GENERAL REQUIREMENTS

- A. Provide products that comply with requirements of NFPA 70.
- B. Provide products listed, classified, and labeled as suitable for the purpose intended.
- C. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, etc. as required for a complete operating system.
- D. Comply with NEMA WC 70.
- E. Thermoplastic-Insulated Conductors and Cables: Listed and labeled as complying with UL 83.
- F. Conductors for Grounding and Bonding: Also comply with Section 26 05 26.
- G. Conductor Material:
 - 1. Provide copper conductors only. Aluminum conductors are not acceptable for this project. Conductor sizes indicated are based on copper.
 - 2. Copper Conductors: Soft drawn annealed, 98 percent conductivity, uncoated copper conductors complying with ASTM B3, ASTM B8, or ASTM B787/B787M unless otherwise indicated.
- H. Minimum Conductor Size:
 - 1. Branch Circuits: 12 AWG.
 - a. Exceptions:
 - 1) 20 A, 120 V circuits longer than 75 feet (23 m): 10 AWG, for voltage drop.
 - 2) 20 A, 120 V circuits longer than 150 feet (46 m): 8 AWG, for voltage drop.
 - 3) 20 A, 277 V circuits longer than 150 feet (46 m): 10 AWG, for voltage drop.
 - 4) Feeders conductors shall be sized for a maximum voltage drop of 3% at design load.
 - 5) Branch circuit conductors shall be sized for a maximum voltage drop of 5% at design load.
 - 6) This contractor shall derate conductor ampacity in areas of high ambient temperature per the NEC.
 - 7) Provide a separate neutral for each phase wire - NO SHARED NEUTRALS. This applies to single phase circuits only.
 - 8) Provide additional derating per NEC tables 310-16 through 310-31 note 8 for all home runs with more than 3 current carrying conductors in a raceway.
 - 2. Control Circuits: 14 AWG.
- I. Conductor Color Coding:

1. Color code conductors as indicated unless otherwise required by the authority having jurisdiction. Maintain consistent color coding throughout project.
2. Color Coding Method: Integrally colored insulation.
3. Color Code:
 - a. 480Y/277 V, 3 Phase, 4 Wire System:
 - 1) Phase A: Brown.
 - 2) Phase B: Orange.
 - 3) Phase C: Yellow.
 - 4) Neutral/Grounded: Gray.
 - b. 208Y/120 V, 3 Phase, 4 Wire System:
 - 1) Phase A: Black.
 - 2) Phase B: Red.
 - 3) Phase C: Blue.
 - 4) Neutral/Grounded: White.
 - c. Equipment Ground, All Systems: Green.
 - d. Travelers for 3-Way and 4-Way Switching: Pink.
 - e. For modifications or additions to existing wiring systems, comply with existing color code when existing code complies with NFPA 70 and is approved by the authority having jurisdiction.
 - f. For control circuits, comply with manufacturer's recommended color code.

2.3 SINGLE CONDUCTOR BUILDING WIRE

A. Manufacturers:

1. Copper Building Wire:
 - a. Cerro Wire LLC: www.cerrowire.com/#sle.
 - b. Encore Wire Corporation: www.encorewire.com/#sle.
 - c. General Cable Technologies Corporation; _____: www.generalcable.com/#sle.
 - d. Southwire Company: www.southwire.com/#sle.
 - e. Or Equal.

B. Description: Single conductor insulated wire.

C. Conductor Stranding:

1. Feeders and Branch Circuits:
 - a. Size 10 AWG and Smaller: Solid.
 - b. Size 8 AWG and Larger: Stranded.
2. Control Circuits: Stranded.

D. Insulation Voltage Rating: 600 V.

E. Insulation:

1. Copper Building Wire: Type THHN/THWN or THHN/THWN-2.

2.4 WIRING CONNECTORS

- ### A. Description: Wiring connectors appropriate for the application, suitable for use with the conductors to be connected, and listed as complying with UL 486A-486B or UL 486C as applicable.

B. Wiring Connectors for Splices and Taps:

1. Copper Conductors Size 8 AWG and Smaller: Use twist-on insulated spring connectors.
2. Copper Conductors Size 6 AWG and Larger: Use mechanical connectors or compression connectors.

C. Wiring Connectors for Terminations:

1. Provide terminal lugs for connecting conductors to equipment furnished with terminations designed for terminal lugs.
2. Provide compression adapters for connecting conductors to equipment furnished with mechanical lugs when only compression connectors are specified.
3. Where over-sized conductors are larger than the equipment terminations can accommodate, provide connectors suitable for reducing to appropriate size, but not less than required for the rating of the overcurrent protective device.
4. Provide motor pigtail connectors for connecting motor leads in order to facilitate disconnection.
5. Copper Conductors Size 8 AWG and Larger: Use mechanical connectors or compression connectors where connectors are required.
6. Stranded Conductors Size 10 AWG and Smaller: Use crimped terminals for connections to terminal screws.
7. Conductors for Control Circuits: Use crimped terminals for all connections.

D. Do not use insulation-piercing or insulation-displacement connectors designed for use with conductors without stripping insulation.

E. Do not use push-in wire connectors as a substitute for twist-on insulated spring connectors.

F. Twist-on Insulated Spring Connectors: Rated 600 V, 221 degrees F (105 degrees C) for standard applications and 302 degrees F (150 degrees C) for high temperature applications; pre-filled with sealant and listed as complying with UL 486D for damp and wet locations.

G. Mechanical Connectors: Provide bolted type or set-screw type.

H. Compression Connectors: Provide circumferential type or hex type crimp configuration.

I. Crimped Terminals: Nylon-insulated, with insulation grip and terminal configuration suitable for connection to be made.

1. For the connection to any of the following: utility transformer, exterior transformer, transition cabinet, or padmount transformer, provide long barrel, 2 hole NEMA spaced, tin plated copper compression connectors with hot dipped galvanized or stainless steel hardware consisting of 1/2 inch bolts, washers, lock washers, and nuts.
2. Engineer to witness installation - schedule accordingly. With engineer approval photographs may be provided in lieu of engineer oversight. Coordinate required photos with engineer.

2.5 WIRING ACCESSORIES

A. Electrical Tape:

1. Vinyl Color Coding Electrical Tape: Integrally colored to match color code indicated; listed as complying with UL 510; minimum thickness of 7 mil (0.18 mm); resistant to abrasion, corrosion, and sunlight; suitable for continuous temperature environment up to 221 degrees F (105 degrees C).
 2. Vinyl Insulating Electrical Tape: Complying with ASTM D3005 and listed as complying with UL 510; minimum thickness of 7 mil (0.18 mm); resistant to abrasion, corrosion, and sunlight; conformable for application down to 0 degrees F (-18 degrees C) and suitable for continuous temperature environment up to 221 degrees F (105 degrees C).
 3. Moisture Sealing Electrical Tape: Insulating mastic compound laminated to flexible, all-weather vinyl backing; minimum thickness of 90 mil (2.3 mm).
- B. Wire Pulling Lubricant: Listed; suitable for use with the conductors or cables to be installed and suitable for use at the installation temperature.
- C. All permanent splices shall be made with compression type connectors. Split bolts shall not be permitted except for temporary wiring.
- D. Solderless Pressure Connectors:
1. Scotch lok brand not acceptable.
- E. Splices and taps shall be approved by owner & engineer prior to installation. When allowed for conductor sizes No. 6 and larger splicing shall be compression with heat shrink insulation.
- F. Where a circuit passes through an outlet box and is tapped, all leads should be pigtailed out to the wiring device, including the equipment ground wire. This prevents loss of neutral or ground during maintenance work.
- G. All underground splices shall be waterproof/watertight.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that interior of building has been protected from weather.
- B. Verify that work likely to damage wire and cable has been completed.
- C. Verify that raceways, boxes, and equipment enclosures are installed and are properly sized to accommodate conductors and cables in accordance with NFPA 70.
- D. Verify that field measurements are as indicated.
- E. Verify that conditions are satisfactory for installation prior to starting work.

3.2 PREPARATION

- A. Clean raceways thoroughly to remove foreign materials before installing conductors and cables.

3.3 INSTALLATION

- A. Circuiting Requirements:

1. Unless dimensioned, circuit routing indicated is diagrammatic.
 2. When circuit destination is indicated without specific routing, determine exact routing required.
 3. Arrange circuiting to minimize splices.
 4. Include circuit lengths required to install connected devices within 10 ft (3.0 m) of location indicated.
 5. Maintain separation of Class 1, Class 2, and Class 3 remote-control, signaling, and power-limited circuits in accordance with NFPA 70.
 6. Maintain separation of wiring for emergency systems in accordance with NFPA 70.
 7. Circuiting Adjustments: Unless otherwise indicated, when branch circuits are indicated as separate, combining them together in a single raceway is permitted, under the following conditions:
 - a. Provide no more than six current-carrying conductors in a single raceway. Dedicated neutral conductors are considered current-carrying conductors.
 - b. Increase size of conductors as required to account for ampacity derating.
 - c. Size raceways, boxes, etc. to accommodate conductors.
 8. Common Neutrals: Unless otherwise indicated, sharing of neutral/grounded conductors among up to three single phase branch circuits of different phases installed in the same raceway is not permitted. Provide dedicated neutral/grounded conductor for each individual branch circuit.
- B. Install products in accordance with manufacturer's instructions.
- C. Perform work in accordance with NECA 1 (general workmanship).
- D. Installation in Raceway:
1. Tape ends of conductors and cables to prevent infiltration of moisture and other contaminants.
 2. Pull all conductors and cables together into raceway at same time.
 3. Do not damage conductors and cables or exceed manufacturer's recommended maximum pulling tension and sidewall pressure.
 4. Use suitable wire pulling lubricant where necessary, except when lubricant is not recommended by the manufacturer.
- E. Paralleled Conductors: Install conductors of the same length and terminate in the same manner.
- F. Secure and support conductors and cables in accordance with NFPA 70 using suitable supports and methods approved by the authority having jurisdiction. Provide independent support from building structure. Do not provide support from raceways, piping, ductwork, or other systems.
1. Installation Above Suspended Ceilings: Do not provide support from ceiling support system. Do not provide support from ceiling grid or allow conductors and cables to lay on ceiling tiles.
 2. Installation in Vertical Raceways: Provide supports where vertical rise exceeds permissible limits.
- G. Install conductors with a minimum of 12 inches (300 mm) of slack at each outlet.
- H. Where conductors are installed in enclosures for future termination by others, provide a minimum of 5 feet (1.5 m) of slack.
- I. Neatly train and bundle conductors inside boxes, wireways, panelboards and other equipment enclosures.

- J. Group or otherwise identify neutral/grounded conductors with associated ungrounded conductors inside enclosures in accordance with NFPA 70.
- K. Make wiring connections using specified wiring connectors.
 - 1. Make splices and taps only in accessible boxes. Do not pull splices into raceways or make splices in conduit bodies or wiring gutters.
 - 2. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors.
 - 3. Do not remove conductor strands to facilitate insertion into connector.
 - 4. Clean contact surfaces on conductors and connectors to suitable remove corrosion, oxides, and other contaminates. Do not use wire brush on plated connector surfaces.
 - 5. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.
 - 6. Compression Connectors: Secure connections using manufacturer's recommended tools and dies.
- L. Insulate splices and taps that are made with uninsulated connectors using methods suitable for the application, with insulation and mechanical strength at least equivalent to unspliced conductors.
- M. Insulate ends of spare conductors using vinyl insulating electrical tape.
- N. Field-Applied Color Coding: Where vinyl color coding electrical tape is used in lieu of integrally colored insulation as permitted in Part 2 under "Color Coding", apply half overlapping turns of tape at each termination and at each location conductors are accessible.
- O. Identify conductors and cables in accordance with Section 26 05 53.
- P. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 26 0010.
- Q. Unless specifically indicated to be excluded, provide final connections to all equipment and devices, including those furnished by others, as required for a complete operating system.
- R. Route wire and cable as required to meet project conditions.
 - 1. Wire and cable routing indicated is approximate unless dimensioned.
 - 2. Where wire and cable destination is indicated and routing is not shown, determine exact routing and lengths required.
 - 3. Include wire and cable of lengths required to install connected devices within 10 ft of location shown.
- S. Make splices, taps, and terminations to carry full ampacity of conductors with no perceptible temperature rise.

3.4 FIELD QUALITY CONTROL

- A. See Section 26 0010 - General Provisions, for additional requirements.

- B. Correct deficiencies and replace damaged or defective conductors and cables.

END OF SECTION

SECTION 26 05 26 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Grounding and bonding requirements.
- B. Conductors for grounding and bonding.
- C. Connectors for grounding and bonding.
- D. Ground bars.
- E. Grounding and bonding components, including grounding electrodes and conductors, equipment grounding conductors, and bonding to complete grounding system consisting of:
 - 1. Metal underground water pipe.
 - 2. Metal frame of building

1.2 RELATED REQUIREMENTS

- A. Section 26 05 19 - Low-Voltage Electrical Power Conductors and Cables: Additional requirements for conductors for grounding and bonding, including conductor color coding.
- B. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.

1.3 REFERENCE STANDARDS

- A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.
- B. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- C. UL 467 - Grounding and Bonding Equipment; Current Edition, Including All Revisions.

1.4 PERFORMANCE REQUIREMENTS

- A. Grounding system Resistance: 5 ohms maximum.

1.5 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Verify exact locations of underground metal water service pipe entrances to building.
 - 2. Coordinate the work with other trades to provide steel reinforcement complying with specified requirements for concrete-encased electrode.
 - 3. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Sequencing:

1. Do not install ground rod electrodes until final backfill and compaction is complete.

1.6 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.
- B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.
- C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.
- E. Products: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.1 GROUNDING AND BONDING REQUIREMENTS

- A. Do not use products for applications other than as permitted by NFPA 70 and product listing.
- B. Unless specifically indicated to be excluded, provide all required components, conductors, connectors, conduit, boxes, fittings, supports, accessories, etc. as necessary for a complete grounding and bonding system.
- C. Where conductor size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.
- D. Grounding for Separate Building or Structure Supplied by Feeder(s) or Branch Circuits:
 1. Provide grounding electrode system for each separate building or structure.
 2. Provide equipment grounding conductor routed with supply conductors.
 3. For each disconnecting means, provide grounding electrode conductor to connect equipment ground bus to grounding electrode system.
 4. Do not make any connections and remove any factory-installed jumpers between neutral (grounded) conductors and ground.
- E. Separately Derived System Grounding:
 1. Separately derived systems include, but are not limited to:
 - a. Transformers (except autotransformers such as buck-boost transformers).
 - b. Uninterruptible power supplies (UPS), when configured as separately derived systems.

- c. Generators, when neutral is switched in the transfer switch.
 - 2. Provide grounding electrode conductor to connect derived system grounded conductor to nearest effectively grounded metal building frame. Unless otherwise indicated, make connection at neutral (grounded) bus in source enclosure.
 - 3. Provide bonding jumper to connect derived system grounded conductor to nearest metal building frame and nearest metal water piping in the area served by the derived system, where not already used as a grounding electrode for the derived system. Make connection at same location as grounding electrode conductor connection.
 - 4. Provide system bonding jumper to connect system grounded conductor to equipment ground bus. Make connection at same location as grounding electrode conductor connection. Do not make any other connections between neutral (grounded) conductors and ground on load side of separately derived system disconnect.
 - 5. Where the source and first disconnecting means are in separate enclosures, provide supply-side bonding jumper between source and first disconnecting means.
- F. Bonding and Equipment Grounding:
- 1. Provide bonding for equipment grounding conductors, equipment ground busses, metallic equipment enclosures, metallic raceways and boxes, device grounding terminals, and other normally non-current-carrying conductive materials enclosing electrical conductors/equipment or likely to become energized as indicated and in accordance with NFPA 70.
 - 2. Provide insulated equipment grounding conductor in each feeder and branch circuit raceway. Do not use raceways as sole equipment grounding conductor.
 - 3. Where circuit conductor sizes are increased for voltage drop, increase size of equipment grounding conductor proportionally in accordance with NFPA 70.
 - 4. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.
 - 5. Terminate branch circuit equipment grounding conductors on solidly bonded equipment ground bus only. Do not terminate on neutral (grounded) or isolated/insulated ground bus.
 - 6. Provide bonding jumper across expansion or expansion/deflection fittings provided to accommodate conduit movement.
- G. Communications Systems Grounding and Bonding:
- 1. Provide intersystem bonding termination at service equipment or metering equipment enclosure and at disconnecting means for any additional buildings or structures in accordance with NFPA 70.
 - 2. Provide bonding jumper in raceway from intersystem bonding termination to each communications room or backboard and provide ground bar for termination.
 - a. Bonding Jumper Size: 6 AWG, unless otherwise indicated or required.
 - b. Raceway Size: 3/4 inch (21 mm) trade size unless otherwise indicated or required.
 - c. Ground Bar Size: 1/4 by 2 by 12 inches (6 by 50 by 300 mm) unless otherwise indicated or required.
 - d. Ground Bar Mounting Height: 18 inches (450 mm) above finished floor unless otherwise indicated.

2.2 GROUNDING AND BONDING COMPONENTS

A. General Requirements:

1. Provide products listed, classified, and labeled as suitable for the purpose intended.
 2. Provide products listed and labeled as complying with UL 467 where applicable.
- B. Conductors for Grounding and Bonding, in Addition to Requirements of Section 26 05 26:
1. Use insulated copper conductors unless otherwise indicated.
 2. Factory Pre-fabricated Bonding Jumpers: Furnished with factory-installed ferrules; size braided cables to provide equivalent gage of specified conductors.
- C. Connectors for Grounding and Bonding:
1. Description: Connectors appropriate for the application and suitable for the conductors and items to be connected; listed and labeled as complying with UL 467.
 2. Unless otherwise indicated, use exothermic welded connections for underground, concealed and other inaccessible connections.
 - a. Exceptions:
 - 1) Use mechanical connectors for connections to electrodes at ground access wells.
 3. Unless otherwise indicated, use mechanical connectors, compression connectors, or exothermic welded connections for accessible connections.
 - a. Exceptions:
 - 1) Use exothermic welded connections for connections to metal building frame.
- D. Ground Bars:
1. Description: Copper rectangular ground bars with mounting brackets and insulators.
 2. Size: As indicated.
 3. Holes for Connections: As indicated or as required for connections to be made.

2.3 CONNECTORS AND ACCESSORIES

- A. Mechanical Connectors (for indoor locations only): Bronze
1. Product by O.Z. Gedney or equivalent
- B. Exothermic Connections:
1. Product by Cadweld or equivalent.
- C. Wire: Stranded copper.
- D. Grounding Electrode Conductor: Size to meet NFPA 70 requirements. Minimum #2/0 bare copper interconnecting ground conductors.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that work likely to damage grounding and bonding system components has been completed.
- B. Verify that field measurements are as indicated.

- C. Verify that conditions are satisfactory for installation prior to starting work.
- D. Verify existing conditions prior to beginning work.
- E. Verify that final backfill and compaction has been completed before driving rod electrodes.

3.2 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Perform work in accordance with NECA 1 (general workmanship).
- C. Make grounding and bonding connections using specified connectors.
 - 1. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors. Do not remove conductor strands to facilitate insertion into connector.
 - 2. Remove nonconductive paint, enamel, or similar coating at threads, contact points, and contact surfaces.
 - 3. Exothermic Welds: Make connections using molds and weld material suitable for the items to be connected in accordance with manufacturer's recommendations.
 - 4. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.
 - 5. Compression Connectors: Secure connections using manufacturer's recommended tools and dies.
- D. Identify grounding and bonding system components in accordance with Section 26 05 53.
- E. Bond together each metallic raceway (2" and larger) , pipe, duct and other metal object entering equipment enclosures. Use 2 AWG bare copper conductor per NEC.
- F. General: Install electrical grounding systems where shown, in accordance with applicable portions of NEC, with NECA's "Standard of Installation", and in accordance with recognized industry practices to ensure that products comply with requirements and serve intended functions.
 - 1. Neutral conductors, cable shields, metallic conduits, cable terminations, junction boxes, and other non-current-carrying metallic parts of equipment shall be grounded.
 - 2. Equipment frames of metal-enclosed equipment, medium-voltage cable shields at cable joints and terminations, metal splice boxes, and other non-current-carrying metal items, shall be grounded unless otherwise indicated. Connections to earth shall be made in the same manner as required for neutral grounding. Equipment operating at more than 750 volts to ground shall be provided with grounds separate from secondary neutral grounds.
 - 3. Coordinate with other electrical work as necessary to interface installation of electrical grounding system with other work.
 - 4. Install clamp-on connectors only on thoroughly cleaned metal contact surfaces, to ensure electrical conductivity and circuit integrity.
- G. Equipotential Ground Plane: Bond concrete floor reinforcement and all exposed metal parts per NEC 547.10.

- H. Provide bonding to meet requirements described in Quality Assurance.
- I. Equipment Grounding Conductor: Provide separate, insulated conductor within each feeder and branch circuit. Terminate each end on suitable lug, bus, or bushing.
- J. Equipment Grounding Conductor: Provide separate, insulated copper equipment grounding conductor in all of the following runs listed below. Terminate each end on suitable lug, bus, or bushing. Where ground conductors are specified or required, conduit sizes shall be increased as necessary to meet the NEC conduit fill requirements.
 - 1. All new feeders.
 - 2. All new feeders run in existing raceways.
 - 3. All raceways for receptacle circuits, including special power receptacles.
 - 4. All surface raceways and multi-outlet assemblies containing power receptacle devices (i.e. Wiremold).
 - 5. All feeds to light fixtures.
 - 6. All motor feeders and branch circuits.
 - 7. All flexible metal conduit.
 - 8. All non-metallic raceways containing power conductors.
- K. Terminate each end of equipment ground conductors in an approved lug or bus or bushing.
- L. In general, equipment ground conductors are not indicated on the plans. Where ground conductors are required, conduit sizes shall be increased as required to comply with NEC conduit fill requirements.

3.3 FIELD QUALITY CONTROL

- A. See Section 01 40 00 - Quality Requirements, for additional requirements.
- B. Perform ground electrode resistance tests under normally dry conditions. Precipitation within the previous 48 hours does not constitute normally dry conditions.
- C. Investigate and correct deficiencies where measured ground resistances do not comply with specified requirements.
- D. Submit detailed reports indicating inspection and testing results and corrective actions taken.

END OF SECTION

SECTION 26 05 29 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Support and attachment requirements and components for equipment, conduit, cable, boxes, and other electrical work.
- B. Conduit and equipment supports.
- C. Anchors and fasteners.
- D. For communication cabling, see also specific sections.

1.2 RELATED REQUIREMENTS

- A. Section 03 30 00 - Cast-in-Place Concrete: Concrete equipment pads.
- B. Section 26 05 33.13 - Conduit for Electrical Systems: Additional support and attachment requirements for conduits.
- C. Section 26 05 33.16 - Boxes for Electrical Systems: Additional support and attachment requirements for boxes.
- D. Section 26 51 00 - Interior Lighting: Additional support and attachment requirements for interior luminaires.
- E. Section 26 56 00 - Exterior Lighting: Additional support and attachment requirements for exterior luminaires.
- F. Section 27 1020 - Cabling for Voice/Data Systems-CAT 6

1.3 REFERENCE STANDARDS

- A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.
- B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2016a.
- C. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel; 2015.
- D. MFMA-4 - Metal Framing Standards Publication; 2004.
- E. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.
- F. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- G. UL 5B - Strut-Type Channel Raceways and Fittings; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate sizes and arrangement of supports and bases with the actual equipment and components to be installed.
2. Coordinate the work with other trades to provide additional framing and materials required for installation.
3. Coordinate compatibility of support and attachment components with mounting surfaces at the installed locations.
4. Coordinate the arrangement of supports with ductwork, piping, equipment and other potential conflicts installed under other sections or by others.
5. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.5 QUALITY ASSURANCE

A. Comply with NFPA 70.

B. Comply with applicable building code.

PART 2 PRODUCTS

2.1 SUPPORT AND ATTACHMENT COMPONENTS

A. General Requirements:

1. Provide all required hangers, supports, anchors, fasteners, fittings, accessories, and hardware as necessary for the complete installation of electrical work.
2. Provide products listed, classified, and labeled as suitable for the purpose intended, where applicable.
3. Where support and attachment component types and sizes are not indicated, select in accordance with manufacturer's application criteria as required for the load to be supported with a minimum safety factor of 25%. Include consideration for vibration, equipment operation, and shock loads where applicable.
4. Do not use products for applications other than as permitted by NFPA 70 and product listing.
5. Steel Components: Use corrosion resistant materials suitable for the environment where installed.
 - a. Indoor Dry Locations: Use zinc-plated steel or approved equivalent unless otherwise indicated.
 - b. Outdoor and Damp or Wet Indoor Locations: Use galvanized steel, stainless steel, or approved equivalent unless otherwise indicated.
 - c. Zinc-Plated Steel: Electroplated in accordance with ASTM B633.
 - d. Galvanized Steel: Hot-dip galvanized after fabrication in accordance with ASTM A123/A123M or ASTM A153/A153M.

B. Conduit and Cable Supports: Straps, clamps, etc. suitable for the conduit or cable to be supported.

1. Conduit Straps: One-hole or two-hole type; steel or malleable iron.
2. Conduit Clamps: Bolted type unless otherwise indicated.
3. Manufacturers:
 - a. Cooper Crouse-Hinds, a division of Eaton Corporation: www.cooperindustries.com.
 - b. Erico International Corporation: www.erico.com.
 - c. O-Z/Gedney, a brand of Emerson Industrial Automation: www.emersonindustrial.com.
 - d. Thomas & Betts Corporation: www.tnb.com.
 - e. Or equal.
- C. Steel Spring Clips:
 1. Product: Caddy or equivalent.
 2. Use only in concealed locations (i.e. above ceilings, within walls, etc.)
- D. Supports: Fabricated of structural steel or formed steel members; galvanized or painted, as required.
- E. Outlet Box Supports: Hangers, brackets, etc. suitable for the boxes to be supported.
- F. Metal Channel (Strut) Framing Systems: Factory-fabricated continuous-slot metal channel (strut) and associated fittings, accessories, and hardware required for field-assembly of supports.
 1. Comply with MFMA-4.
 2. Channel (Strut) Used as Raceway (only where specifically indicated): Listed and labeled as complying with UL 5B.
 3. Channel Material:
 - a. Indoor Dry Locations: Use painted steel, zinc-plated steel, or galvanized steel.
 - b. Outdoor and Damp or Wet Indoor Locations: Use galvanized steel.
 4. Minimum Channel Thickness: Steel sheet, 12 gage, 0.1046 inch (2.66 mm).
 5. Minimum Channel Dimensions: 1-5/8 inch (41 mm) width by 13/16 inch (21 mm) height.
 6. Manufacturers:
 - a. Cooper B-Line, a division of Eaton Corporation: www.cooperindustries.com.
 - b. Thomas & Betts Corporation: www.tnb.com.
 - c. Unistrut, a brand of Atkore International Inc: www.unistrut.com.
 - d. Or equal.
- G. Hanger Rods: Threaded zinc-plated steel unless otherwise indicated.
 1. Minimum Size, Unless Otherwise Indicated or Required:
 - a. Equipment Supports: 1/2 inch (13 mm) diameter.
 - b. Busway Supports: 1/2 inch (13 mm) diameter.
 - c. Single Conduit up to 1 inch (27 mm) trade size: 1/4 inch (6 mm) diameter.
 - d. Single Conduit larger than 1 inch (27 mm) trade size: 3/8 inch (10 mm) diameter.
 - e. Trapeze Support for Multiple Conduits: 3/8 inch (10 mm) diameter.
 - f. Outlet Boxes: 1/4 inch (6 mm) diameter.
 - g. Luminaires: 1/4 inch (6 mm) diameter.
- H. Anchors and Fasteners:

1. Unless otherwise indicated and where not otherwise restricted, use the anchor and fastener types indicated for the specified applications.
2. Concrete: Use preset concrete inserts, expansion anchors, or screw anchors.
3. Solid or Grout-Filled Masonry: Use expansion anchors or screw anchors.
4. Hollow Masonry: Use toggle bolts.
5. Hollow Stud Walls: Use toggle bolts.
6. Steel: Use beam clamps, machine bolts, or welded threaded studs.
7. Sheet Metal: Use sheet metal screws.
8. Wood: Use wood screws.
9. Plastic and lead anchors are not permitted.
10. Preset Concrete Inserts: Continuous metal channel (strut) and spot inserts specifically designed to be cast in concrete ceilings, walls, and floors.
 - a. Comply with MFMA-4.
 - b. Channel Material: Use galvanized steel.
 - c. Manufacturer: Same as manufacturer of metal channel (strut) framing system.
11. Post-Installed Concrete and Masonry Anchors: Evaluated and recognized by ICC Evaluation Service, LLC (ICC-ES) for compliance with applicable building code.
12. Manufacturers - Mechanical Anchors:
 - a. Hilti, Inc: www.us.hilti.com.
 - b. ITW Red Head, a division of Illinois Tool Works, Inc: www.itwredhead.com.
 - c. Powers Fasteners, Inc: www.powers.com.
 - d. Simpson Strong-Tie Company Inc: www.strongtie.com.
 - e. Or equal.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Perform work in accordance with NECA 1 (general workmanship).
- C. Install anchors and fasteners in accordance with ICC Evaluation Services, LLC (ICC-ES) evaluation report conditions of use where applicable.
- D. Install hangers and supports as required to adequately and securely support electrical system components, in a neat and workmanlike manner, as specified in NECA 1.
 1. Do not drill or cut structural members, unless specifically approved in writing by Structural Engineer.
- E. Rigidly weld support members or use hexagon-head bolts to present neat appearance with adequate strength and rigidity. Use spring lock washers under all nuts.
- F. Install surface-mounted cabinets and panelboards with minimum of four anchors.

- G. In wet and damp locations, use steel channel supports to stand cabinets and panelboards 1 inch (25 mm) off wall.
- H. All supports shall be securely positioned to the structure, not equipment or ceiling tile supports. Coordinate structure load capabilities with General Contractor.
- I. Use sheet metal channel to bridge studs above and below cabinets and panelboards recessed in hollow partitions.
- J. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.
- K. Unless specifically indicated or approved by Architect, do not provide support from suspended ceiling support system or ceiling grid.
- L. Unless specifically indicated or approved by Architect, do not provide support from roof deck.
- M. Do not penetrate or otherwise notch or cut structural members without approval of Structural Engineer.
- N. Equipment Support and Attachment:
 - 1. Use metal fabricated supports or supports assembled from metal channel (strut) to support equipment as required.
 - 2. Use metal channel (strut) secured to studs to support equipment surface-mounted on hollow stud walls when wall strength is not sufficient to resist pull-out.
 - 3. Use metal channel (strut) to support surface-mounted equipment in wet or damp locations to provide space between equipment and mounting surface.
 - 4. Use metal channel (strut) mounted securely to walls to support surface-mounted panelboards and disconnects.
 - 5. Unless otherwise indicated, mount floor-mounted equipment on properly sized 3 inch (80 mm) high concrete pad constructed in accordance with Section 03 30 00.
 - 6. Securely fasten floor-mounted equipment. Do not install equipment such that it relies on its own weight for support.
- O. Conduit Support and Attachment: Also comply with Section 26 05 33.13.
- P. Box Support and Attachment: Also comply with Section 26 05 33.16.
- Q. Interior Luminaire Support and Attachment: Also comply with Section 26 51 00.
- R. Preset Concrete Inserts: Use manufacturer provided closure strips to inhibit concrete seepage during concrete pour.
- S. Secure fasteners according to manufacturer's recommended torque settings.
- T. Remove temporary supports.

3.2 FIELD QUALITY CONTROL

- A. See Section 01 40 00 - Quality Requirements, for additional requirements.

- B. Inspect support and attachment components for damage and defects.
- C. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer.
Replace components that exhibit signs of corrosion.
- D. Correct deficiencies and replace damaged or defective support and attachment components.

END OF SECTION

SECTION 26 05 33.13 - CONDUIT FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Galvanized steel rigid metal conduit (RMC).
- B. Intermediate metal conduit (IMC).
- C. PVC-coated galvanized steel rigid metal conduit (RMC).
- D. Flexible metal conduit (FMC).
- E. Liquidtight flexible metal conduit (LFMC).
- F. Electrical metallic tubing (EMT).
- G. Rigid polyvinyl chloride (PVC) conduit.
- H. Reinforced thermosetting resin conduit (RTRC).
- I. Conduit fittings.
- J. Accessories.

1.2 RELATED REQUIREMENTS

- A. Section 07 84 00 - Firestopping.
- B. Section 26 00 50 - Firestopping.
- C. Section 26 05 26 - Grounding and Bonding for Electrical Systems.
 - 1. Includes additional requirements for fittings for grounding and bonding.
- D. Section 26 05 29 - Hangers and Supports for Electrical Systems.
- E. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.

1.3 REFERENCE STANDARDS

- A. ANSI C80.1 - American National Standard for Electrical Rigid Steel Conduit (ERSC); 2015.
- B. ANSI C80.3 - American National Standard for Electrical Metallic Tubing -- Steel (EMT-S); 2015.
- C. ANSI C80.6 - American National Standard for Electrical Intermediate Metal Conduit (EIMC); 2005.
- D. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.
- E. NECA 101 - Standard for Installing Steel Conduits (Rigid, IMC, EMT); 2013.
- F. NECA 102 - Standard for Installing Aluminum Rigid Metal Conduit; 2004.

- G. NECA 111 - Standard for Installing Nonmetallic Raceways (RNC, ENT, LFNC); 2003.
- H. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable; 2014.
- I. NEMA RN 1 - Polyvinyl-Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit; 2018.
- J. NEMA TC 2 - Electrical Polyvinyl Chloride (PVC) Conduit; 2013.
- K. NEMA TC 3 - Polyvinyl Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing; 2016.
- L. NEMA TC 14 (SERIES) - Reinforced Thermosetting Resin Conduit and Fittings Series; 2015.
- M. NEMA TC 14.AG - Aboveground Reinforced Thermosetting Resin Conduit (RTRC) and Fittings; 2015.
- N. NEMA TC 14.BG - Belowground Reinforced Thermosetting Resin Conduit (RTRC) and Fittings; 2015.
- O. NEMA TC 14.XW - Extra Heavy Wall Aboveground Reinforced Thermosetting Resin Conduit (RTRC) and Fittings; 2015.
- P. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- Q. UL 1 - Flexible Metal Conduit; Current Edition, Including All Revisions.
- R. UL 6 - Electrical Rigid Metal Conduit-Steel; Current Edition, Including All Revisions.
- S. UL 6A - Electrical Rigid Metal Conduit-Aluminum, Red Brass, and Stainless Steel; Current Edition, Including All Revisions.
- T. UL 360 - Liquid-Tight Flexible Steel Conduit; Current Edition, Including All Revisions.
- U. UL 514B - Conduit, Tubing, and Cable Fittings; Current Edition, Including All Revisions.
- V. UL 651 - Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings; Current Edition, Including All Revisions.
- W. UL 797 - Electrical Metallic Tubing-Steel; Current Edition, Including All Revisions.
- X. UL 1242 - Electrical Intermediate Metal Conduit-Steel; Current Edition, Including All Revisions.
- Y. UL 2420 - Belowground Reinforced Thermosetting Resin Conduit (RTRC) and Fittings; Current Edition, Including All Revisions.
- Z. UL 2515 - Aboveground Reinforced Thermosetting Resin Conduit (RTRC) and Fittings; Current Edition, Including All Revisions.
- AA. UL 2515A - Standard for Supplemental Requirements for Extra Heavy Wall Reinforced Thermosetting Resin Conduit (RTRC) and Fittings; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:

1. Coordinate minimum sizes of conduits with the actual conductors to be installed, including adjustments for conductor sizes increased for voltage drop.
2. Coordinate the arrangement of conduits with structural members, ductwork, piping, equipment and other potential conflicts installed under other sections or by others.
3. Verify exact conduit termination locations required for boxes, enclosures, and equipment installed under other sections or by others.
4. Coordinate the work with other trades to provide roof penetrations that preserve the integrity of the roofing system and do not void the roof warranty.
5. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Sequencing:

1. Do not begin installation of conductors and cables until installation of conduit is complete between outlet, junction and splicing points.

1.5 SUBMITTALS

- A. There are no shop drawing submittals required for this section.
- B. Project Record Documents: Accurately record actual routing of conduits 2 inches (51 mm) or larger.

1.6 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store conduit and fittings in accordance with manufacturer's instructions.
- B. Protect PVC conduit from sunlight.
- C. Protect conduit from corrosion and entrance of debris by storing above grade. Provide appropriate covering.

PART 2 PRODUCTS

2.1 CONDUIT APPLICATIONS

- A. All conductors and cabling installed as part of this project shall be installed in conduit or other approved raceway system. No open wiring methods will be acceptable for this project unless specifically noted on plans.
- B. Do not use conduit and associated fittings for applications other than as permitted by NFPA 70 and product listing.
- C. Unless otherwise indicated and where not otherwise restricted, use the conduit types indicated for the specified applications. Where more than one listed application applies, comply with the most restrictive

requirements. Where conduit type for a particular application is not specified, use galvanized steel rigid metal conduit.

D. Underground:

1. Under Slab on Grade: Use thinwall non-metallic conduit.
2. Exterior, Direct-Buried: Use PVC-coated galvanized steel rigid metal conduit or rigid PVC conduit.
3. Where conduit passes through concrete: Use PVC-coated galvanized steel rigid metal conduit.
4. Where rigid polyvinyl (PVC) or thin wall polyvinyl (PVC) is placed underground, use PVC-coated galvanized steel rigid metal conduit elbows or [reinforced thermosetting resin conduit (RTRC) elbows] for bends to turn up and use PVC-coated galvanized steel rigid metal conduit to extend to 2 inches above grade. Use galvanized steel rigid metal conduit once above grade.
5. Where rigid polyvinyl (PVC) conduit is provided, use PVC-coated galvanized steel rigid metal conduit elbows or reinforced thermosetting resin conduit (RTRC) elbows for bends.
6. Where steel conduit emerges from concrete into soil, use corrosion protection tape to provide supplementary corrosion protection for a minimum of 4 inches (100 mm) on either side of where conduit emerges or use PVC-coated galvanized steel rigid metal conduit.
7. Through floor risers shall be rigid metal conduit.
8. Minimum Size: 3/4 inch (19 mm).

E. Embedded Within Concrete:

1. Within Slab on Grade: Not permitted.
2. Within Slab Above Ground: Not permitted.

F. Concealed Within Masonry Walls: Use electrical metallic tubing (EMT).

G. Concealed Within Hollow Stud Walls: Use electrical metallic tubing (EMT).

H. Concealed Above Accessible Ceilings: Use electrical metallic tubing (EMT).

I. Interior, Damp or Wet Locations: Use galvanized steel rigid metal conduit or intermediate metal conduit (IMC).

1. Liquid tight conduit with liquid tight fittings shall be used in pump rooms, kitchens, wells, sump pits, transformer connections, and other areas of moisture content

J. Exposed, Interior, Not Subject to Physical Damage: Use electrical metallic tubing (EMT).

K. Exposed, Interior, Subject to Physical Damage: Use galvanized steel rigid metal conduit or intermediate metal conduit (IMC).

1. Locations subject to physical damage include, but are not limited to:
 - a. Where exposed below 8 feet (2.4 m), except within electrical and communication rooms or closets.
 - b. Where exposed below 20 feet (6.1 m) in warehouse and maintenance areas of the Maintenance Support Facility as well as other shop, storage, and tunnel areas.

L. Exposed, Exterior: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), or PVC-coated galvanized steel rigid metal conduit.

- M. Concealed, Exterior, not embedded in Concrete or in Contact With Earth: Use galvanized steel rigid metal conduit.
- N. Connections to Luminaires Above Accessible Ceilings: Use flexible metal conduit.
 - 1. Maximum Length: 6 feet (1.8 m).
- O. Connections to Vibrating Equipment:
 - 1. Dry Locations: Use liquidtight flexible metal conduit.
 - 2. Damp, Wet, or Corrosive Locations: Use liquidtight flexible metal conduit.
 - 3. Maximum Length: 6 feet (1.8 m) unless otherwise indicated.
 - 4. Vibrating equipment includes, but is not limited to:
 - a. Transformers.
 - b. Motors.
- P. Fished in Existing Walls, Where Necessary: Use flexible metal conduit.

2.2 CONDUIT REQUIREMENTS

- A. Existing Work: Where existing conduits are indicated to be reused, they may be reused only where they comply with specified requirements, are free from corrosion, and integrity is verified by pulling a mandrel through them.
- B. Security System Conduits: Provide conduits complying with this specification section for all security system cable installed as part of this project.
- C. Fittings for Grounding and Bonding: Also comply with Section 26 05 26.
- D. Provide all conduit, fittings, supports, and accessories required for a complete raceway system.
- E. Provide products listed, classified, and labeled as suitable for the purpose intended.
- F. Minimum Conduit Size, Unless Otherwise Indicated:
 - 1. Branch Circuits: 1/2 inch (16 mm) trade size.
 - 2. Branch Circuit Homeruns: 3/4 inch (21 mm) trade size.
 - 3. Minimum Size: data/voice/security conduits - 3/4 inch unless noted otherwise under specific section or noted on plans.
- G. Where conduit size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

2.3 GALVANIZED STEEL RIGID METAL CONDUIT (RMC)

- A. Manufacturers: Republic Steel Company, Youngstown, Triangle, Allied, Wheatland, or approved equivalent.
- B. Description: NFPA 70, Type RMC galvanized steel rigid metal conduit complying with ANSI C80.1 and listed and labeled as complying with UL 6.

C. Fittings:

1. Non-Hazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
2. Material: Use steel or malleable iron.
 - a. Do not use die cast zinc fittings.
3. Connectors and Couplings: Use threaded type fittings only. Threadless set screw and compression (gland) type fittings are not permitted.
4. All connectors shall have insulated throats.

2.4 INTERMEDIATE METAL CONDUIT (IMC)

- A. Description: NFPA 70, Type IMC galvanized steel intermediate metal conduit complying with ANSI C80.6 and listed and labeled as complying with UL 1242.

B. Fittings:

1. Non-Hazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
2. Material: Use steel or malleable iron.
3. Connectors and Couplings: Use threaded type fittings only. Threadless set screw and compression (gland) type fittings are not permitted.

2.5 PVC-COATED GALVANIZED STEEL RIGID METAL CONDUIT (RMC)

- A. Manufacturers: Allied, Robroy Industries or approved equivalent.

- B. Description: NFPA 70, Type RMC galvanized steel rigid metal conduit with external polyvinyl chloride (PVC) coating complying with NEMA RN 1 and listed and labeled as complying with UL 6.

- C. Exterior Coating: Polyvinyl chloride (PVC), nominal thickness of 40 mil (1.02 mm).

D. PVC-Coated Fittings:

1. Manufacturer: Same as manufacturer of PVC-coated conduit to be installed.
2. Non-Hazardous Locations: Use fittings listed and labeled as complying with UL 514B.
3. Material: Use steel or malleable iron.
4. Exterior Coating: Polyvinyl chloride (PVC), minimum thickness of 40 mil (1.02 mm).

- E. PVC-Coated Supports: Furnish with exterior coating of polyvinyl chloride (PVC), minimum thickness of 15 mil (0.38 mm).

2.6 FLEXIBLE METAL CONDUIT (FMC)

A. Manufacturers:

1. AFC, Electri-flex, International Metal Hose.

- B. Description: NFPA 70, Type FMC standard wall steel flexible metal conduit listed and labeled as complying with UL 1, and listed for use in classified firestop systems to be used.
- C. Fittings:
 - 1. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
 - 2. Material: Use steel or malleable iron.
 - a. Do not use die cast zinc fittings.
 - 3. All connectors shall have insulated throats.

2.7 LIQUIDTIGHT FLEXIBLE METAL CONDUIT (LFMC)

- A. Manufacturers: Anaconda, Liqueflex, or Electri-Flex or approved equivalent.
 - 1. AFC, Electri-flex, International Metal Hose.
- B. Description: NFPA 70, Type LFMC polyvinyl chloride (PVC) jacketed steel flexible metal conduit listed and labeled as complying with UL 360.
- C. Fittings:
 - 1. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
 - 2. Material: Use steel or malleable iron.
 - a. Do not use die cast zinc fittings.
 - 3. All connectors shall have insulated throats.

2.8 ELECTRICAL METALLIC TUBING (EMT)

- A. Manufacturers:
 - 1. AFC, Electri-flex, International Metal Hose.
- B. Description: NFPA 70, Type EMT steel electrical metallic tubing complying with ANSI C80.3 and listed and labeled as complying with UL 797.
- C. Fittings:
 - 1. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
 - 2. Material: Use steel or malleable iron.
 - a. Do not use die cast zinc fittings.
 - 3. Connectors and Couplings: Use compression (gland) or set-screw type.
 - a. Do not use indenter type connectors and couplings.
 - 4. All connectors shall have insulated throats.

2.9 RIGID POLYVINYL CHLORIDE (PVC) CONDUIT

- A. Manufacturers: Cantex, Carlon, Triangle, Johns-Manville or approved equivalent.
- B. Description: NFPA 70, Type PVC rigid polyvinyl chloride conduit complying with NEMA TC 2 and listed and labeled as complying with UL 651; Schedule 40 unless otherwise indicated, Schedule 80 where subject to physical damage; rated for use with conductors rated 90 degrees C.
- C. Fittings:
 - 1. Manufacturer: Same as manufacturer of conduit to be connected.
 - 2. Description: Fittings complying with NEMA TC 3 and listed and labeled as complying with UL 651; material to match conduit.
- D. Provide equipment grounding conductor. Adjust conduit size accordingly.

2.10 REINFORCED THERMOSETTING RESIN CONDUIT (RTRC)

- A. Manufacturers:
 - 1. Champion Fiberglass, Inc; _____: www.championfiberglass.com.
 - 2. FRE Composites; _____: www.frecompositesinc.com
 - 3. United Fiberglass of America, Inc; _____: www.unitedfiberglass.com
- B. Description: NFPA 70, Type RTRC reinforced thermosetting resin conduit complying with NEMA TC 14 (SERIES).
 - 1. Belowground (BG) RTRC: Comply with NEMA TC 14.BG and list and label as complying with UL 2420.
- C. Supports: Per manufacturer's recommendations.
- D. Fittings: Same type and manufacturer as conduit to be connected.
 - 1. Cement- and Water-Tight Joints: Use adhesive and manufacturer's standard gaskets.

2.11 ACCESSORIES

- A. Corrosion Protection Tape: PVC-based, minimum thickness of 20 mil (0.51 mm).
- B. Conduit Joint Compound: Corrosion-resistant, electrically conductive; suitable for use with the conduit to be installed.
- C. Solvent Cement for PVC Conduit and Fittings: As recommended by manufacturer of conduit and fittings to be installed.
- D. Epoxy Adhesive for RTRC Conduit and Fittings: As recommended by manufacturer of conduit and fittings to be installed.
- E. Pull Strings: Use nylon cord with average breaking strength of not less than 200 pound-force (890 N).

- F. Sealing Compound for Sealing Fittings: Listed for use with the particular fittings to be installed.
- G. Modular Seals for Conduit Penetrations: Rated for minimum of 40 psig; Suitable for the conduits to be installed.
 - 1. Provide sealed fittings in conduits transitioning from conditioned areas to non-conditioned areas.
 - 2. Seal conduits that route from inside to outside building.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that mounting surfaces are ready to receive conduits.
- C. Verify that conditions are satisfactory for installation prior to starting work.
- D. Verify routing and termination locations of conduit prior to rough-in.
- E. Conduit routing is shown on drawings in approximate locations unless dimensioned. Route as required to complete wiring system.

3.2 INSTALLATION

- A. At contractor's option, existing conduit in remodeled areas may be reused for new branch circuits and feeders where practical, and as noted on the plans. Existing conduits shall meet all requirements for new conduit as specified herein, and shall be warranted as new by the contractor.
- B. Install products in accordance with manufacturer's instructions.
- C. Perform work in accordance with NECA 1 (general workmanship).
- D. Install galvanized steel rigid metal conduit (RMC) in accordance with NECA 101.
- E. Install aluminum rigid metal conduit (RMC) in accordance with NECA 102.
- F. Install intermediate metal conduit (IMC) in accordance with NECA 101.
- G. Install PVC-coated galvanized steel rigid metal conduit (RMC) using only tools approved by the manufacturer.
- H. Install rigid polyvinyl chloride (PVC) conduit in accordance with NECA 111.
- I. Install nonmetallic conduit in accordance with manufacturer's instructions.
 - 1. For all nonmetallic conduit runs 2 inch trade size and larger, all sweeps shall be of galvanized rigid construction. If sweeps are underground, sweeps shall be PVC coated rigid steel or fiberglass..
- J. Cut conduit square using saw or pipecutter; de-burr cut ends.
- K. Bring conduit to shoulder of fittings; fasten securely.

- L. Join nonmetallic conduit using cement as recommended by manufacturer. Wipe nonmetallic conduit dry and clean before joining. Apply full even coat of cement to entire area inserted in fitting. Allow joint to cure for 20 minutes, minimum.
- M. Use conduit hubs or sealing locknuts to fasten conduit to sheet metal boxes in damp and wet locations.
- N. Install no more than equivalent of three 90 degree bends between boxes. Use conduit bodies to make sharp changes in direction, as around beams. Use hydraulic one shot bender to fabricate bends in metal conduit larger than 2 inch (50 mm) size. Runs that require more than three 90 degree bends shall be brought to the attention of the Engineer.
- O. Avoid moisture traps; provide junction box with drain fitting at low points in conduit system.
- P. Provide suitable pull string in each empty conduit except sleeves and nipples.
- Q. Use suitable caps to protect installed conduit against entrance of dirt and moisture.
- R. Conduit Routing:
 - 1. Unless dimensioned, conduit routing indicated is diagrammatic.
 - 2. When conduit destination is indicated without specific routing, determine exact routing required.
 - 3. Conceal all conduits unless specifically indicated to be exposed.
 - 4. Unless otherwise approved, do not route conduits exposed:
 - a. Across floors.
 - b. Across roofs.
 - c. Across top of parapet walls.
 - d. Across building exterior surfaces.
 - 5. Conduits installed underground may be routed in the shortest possible manner unless otherwise indicated. Route all other conduits parallel or perpendicular to building structure and surfaces, following surface contours where practical.
 - 6. Arrange conduit to maintain adequate headroom, clearances, and access.
 - 7. Arrange conduit to provide no more than the equivalent of four 90 degree bends between pull points.
 - 8. Arrange conduit to provide no more than 150 feet (46 m) between pull points.
 - 9. Route conduits above water and drain piping where possible.
 - 10. Arrange conduit to prevent moisture traps. Provide drain fittings at low points and at sealing fittings where moisture may collect.
 - 11. Maintain minimum clearance of 6 inches (150 mm) between conduits and piping for other systems.
 - 12. Maintain minimum clearance of 12 inches (300 mm) between conduits and hot surfaces. This includes, but is not limited to:
 - a. Heaters.
 - b. Hot water piping.
 - c. Flues.
 - 13. Group parallel conduits in the same area together on a common rack.

14. Service conduits for basement gear (below grade) shall enter the building outside the footprint of the gear, shall be routed with conduits sloping up from the transformer, and shall have a pull box with sweep holes located outside gear footprint. Bottom entry is not acceptable.
15. Provide conduits and junction boxes at each door frame opening for door position switch(es); card reader; electrified hardware; etc per details on plans. For information related to electrified hardware and its' associated power supply refer to Section 08710.
16. Conduit shall be installed as high as possible & up in joist space as tight to structure or deck as NEC allows. Verify with architect, engineer, & other trades for mounting height and routing of conduits prior to installation.
17. Route exposed conduit parallel and perpendicular to walls.
18. Route conduit installed above accessible ceilings parallel and perpendicular to walls.
19. Route conduit under slab, and underground from point-to-point.
20. No conduit shall be run within concrete slabs unless specifically noted otherwise.
21. Maintain adequate clearance between conduit and piping.
22. Maintain 12 inch (300 mm) clearance between conduit and surfaces with temperatures exceeding 104 degrees F (40 degrees C).

S. Conduit Support:

1. Secure and support conduits in accordance with NFPA 70 and Section 26 05 29 using suitable supports and methods approved by the authority having jurisdiction.
2. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.
3. Installation Above Suspended Ceilings: Do not provide support from ceiling support system. Do not provide support from ceiling grid or allow conduits to lay on ceiling tiles.
4. Use conduit strap to support single surface-mounted conduit.
 - a. Use clamp back spacer with conduit strap for damp and wet locations to provide space between conduit and mounting surface.
5. Use metal channel (strut) with accessory conduit clamps to support multiple parallel surface-mounted conduits.
6. Use trapeze hangers assembled from threaded rods and metal channel (strut) with accessory conduit clamps to support multiple parallel suspended conduits.
7. Use of spring steel conduit clips for support of conduits is not permitted.
8. Use of wire for support of conduits is not permitted.
9. Where conduit support intervals specified in NFPA 70 and NECA standards differ, comply with the most stringent requirements.
10. Do not support conduit with wire or perforated pipe straps. Remove wire used for temporary supports.
11. Arrange supports to prevent misalignment during wiring installation.
12. Group related conduits; support using conduit rack. Construct rack using steel channel ; provide space on each for 25 percent additional conduits.

T. Connections and Terminations:

1. Use approved zinc-rich paint or conduit joint compound on field-cut threads of galvanized steel conduits prior to making connections.
2. Where two threaded conduits must be joined and neither can be rotated, use three-piece couplings or split couplings. Do not use running threads.
3. Use suitable adapters where required to transition from one type of conduit to another.
4. Provide drip loops for liquidtight flexible conduit connections to prevent drainage of liquid into connectors.
5. Terminate threaded conduits in boxes and enclosures using threaded hubs or double lock nuts for dry locations and raintight hubs for wet locations.
6. Where spare conduits stub up through concrete floors and are not terminated in a box or enclosure, provide threaded couplings equipped with threaded plugs set flush with finished floor.
7. Provide insulating bushings or insulated throats at all conduit terminations to protect conductors.
8. Secure joints and connections to provide maximum mechanical strength and electrical continuity.

U. Penetrations:

1. Do not penetrate or otherwise notch or cut structural members, including footings and grade beams, without approval of Structural Engineer.
2. Make penetrations perpendicular to surfaces unless otherwise indicated.
3. Provide sleeves for penetrations as indicated or as required to facilitate installation. Set sleeves flush with exposed surfaces unless otherwise indicated or required.
4. Conceal bends for conduit risers emerging above ground.
5. Seal interior of conduits entering the building from underground at first accessible point to prevent entry of moisture and gases.
6. Where conduits penetrate waterproof membrane, seal as required to maintain integrity of membrane.
7. Make penetrations for roof-mounted equipment within associated equipment openings and curbs where possible to minimize roofing system penetrations. Where penetrations are necessary, seal as indicated or as required to preserve integrity of roofing system and maintain roof warranty. Include proposed locations of penetrations and methods for sealing with submittals.
 - a. Sealing shall be rubber boot system. Caulking around opening only is not acceptable.
8. Provide metal escutcheon plates for conduit penetrations exposed to public view.
9. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 84 00 and/or Section 26 0050
10. Where conduits pass through exterior walls or roofs, Contractor shall seal penetrations with materials outlined in Section 07 9200.
11. Where conduits pass through smoke or fire rated walls Contractor shall seal penetrations with appropriate smoke and/or fire rated materials as outlined in Section 07 8400 and/or Section 26 0050.

V. Underground Installation:

1. Provide trenching and backfilling in accordance with Section 26 05 10 Trenching for Site Utilities.
 2. Minimum Cover, Unless Otherwise Indicated or Required:
 - a. Underground, Exterior: 24 inches (610 mm).
 - b. Under Slab on Grade: 12 inches (300 mm) to bottom of slab.
 3. Provide underground warning tape in accordance with Section 26 05 53 along entire conduit length for service entrance where not concrete-encased.
- W. Hazardous (Classified) Locations: Where conduits cross boundaries of hazardous (classified) locations, provide sealing fittings located as indicated or in accordance with NFPA 70.
- X. Conduit Movement Provisions: Where conduits are subject to movement, provide expansion and expansion/deflection fittings to prevent damage to enclosed conductors or connected equipment. This includes, but is not limited to:
1. Where conduits cross structural joints intended for expansion, contraction, or deflection.
 2. Where calculated in accordance with NFPA 70 for rigid polyvinyl chloride (PVC) conduit installed above ground to compensate for thermal expansion and contraction.
 3. Where calculated in accordance with NFPA 70 for reinforced thermosetting resin conduit (RTRC) conduit installed above ground to compensate for thermal expansion and contraction.
 4. Where conduits are subject to earth movement by settlement or frost.
- Y. Condensation Prevention: Where conduits cross barriers between areas of potential substantial temperature differential, provide sealing fitting or approved sealing compound at an accessible point near the penetration to prevent condensation. This includes, but is not limited to:
1. Where conduits pass from outdoors into conditioned interior spaces.
 2. Where conduits pass from unconditioned interior spaces into conditioned interior spaces.
- Z. Provide pull string in all empty conduits and in conduits where conductors and cables are to be installed by others. Leave minimum slack of 12 inches (300 mm) at each end.
- AA. Provide grounding and bonding in accordance with Section 26 05 26.
- AB. Identify conduits in accordance with Section 26 05 53.
- AC. All conduits to cable trays shall be bonded to the cable tray.
- AD. Provide conduit seals where raceway enters the building from underground. Seal in accordance with NEC requirements.
- AE. Provide suitable fittings to accommodate expansion and deflection where conduit crosses expansion joints.
- AF. Provide grounding bushings on all conduits 2" and larger.
- AG. Flexible metal conduit shall not be used in lengths longer than six feet.

3.3 FIELD QUALITY CONTROL

- A. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.
- B. Where coating of PVC-coated galvanized steel rigid metal conduit (RMC) contains cuts or abrasions, repair in accordance with manufacturer's instructions.
- C. Correct deficiencies and replace damaged or defective conduits.

3.4 CLEANING

- A. Clean interior of conduits to remove moisture and foreign matter.

3.5 PROTECTION

- A. Immediately after installation of conduit, use suitable manufactured plugs to provide protection from entry of moisture and foreign material and do not remove until ready for installation of conductors.

3.6 INTERFACE WITH OTHER PRODUCTS

- A. Install conduit to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 26 0050.
- B. Route conduit through roof openings for piping and ductwork wherever possible. Where separate roofing penetration is required, coordinate location and installation method with roofing installation

END OF SECTION

SECTION 26 05 33.16 - BOXES FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Outlet and device boxes up to 100 cubic inches (1,650 cu cm), including those used as junction and pull boxes.
- B. Cabinets and enclosures, including junction and pull boxes larger than 100 cubic inches (1,650 cu cm).
- C. Wall and ceiling outlet boxes.
- D. Pull and junction boxes.

1.2 RELATED REQUIREMENTS

- A. Section 26 05 26 - Grounding and Bonding for Electrical Systems.
- B. Section 26 05 29 - Hangers and Supports for Electrical Systems.
- C. Section 26 05 33.13 - Conduit for Electrical Systems:
 - 1. Conduit bodies and other fittings.
 - 2. Additional requirements for locating boxes to limit conduit length and/or number of bends between pulling points.
- D. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.
- E. Section 26 27 26 - Wiring Devices:
 - 1. Wall plates.
- F. Section 271020 - Cabling for Voice/Data Systems - CAT 6 & Fiber Optic.
- G. Section 281315 - Security and Database Management System.

1.3 REFERENCE STANDARDS

- A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.
- B. NECA 130 - Standard for Installing and Maintaining Wiring Devices; 2010.
- C. NEMA OS 1 - Sheet-Steel Outlet Boxes, Device Boxes, Covers, and Box Supports; 2013.
- D. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2018.
- E. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- F. SCTE 77 - Specification for Underground Enclosure Integrity; 2017.

- G. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.
- H. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations; Current Edition, Including All Revisions.
- I. UL 508A - Industrial Control Panels; 2013.
- J. UL 514A - Metallic Outlet Boxes; Current Edition, Including All Revisions.
- K. UL 514C - Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances for electrical equipment required by NFPA 70.
 - 2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
 - 3. Coordinate minimum sizes of boxes with the actual installed arrangement of conductors, clamps, support fittings, and devices, calculated according to NFPA 70.
 - 4. Coordinate minimum sizes of pull boxes with the actual installed arrangement of connected conduits, calculated according to NFPA 70.
 - 5. Coordinate the placement of boxes with millwork, furniture, devices, equipment, etc. installed under other sections or by others.
 - 6. Coordinate the work with other trades to preserve insulation integrity.
 - 7. Coordinate the work with other trades to provide walls suitable for installation of flush-mounted boxes where indicated.
 - 8. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.5 SUBMITTALS

- A. See Section 26 0010 - General Provisions, for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for cabinets and enclosures and boxes for hazardous (classified) locations.
- C. Project Record Documents: Record actual locations for outlet and device boxes, pull boxes, and cabinets and enclosures.
- D. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 01 60 00 - Product Requirements, for additional provisions.
 - 2. Keys for Lockable Enclosures: Two of each different key.

1.6 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.

PART 2 PRODUCTS

2.1 BOXES

- A. General Requirements:

1. Do not use boxes and associated accessories for applications other than as permitted by NFPA 70 and product listing.
2. Provide all boxes, fittings, supports, and accessories required for a complete raceway system and to accommodate devices and equipment to be installed.
3. Provide products listed, classified, and labeled as suitable for the purpose intended.
4. Where box size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.
5. Provide grounding terminals within boxes where equipment grounding conductors terminate.

- B. Outlet and Device Boxes Up to 100 cubic inches (1,650 cu cm), Including Those Used as Junction and Pull Boxes:

1. Use sheet-steel boxes for dry locations unless otherwise indicated or required.
2. Use cast iron boxes or cast aluminum boxes for damp or wet locations unless otherwise indicated or required; furnish with compatible weatherproof gasketed covers.
3. Use suitable concrete type boxes where flush-mounted in concrete.
4. Use suitable masonry type boxes where flush-mounted in masonry walls.
5. Use raised covers suitable for the type of wall construction and device configuration where required.
6. Use shallow boxes where required by the type of wall construction.
7. Do not use "through-wall" boxes designed for access from both sides of wall.
8. Sheet-Steel Boxes: Comply with NEMA OS 1, and list and label as complying with UL 514A.
9. Boxes for Supporting Luminaires and Ceiling Fans: Listed as suitable for the type and weight of load to be supported; furnished with fixture stud to accommodate mounting of luminaire where required.
10. Boxes for Ganged Devices: Use multigang boxes of single-piece construction. Do not use field-connected gangable boxes.
11. Wall Plates: Comply with Section 26 27 26.

- C. Cabinets and Enclosures, Including Junction and Pull Boxes Larger Than 100 cubic inches (1,650 cu cm):

1. Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E, or UL 508A.
2. NEMA 250 Environment Type, Unless Otherwise Indicated:

- a. Indoor Clean, Dry Locations: Type 1, painted steel.
- b. Outdoor Locations: Type 3R, painted steel.
3. Junction and Pull Boxes Larger Than 100 cubic inches (1,650 cu cm):
 - a. Provide screw-cover or hinged-cover enclosures unless otherwise indicated.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that mounting surfaces are ready to receive boxes.
- C. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Install boxes in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards where mounting heights are not indicated.
- C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.
- D. Provide separate boxes for emergency power and normal power systems.
- E. Unless otherwise indicated, provide separate boxes for line voltage and low voltage systems.
- F. Flush-mount boxes in finished areas unless specifically indicated to be surface-mounted.
- G. Unless otherwise indicated, boxes may be surface-mounted where exposed conduits are indicated or permitted.
- H. Box Locations:
 1. Unless dimensioned, box locations indicated are approximate.
 - a. Adjust box locations up to 10 feet (3m) if required to accommodate intended purpose without adjustment in contract amount.
 2. Locate boxes as required for devices installed under other sections or by others.
 - a. Switches, Receptacles, and Other Wiring Devices: Comply with Section 26 27 26.
 - b. Communications Systems Outlets: Comply with Section 271020.
 - c. Security System Devices: Comply with Section 281315.
 - d. For equipment connected under Section 26 2717.
 3. Locate boxes so that wall plates do not span different building finishes.
 4. Locate boxes so that wall plates do not cross masonry joints.
 5. Unless otherwise indicated, where multiple outlet boxes are installed at the same location at different mounting heights, install along a common vertical center line.

6. Do not install flush-mounted boxes on opposite sides of walls back-to-back. Provide minimum 6 inches (150 mm) horizontal separation unless otherwise indicated.
 7. Acoustic-Rated Walls: Do not install flush-mounted boxes on opposite sides of walls back-to-back; provide minimum 24 inches (610 mm) horizontal separation.
 8. Fire Resistance Rated Walls: Install flush-mounted boxes such that the required fire resistance will not be reduced.
 - a. Do not install flush-mounted boxes on opposite sides of walls back-to-back; provide minimum 24 inches (610 mm) separation where wall is constructed with individual noncommunicating stud cavities or protect both boxes with listed putty pads.
 - b. Do not install flush-mounted boxes with area larger than 16 square inches (0.0103 sq m) or such that the total aggregate area of openings exceeds 100 square inches (0.0645 sq m) for any 100 square feet (9.29 sq m) of wall area.
 9. Locate junction and pull boxes as indicated, as required to facilitate installation of conductors, and to limit conduit length and/or number of bends between pulling points in accordance with Section 26 05 33.13.
 10. Locate junction and pull boxes in the following areas, unless otherwise indicated or approved by the Architect:
 - a. Concealed above accessible suspended ceilings.
 - b. Within joists in areas with no ceiling.
 - c. Electrical rooms.
 - d. Mechanical equipment rooms.
 11. Install in locations as shown on Drawings and approved by owner, and as required for splices, taps, wire pulling, equipment connections, and as required by NFPA 70.
 12. Set wall mounted boxes at elevations to accommodate mounting heights as indicated.
 13. Coordinate mounting heights and locations of outlets mounted above counters, benches, and backsplashes.
 14. Locate outlet boxes to allow luminaires positioned as shown on reflected ceiling plan.
 15. Align adjacent wall mounted outlet boxes for switches, thermostats, and similar devices.
- I. Box Supports:
1. Secure and support boxes in accordance with NFPA 70 and Section 26 05 29 using suitable supports and methods approved by the authority having jurisdiction.
 2. Provide independent support from building structure except for cast metal boxes (other than boxes used for fixture support) supported by threaded conduit connections in accordance with NFPA 70. Do not provide support from piping, ductwork, or other systems.
 3. Installation Above Suspended Ceilings: Do not provide support from ceiling grid or ceiling support system.
 4. Use far-side support to secure flush-mounted boxes supported from single stud in hollow stud walls. Repair or replace supports for boxes that permit excessive movement.
- J. Install boxes plumb and level.
- K. Flush-Mounted Boxes:

1. Install boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that front edge of box or associated raised cover is not set back from finished surface more than 1/4 inch (6 mm) or does not project beyond finished surface.
 2. Install boxes in combustible materials such as wood so that front edge of box or associated raised cover is flush with finished surface.
 3. Repair rough openings around boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that there are no gaps or open spaces greater than 1/8 inch (3 mm) at the edge of the box.
- L. Install boxes as required to preserve insulation integrity.
- M. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.
- N. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 26 00 50.
- O. Close unused box openings.
- P. Install blank wall plates on junction boxes and on outlet boxes with no devices or equipment installed or designated for future use.
- Q. Provide grounding and bonding in accordance with Section 26 05 26.
- R. Identify boxes in accordance with Section 26 05 53.
- S. Orient boxes to accommodate wiring devices oriented as specified in Section 26 27 26.
- T. Install pull boxes and junction boxes above accessible ceilings and in unfinished areas only.

3.3 ADJUSTING

- A. Adjust floor boxes flush with finish flooring material.
- B. Adjust flush-mounting outlets to make front flush with finished wall material.
- C. install knockout closures in unused box openings.

3.4 CLEANING

- A. Clean interior of boxes to remove dirt, debris, plaster and other foreign material.

3.5 PROTECTION

- A. Immediately after installation, protect boxes from entry of moisture and foreign material until ready for installation of conductors.
- B. Clean exposed surfaces and restore finish.

END OF SECTION

SECTION 26 05 53 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Electrical identification requirements.
- B. Identification nameplates and labels.
- C. Wire and cable markers.
- D. Underground warning tape.
- E. Warning signs and labels.
- F. Field-painted identification of conduit.

1.2 RELATED REQUIREMENTS

- A. Section 26 05 19 - Low-Voltage Electrical Power Conductors and Cables: Color coding for power conductors and cables 600 V and less; vinyl color coding electrical tape.
- B. Section 260533.13 - Conduit for Electrical Systems.
- C. Section 260533.16 - Boxes for Electrical Systems.
- D. Section 262416 Panelboards
- E. Section 262817 - Enclosed Circuit Breakers
- F. Section 262818 Enclosed Switches
- G. Section 262913 - Enclosed Controllers

1.3 REFERENCE STANDARDS

- A. ANSI Z535.2 - American National Standard for Environmental and Facility Safety Signs; 2011.
- B. ANSI Z535.4 - American National Standard for Product Safety Signs and Labels; 2011.
- C. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- D. NFPA 70E - Standard for Electrical Safety in the Workplace; 2018.
- E. UL 969 - Marking and Labeling Systems; Current Edition, Including All Revisions.

1.4 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.

1.5 FIELD CONDITIONS

- A. Do not install adhesive products when ambient temperature is lower than recommended by manufacturer.

PART 2 PRODUCTS

2.1 IDENTIFICATION REQUIREMENTS

A. Identification for Equipment:

1. Use identification nameplate to identify each piece of electrical distribution and control equipment and associated sections, compartments, and components.
 - a. Panelboards:
 - 1) Identify power source and circuit number. Include location when not within sight of equipment.
 - 2) Use typewritten circuit directory to identify load(s) served for panelboards with a door. Identify spares and spaces using pencil.
 - 3) For power panelboards without a door, use identification nameplate to identify load(s) served for each branch device. Do not identify spares and spaces.
 - b. Enclosed switches, circuit breakers, and motor controllers:
 - 1) Identify voltage and phase.
 - 2) Identify power source and circuit number. Include location when not within sight of equipment.
 - 3) Identify load(s) served. Include location when not within sight of equipment.
 - c. Enclosed Contactors:
 - 1) Identify ampere rating.
 - 2) Identify voltage and phase.
 - 3) Identify load(s) and associated circuits controlled. Include location.
2. Use identification nameplate to identify disconnect location for equipment with remote disconnecting means.
3. Available Fault Current Documentation: Use identification label to identify the available fault current and date calculations were performed at locations requiring documentation by NFPA 70, including but not limited to the following.
 - a. Service equipment.
 - b. Industrial control panels.
 - c. Motor control centers.
 - d. Elevator control panels.
 - e. Industrial machinery.
 - f. Motor Controller for Multi-Motor and Combination Load Equipment.
 - g. Condensing units.
 - h. Chillers.
 - i. Heat Pumps.
 - j. Roof Top Units.
 - k. Air Handling Units.
4. Arc Flash Hazard Warning Labels: Use warning labels to identify arc flash hazards for electrical equipment, such as switchboards, panelboards, industrial control panels, meter socket enclosures, and motor control centers that are likely to require examination, adjustment, servicing, or maintenance while energized.
 - a. Minimum Size: 4 by 4 inches (____ by ____ mm).

- b. Legend: Include orange header that reads "WARNING", followed by the word message "Arc Flash and Shock Hazard; Appropriate PPE Required; Do not operate controls or open covers without appropriate personal protection equipment; Failure to comply may result in injury or death; Refer to NFPA 70E for minimum PPE requirements" or approved equivalent.
- c. Service Equipment: Include the following information in accordance with NFPA 70.
 - 1) Nominal system voltage.
 - 2) Available fault current.
 - 3) Arc Flash Label - clearing time of overcurrent protective device option not allowed.
 - 4) Date label applied.

B. Identification for Conductors and Cables:

- 1. Color Coding for Power Conductors 600 V and Less: Comply with Section 26 05 19.
- 2. Use identification nameplate or identification label to identify color code for ungrounded and grounded power conductors inside door or enclosure at each piece of feeder or branch-circuit distribution equipment when premises has feeders or branch circuits served by more than one nominal voltage system.

C. Identification for Raceways:

- 1. Conduit systems shall be color coded as follows:
 - a. This color coding shall be accomplished by painting stripes or using Scotch 33 colored tape on conduit at each junction box: every 10 feet; at change in direction; and on each side of a penetration of wall, floor or ceiling.
 - 1) Normal Power - White
 - 2) Fire Alarm System - Red
 - 3) Security - Orange
 - 4) Telephone, Intercom and Data - Blue

D. Identification for Boxes:

- 1. Use voltage markers or color coded boxes to identify systems other than normal power system.
 - a. Color-Coded Boxes: Field-painted to match the same color code used for raceways.
 - b. In addition to color coding, the voltage of the homerun circuits shall be stenciled on the box cover, indicating either 480Y/277V or 208Y/120V.
- 2. Use identification labels or handwritten text using indelible marker to identify circuits enclosed. Boxes containing sound, fire alarm, voice, intercom, clock system, data, etc. shall be labeled as such.

E. Identification for Devices:

- 1. Identification for Communications Devices: Comply with Section 271020.
- 2. Identification for Security Devices: Comply with Section 281315.
- 3. Wiring Device and Wallplate Finishes: Comply with Section 26 27 26.
- 4. Use identification label to identify serving branch circuit for all receptacles.

2.2 IDENTIFICATION NAMEPLATES AND LABELS

A. Identification Nameplates:

- 1. Materials:
 - a. Indoor Clean, Dry Locations: Use plastic nameplates.

- b. Outdoor Locations: Use plastic, stainless steel, or aluminum nameplates suitable for exterior use.
 - 2. Plastic Nameplates: Two-layer or three-layer laminated acrylic or electrically non-conductive phenolic with beveled edges; minimum thickness of 1/16 inch (1.6 mm); engraved text.
 - 3. Stainless Steel Nameplates: Minimum thickness of 1/32 inch (0.8 mm); engraved or laser-etched text.
 - 4. Aluminum Nameplates: Anodized; minimum thickness of 1/32 inch (0.8 mm); engraved or laser-etched text.
 - 5. Mounting Holes for Mechanical Fasteners: Two, centered on sides for sizes up to 1 inch (25 mm) high; Four, located at corners for larger sizes.
- B. Identification Labels:
- 1. Materials: Use self-adhesive laminated plastic labels; UV, chemical, water, heat, and abrasion resistant.
 - 2. Text: Use factory pre-printed or machine-printed text. Do not use handwritten text unless otherwise indicated.
- C. Format for Equipment Identification:
- 1. Minimum Size: 1 inch (25 mm) by 2.5 inches (64 mm).
 - 2. Legend:
 - a. System designation where applicable:
 - 1) Fire Alarm System: Identify with text "FIRE ALARM".
 - b. Equipment designation or other approved description.
 - 3. Text: All capitalized unless otherwise indicated.
 - 4. Minimum Text Height:
 - a. System Designation: 1 inch (25 mm).
 - b. Equipment Designation: 1/2 inch (13 mm).
 - 5. Color:
 - a. Normal Power System: White text on black background.
 - b. Emergency Power System: White text on red background.

2.3 UNDERGROUND WARNING TAPE

- A. Materials: Use non-detectable type polyethylene tape suitable for direct burial, unless otherwise indicated.
- B. Foil-backed Detectable Type Tape: 6 inches (152 mm) wide, with minimum thickness of 5 mil (0.1 mm), unless otherwise required for proper detection.
- C. Legend: Type of service, continuously repeated over full length of tape.
- D. Color:
 - 1. Tape for Buried Power Lines: Black text on red background.
 - 2. Tape for Buried Communication, Alarm, and Signal Lines: Black text on orange background.

2.4 WARNING SIGNS AND LABELS

- A. Comply with ANSI Z535.2 or ANSI Z535.4 as applicable.
- B. Warning Signs:
 - 1. Materials:
 - a. Indoor Dry, Clean Locations: Use factory pre-printed rigid plastic or self-adhesive vinyl signs.
 - 2. Rigid Signs: Provide four mounting holes at corners for mechanical fasteners.
 - 3. Minimum Size: 7 by 10 inches (178 by 254 mm) unless otherwise indicated.
- C. Warning Labels:
 - 1. Materials: Use factory pre-printed or machine-printed self-adhesive polyester or self-adhesive vinyl labels; UV, chemical, water, heat, and abrasion resistant; produced using materials recognized to UL 969.
 - 2. Machine-Printed Labels: Use thermal transfer process printing machines and accessories recommended by label manufacturer.
 - 3. Minimum Size: 2 by 4 inches (51 mm by 102 mm) unless otherwise indicated.

PART 3 EXECUTION

3.1 PREPARATION

- A. Clean surfaces to receive adhesive products according to manufacturer's instructions.
- B. Degrease and clean surfaces to receive nameplates and labels.

3.2 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Install identification products to be plainly visible for examination, adjustment, servicing, and maintenance. Unless otherwise indicated, locate products as follows:
 - 1. Surface-Mounted Equipment: Enclosure front.
 - 2. Flush-Mounted Equipment: Enclosure front.
 - 3. Free-Standing Equipment: Enclosure front; also enclosure rear for equipment with rear access.
 - 4. Elevated Equipment: Legible from the floor or working platform.
 - 5. Branch Devices: Adjacent to device.
 - 6. Interior Components: Legible from the point of access.
 - 7. Conduits: Legible from the floor.
 - 8. Boxes: Outside face of cover.
 - 9. Conductors and Cables: Legible from the point of access.

- 10. Devices: Outside face of cover.
- C. Install identification products centered, level, and parallel with lines of item being identified.
- D. Secure nameplates to exterior surfaces of enclosures using stainless steel screws and to interior surfaces using self-adhesive backing or epoxy cement.
- E. Install self-adhesive labels and markers to achieve maximum adhesion, with no bubbles or wrinkles and edges properly sealed.
- F. Install underground warning tape above buried lines with one tape per trench at 3 inches (75 mm) below finished grade.
- G. Secure rigid signs using stainless steel screws.
- H. Mark all handwritten text, where permitted, to be neat and legible.

3.3 FIELD QUALITY CONTROL

- A. See Section 26 0010 - General Provisions, for additional requirements.
- B. Replace self-adhesive labels and markers that exhibit bubbles, wrinkles, curling or other signs of improper adhesion.

END OF SECTION

SECTION 26 05 83 - WIRING CONNECTIONS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Electrical connections to equipment.

1.2 RELATED REQUIREMENTS

- A. Section 26 05 19 - Low-Voltage Electrical Power Conductors and Cables.
- B. Section 26 05 33.13 - Conduit for Electrical Systems.
- C. Section 26 05 33.16 - Boxes for Electrical Systems.
- D. Section 26 27 26 - Wiring Devices.

1.3 REFERENCE STANDARDS

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

1.4 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Obtain and review shop drawings, product data, manufacturer's wiring diagrams, and manufacturer's instructions for equipment furnished under other sections.
 - 2. Determine connection locations and requirements.
- B. Sequencing:
 - 1. Install rough-in of electrical connections before installation of equipment is required. Ensure that disconnects and other items that will require proper clearances are placed so that those clearances are maintained once the equipment is installed.
 - 2. Make electrical connections before required start-up of equipment.

1.5 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.
- B. Products: Listed, classified, and labeled as suitable for the purpose intended.
- C. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Wiring Devices: As specified in Section 26 27 26.
- B. Wire and Cable: As specified in Section 26 05 19.
- C. Boxes: As specified in Section 26 05 33.16.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that equipment is ready for electrical connection, wiring, and energization.

3.2 ELECTRICAL CONNECTIONS

- A. Confirm voltages and amperages of equipment from nameplate data on equipment. Do not provide connections to equipment that does not match plans or that varies in voltage requirements from what is shown on plans. Connecting equipment with incorrect voltage or protection will void all warranties. Contractor will be responsible for paying for all materials and labor necessary to fix or replace damaged equipment do to connecting to the wrong voltage.
- B. Make electrical connections in accordance with equipment manufacturer's instructions.
- C. Make conduit connections to equipment using flexible conduit. Use liquidtight flexible conduit with watertight connectors in damp or wet locations.
- D. Connect heat producing equipment using wire and cable with insulation suitable for temperatures encountered.
- E. Provide receptacle outlet to accommodate connection with attachment plug.
- F. Provide cord and cap where field-supplied attachment plug is required.
- G. Install suitable strain-relief clamps and fittings for cord connections at outlet boxes and equipment connection boxes.
- H. Install disconnect switches, controllers, control stations, and control devices to complete equipment wiring requirements.
- I. Install terminal block jumpers to complete equipment wiring requirements.
- J. Install interconnecting conduit and wiring between devices and equipment to complete equipment wiring requirements.

END OF SECTION

SECTION 26 24 16 - PANELBOARDS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Power distribution panelboards.
- B. Lighting and appliance panelboards.
- C. Overcurrent protective devices for panelboards.

1.2 RELATED REQUIREMENTS

- A. Section 26 05 26 - Grounding and Bonding for Electrical Systems.
- B. Section 26 05 19 - Low-Voltage Electrical Power Conductors and Cables.
- C. Section 26 05 29 - Hangers and Supports for Electrical Systems.
- D. Section 26 05 33.13 - Conduit for Electrical Systems.
- E. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.
- F. Section 26 22 00 - Low-Voltage Transformers: Small power centers with integral primary breaker, transformer, and panelboard.
- G. Section 26 43 00 - Surge Protective Devices.

1.3 REFERENCE STANDARDS

- A. FS W-C-375 - Circuit Breakers, Molded Case; Branch Circuit and Service; 2013e (Amended 2017).
- B. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.
- C. NECA 407 - Standard for Installing and Maintaining Panelboards; 2015.
- D. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2018.
- E. NEMA KS 1 - Heavy Duty Enclosed and Dead-Front Switches (600 Volts Maximum); 2013.
- F. NEMA PB 1 - Panelboards; 2011.
- G. NEMA PB 1.1 - General Instructions for Proper Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less; 2013.
- H. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems; 2017.
- I. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- J. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.

- K. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations; Current Edition, Including All Revisions.
- L. UL 67 - Panelboards; Current Edition, Including All Revisions.
- M. UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures; Current Edition, Including All Revisions.
- N. UL 869A - Reference Standard for Service Equipment; Current Edition, Including All Revisions.
- O. UL 943 - Ground-Fault Circuit-Interrupters; Current Edition, Including All Revisions.
- P. UL 1053 - Ground-Fault Sensing and Relaying Equipment; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances for electrical equipment required by NFPA 70.
 - 2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
 - 3. Coordinate the work with other trades to provide walls suitable for installation of flush-mounted panelboards where indicated.
 - 4. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
 - 5. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.5 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements and 26 0010 General Provisions, for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for panelboards, enclosures, overcurrent protective devices, and other installed components and accessories.
- C. Shop Drawings: Indicate outline and support point dimensions, voltage, main bus ampacity, overcurrent protective device arrangement and sizes, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.
 - 1. Include wiring diagrams showing all factory and field connections.
 - 2. Clearly indicate whether proposed short circuit current ratings are fully rated or, where acceptable, series rated systems.
- D. Supplier of Switchgear, Panelboards and Fusible Disconnect Switches shall provide a coordination study for short circuit to ensure compliance with NEC requirements. The Supplier to assume infinite short circuit available at the bus on high side of utility transformer or Supplier shall coordinate directly with Utility Company for actual fault available.

- E. Supplier of Switchgear, Panelboards and Fusible Disconnect Switches shall provide an arc flash study in accordance with NFPA 70 and 70E. Contractor shall also provide arc flash labeling of Switchgear, Panelboards and Fusible Disconnect Switches to ensure compliance with NFPA 70 and 70E requirements.
- F. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.
- G. Project Record Documents: Record actual installed locations of panelboards and actual installed circuiting arrangements.
- H. Maintenance Data: Include information on replacement parts and recommended maintenance procedures and intervals.
- I. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 26 00 10 - GENERAL PROVISIONS, for additional provisions.
 - 2. Panelboard Keys: Two of each different key.

1.6 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.
- B. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. ABB/GE: www.geindustrial.com/#sle.
- B. Eaton Corporation: www.eaton.com.
- C. Schneider Electric; Square D Products: www.schneider-electric.us.
- D. Siemens Industry, Inc: www.usa.siemens.com.
- E. Source Limitations: Furnish panelboards and associated components produced by the same manufacturer as the other electrical distribution equipment used for this project and obtained from a single supplier.

2.2 PANELBOARDS - GENERAL REQUIREMENTS

- A. Provide products listed, classified, and labeled as suitable for the purpose intended.
- B. Unless otherwise indicated, provide products suitable for continuous operation under the following service conditions:
 - 1. Altitude: Less than 6,600 feet (2,000 m).
 - 2. Ambient Temperature:

- a. Panelboards Containing Circuit Breakers: Between 23 degrees F (-5 degrees C) and 104 degrees F (40 degrees C).
- C. Short Circuit Current Rating:
 - 1. Provide panelboards with listed short circuit current rating as indicated on the drawings. Ratings shall be confirmed and adjusted as needed based on the short circuit study performed by the supplier.
 - 2. Listed series ratings are not acceptable.
- D. Panelboards Used for Service Entrance: Listed and labeled as suitable for use as service equipment according to UL 869A.
- E. Mains: Configure for top or bottom incoming feed as indicated or as required for the installation.
- F. Branch Overcurrent Protective Devices: Replaceable without disturbing adjacent devices.
- G. Bussing: Sized in accordance with UL 67 temperature rise requirements.
 - 1. Provide fully rated neutral bus unless otherwise indicated, with a suitable lug for each feeder or branch circuit requiring a neutral connection.
 - 2. Provide solidly bonded equipment ground bus in each panelboard, with a suitable lug for each feeder and branch circuit equipment grounding conductor.
- H. Conductor Terminations: Suitable for use with the conductors to be installed.
- I. Enclosures: Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E.
 - 1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
 - a. Indoor Clean, Dry Locations: Type 1.
 - b. Outdoor Locations: Type 4X, stainless steel.
 - 2. Boxes: Galvanized steel unless otherwise indicated.
 - a. Provide wiring gutters sized to accommodate the conductors to be installed.
 - 3. Fronts:
 - a. Fronts for Surface-Mounted Enclosures: Same dimensions as boxes.
 - b. Fronts for Flush-Mounted Enclosures: Overlap boxes on all sides to conceal rough opening.
 - 4. Lockable Doors: All locks keyed alike unless otherwise indicated.
- J. Future Provisions: Prepare all unused spaces for future installation of devices including bussing, connectors, mounting hardware and all other required provisions.
- K. Surge Protective Devices: Where factory-installed, internally mounted surge protective devices are provided in accordance with Section 26 43 00, list and label panelboards as a complete assembly including surge protective device.
- L. Ground Fault Protection: Where ground-fault protection is indicated, provide system listed and labeled as complying with UL 1053.
 - 1. Where electronic circuit breakers equipped with integral ground fault protection are used, provide separate neutral current sensor where applicable.

- M. Selectivity: Where the requirement for selectivity is indicated, furnish products as required to achieve selective coordination.
- N. Multi-Section Panelboards: Provide enclosures of the same height, with feed-through lugs or sub-feed lugs and feeders as indicated or as required to interconnect sections.
- O. Load centers are not acceptable.
- P. Provide the following features and accessories where indicated or where required to complete installation:
 - 1. Feed-through lugs.
 - 2. Sub-feed lugs.

2.3 LIGHTING AND APPLIANCE PANELBOARDS

- A. Description: Panelboards complying with NEMA PB 1, lighting and appliance branch circuit type, circuit breaker type, and listed and labeled as complying with UL 67; ratings, configurations and features as indicated on the drawings.
- B. Shall be Square D Type NQ or Type NF depending on voltage or equivalent.
- C. Conductor Terminations:
 - 1. Main and Neutral Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
 - 2. Main and Neutral Lug Type: Mechanical.
- D. Bussing:
 - 1. Phase Bus Connections: Arranged for sequential phasing of overcurrent protective devices.
 - 2. Phase and Neutral Bus Material: Aluminum or copper.
 - 3. Ground Bus Material: Aluminum or copper.
- E. Circuit Breakers: Thermal magnetic bolt-on type, with common trip handle for all poles; UL listed unless otherwise indicated.
 - 1. Type SWD for lighting circuits.
 - 2. Type HACR for air conditioning equipment circuits.
 - 3. Class A ground fault interrupter circuit breakers where scheduled.
- F. Minimum Integrated Short Circuit Rating:
 - 1. 208 Volt Panelboards: Minimum 22,000 amperes rms symmetrical.
 - 2. 480 Volt Panelboards: 42,000 amperes rms symmetrical.
- G. Enclosures:
 - 1. Provide surface-mounted or flush-mounted enclosures as indicated.

2. Fronts: Provide door-in-door trim with hinged cover for access to load terminals and wiring gutters, and separate lockable hinged door with concealed hinges for access to overcurrent protective device handles without exposing live parts.
 3. Provide clear plastic circuit directory holder mounted on inside of door.
- H. Where scheduled, provide integral Surge Protection (SPD), as specified in Section 26 43 00.

2.4 OVERCURRENT PROTECTIVE DEVICES

A. Molded Case Circuit Breakers:

1. Description: Quick-make, quick-break, over center toggle, trip-free, trip-indicating circuit breakers listed and labeled as complying with UL 489, and complying with FS W-C-375 where applicable; ratings, configurations, and features as indicated on the drawings.
2. Interrupting Capacity:
 - a. Provide circuit breakers with interrupting capacity as required to provide the short circuit current rating indicated.
 - b. Fully Rated Systems: Provide circuit breakers with interrupting capacity not less than the short circuit current rating indicated.
3. Conductor Terminations:
 - a. Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
4. Thermal Magnetic Circuit Breakers: For each pole, furnish thermal inverse time tripping element for overload protection and magnetic instantaneous tripping element for short circuit protection.
5. Electronic Trip Circuit Breakers: Furnish solid state, microprocessor-based, true rms sensing trip units.
 - a. Provide the following field-adjustable trip response settings for all breakers 200A and larger:
 - 1) Long time delay.
 - 2) Short time pickup and delay.
 - 3) Instantaneous pickup.
6. Multi-Pole Circuit Breakers: Furnish with common trip for all poles.
7. Provide the following circuit breaker types where indicated:
 - a. Ground Fault Circuit Interrupter (GFCI) Circuit Breakers: Listed as complying with UL 943, class A for protection of personnel.
 - b. Ground Fault Equipment Protection Circuit Breakers: Designed to trip at 30 mA for protection of equipment.
8. Do not use tandem circuit breakers.
9. Do not use handle ties in lieu of multi-pole circuit breakers.
10. Provide multi-pole circuit breakers for multi-wire branch circuits as required by NFPA 70.
11. Provide the following features and accessories where indicated or where required to complete installation:
 - a. Handle Pad-Lock Provision: For locking circuit breaker handle in OFF position.

2.5 SOURCE QUALITY CONTROL

- A. Factory test panelboards according to NEMA PB 1.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that the ratings and configurations of the panelboards and associated components are consistent with the indicated requirements.
- C. Verify that mounting surfaces are ready to receive panelboards.
- D. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

- A. Perform work in accordance with NECA 1 (general workmanship).
- B. Install products in accordance with manufacturer's instructions.
- C. Install panelboards in accordance with NECA 407 and NEMA PB 1.1.
- D. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.
- E. Provide required support and attachment in accordance with Section 26 05 29.
- F. Install panelboards plumb.
- G. Install flush-mounted panelboards so that trims fit completely flush to wall with no gaps and rough opening completely covered.
- H. Mount panelboards such that the highest position of any operating handle for circuit breakers or switches does not exceed 79 inches (2000 mm) above the floor or working platform.
- I. Provide grounding and bonding in accordance with Section 26 05 26.
 - 1. Terminate branch circuit equipment grounding conductors on solidly bonded equipment ground bus only. Do not terminate on isolated/insulated ground bus.
 - 2. Terminate branch circuit isolated grounding conductors on isolated/insulated ground bus only. Do not terminate on solidly bonded equipment ground bus.
- J. Install all field-installed branch devices, components, and accessories.
- K. Multi-Wire Branch Circuits: Group grounded and ungrounded conductors together in the panelboard as required by NFPA 70.
- L. Set field-adjustable ground fault protection pickup and time delay settings as indicated.
- M. Provide filler plates to cover unused spaces in panelboards.
- N. Identify panelboards in accordance with Section 26 05 53.

1. Provide identification nameplate for each power distribution panelboard branch device in accordance with Section 26 05 53, clearly and specifically indicating the loads served.
- O. Provide typed circuit directory for each lighting and appliance panelboard and each power distribution panelboard provided with a door, clearly and specifically indicating the loads served. Identify spares and spaces. Revise directory to reflect circuiting changes required to balance phase loads. Hand written directories are not acceptable. Replace existing directories with new updated versions in renovation situations. Directory shall include room numbers.
- P. The Electrical Contractor shall be responsible to provide and install the Arc Fault and SCCR labels to the equipment required by the NEC. This includes, but is not limited to Switchboards, Panelboards, Motor Control Centers, elevators, industrial control panels and industrial machinery. This calculation must be done by a qualified person with experience doing these calculations and must be documented and available to the Engineer for review, if requested.
- Q. Provide arc flash warning labels in accordance with NFPA 70.
- R. Ground and bond panelboard enclosure according to Section 26 05 26.

3.3 FIELD QUALITY CONTROL

- A. Inspect and test in accordance with NETA ATS, except Section 4.
- B. Molded Case Circuit Breakers: Perform inspections and tests listed in NETA ATS, Section 7.6.1.1 for all main circuit breakers and circuit breakers larger than 200 amperes. Tests listed as optional are not required.
- C. Ground Fault Protection Systems: Test in accordance with manufacturer's instructions as required by NFPA 70.
- D. Test GFCI circuit breakers to verify proper operation.
- E. Test shunt trips to verify proper operation.
- F. Correct deficiencies and replace damaged or defective panelboards or associated components.

3.4 ADJUSTING

- A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.
- B. Adjust alignment of panelboard fronts.
- C. Load Balancing: For each panelboard, rearrange circuits such that the difference between each measured steady state phase load does not exceed 20 percent and adjust circuit directories accordingly. Maintain proper phasing for multi-wire branch circuits.

3.5 CLEANING

- A. Clean dirt and debris from panelboard enclosures and components according to manufacturer's instructions.

- B. Repair scratched or marred exterior surfaces to match original factory finish.

END OF SECTION

SECTION 26 27 26 - WIRING DEVICES

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Wall switches.
- B. Receptacles.
- C. Wall plates.

1.2 RELATED REQUIREMENTS

- A. Section 26 05 33.13 - Conduit for Electrical Systems.
- B. Section 26 05 33.16 - Boxes for Electrical Systems.
- C. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.
- D. Section 26 05 83 - Wiring Connections: Cords and plugs for equipment.

1.3 REFERENCE STANDARDS

- A. FS W-C-596 .- Connector, Electrical, Power, General Specification for; Revision G, 2001
- B. FS W-C-596 - Connector, Electrical, Power, General Specification for; 2017h.
- C. FS W-S-896 - Switches, Toggle (Toggle and Lock), Flush-mounted (General Specification); 2017g.
- D. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.
- E. NECA 130 - Standard for Installing and Maintaining Wiring Devices; 2010.
- F. NEMA WD 1 - General Color Requirements for Wiring Devices; 1999 (Reaffirmed 2015).
- G. NEMA WD 6 - Wiring Devices - Dimensional Specifications; 2016.
- H. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- I. UL 20 - General-Use Snap Switches; Current Edition, Including All Revisions.
- J. UL 498 - Attachment Plugs and Receptacles; Current Edition, Including All Revisions.
- K. UL 514D - Cover Plates for Flush-Mounted Wiring Devices; Current Edition, Including All Revisions.
- L. UL 943 - Ground-Fault Circuit-Interrupters; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:

1. Coordinate the placement of outlet boxes with millwork, furniture, equipment, etc. installed under other sections or by others.
2. Coordinate wiring device ratings and configurations with the electrical requirements of actual equipment to be installed.
3. Coordinate the placement of outlet boxes for wall switches with actual installed door swings.
4. Coordinate the installation and preparation of uneven surfaces, such as split face block or corrugated tin, to provide suitable surface for installation of wiring devices.
5. Notify Architect of any conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.

B. Sequencing:

1. Do not install wiring devices until final surface finishes and painting are complete.

1.5 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements and 26 0010 General Provisions for submittal procedures.
- B. Product Data: Provide manufacturer's catalog information showing dimensions, colors, and configurations.
- C. Shop Drawings: Required.
- D. Operation and Maintenance Data:
 1. Wall Dimmers: Include information on operation and setting of presets.
 2. Occupancy Sensors: Include information on operation and setting of presets.
 3. GFCI Receptacles: Include information on status indicators.

1.6 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.
- B. Products: Listed, classified, and labeled as suitable for the purpose intended.
- C. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.7 DELIVERY, STORAGE, AND PROTECTION

- A. Store in a clean, dry space in original manufacturer's packaging until ready for installation.
- B. Products listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

PART 2 PRODUCTS

2.1 WIRING DEVICE APPLICATIONS

- A. Provide wiring devices suitable for intended use and with ratings adequate for load served.
- B. For single receptacles installed on an individual branch circuit, provide receptacle with ampere rating not less than that of the branch circuit.
- C. Provide weather resistant GFCI receptacles with specified weatherproof covers for receptacles installed outdoors or in damp or wet locations.
- D. Provide GFCI protection for receptacles installed within 6 feet (1.8 m) of sinks.
- E. Provide GFCI protection for all receptacles installed in headframes in accordance with 2017 NEC 210.8(B)(8).
- F. Unless otherwise noted, do not use combination switch/receptacle devices.

2.2 WIRING DEVICE FINISHES

- A. Provide wiring device finishes as described below unless otherwise indicated.
- B. Wiring Devices, Unless Otherwise Indicated: Gray with stainless steel wall plate.
- C. Wiring Devices Installed in Unfinished Spaces: Gray with galvanized steel wall plate.

2.3 WALL SWITCHES

- A. Manufacturers:
 - 1. Hubbell Incorporated; _____: www.hubbell.com/#sle.
 - 2. Leviton Manufacturing Company, Inc: www.leviton.com.
 - 3. Pass & Seymour, a brand of Legrand North America, Inc: www.legrand.us
- B. Wall Switches - General Requirements: AC only, quiet operating, general-use snap switches with silver alloy contacts, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 20 and where applicable, FS W-S-896; types as indicated on the drawings.
 - 1. Wiring Provisions: Terminal screws for side wiring and screw actuated binding clamp for back wiring with separate ground terminal screw.
- C. Standard Wall Switches: Industrial specification grade, 20 A, 120/277 V with standard toggle type switch actuator and maintained contacts; single pole single throw, double pole single throw, three way, or four way as indicated on the drawings.
 - 1. Hubbell No. HBL1221GY Series, or equivalent.

2.4 RECEPTACLES

A. Manufacturers:

1. Hubbell Incorporated: www.hubbell.com/#sle.
2. Leviton Manufacturing Company, Inc: www.leviton.com.
3. Lutron Electronics Company, Inc; Designer Style: www.lutron.com/#sle.
4. Pass & Seymour, a brand of Legrand North America, Inc: www.legrand.us
5. Cooper/Arrow Hart: www.cooperindustries.com.

B. Receptacles - General Requirements: Self-grounding, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 498, and where applicable, FS W-C-596; types as indicated on the drawings.

1. Wiring Provisions: Terminal screws for side wiring or screw actuated binding clamp for back wiring with separate ground terminal screw.
2. NEMA configurations specified are according to NEMA WD 6.
3. Provide labeling of receptacles as outlined in Section 26 05 53.

C. Convenience Receptacles:

1. Standard Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R; single or duplex as indicated on the drawings.
 - a. Products:
 - 1) Hubbell #5362AG or equivalent.

D. GFCI Receptacles:

1. GFCI Receptacles - General Requirements: Self-testing, with feed-through protection and light to indicate ground fault tripped condition and loss of protection; listed as complying with UL 943, class A.
 - a. Provide in all locations as required by NEC.
 - b. All GFI's shall be accessible for resetting.
2. Standard GFCI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style.
 - a. Products:
 - 1) Hubbell #GFR5362GGY, or equivalent.
3. Weather Resistant GFCI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style, listed and labeled as weather resistant type complying with UL 498 Supplement SE suitable for installation in damp or wet locations.
 - a. Products:
 - 1) Hubbell #GFR5362GGY, or equivalent.

E. Special purpose receptacles, as noted or shown on drawings.

2.5 WALL PLATES

A. Wall Plates: Comply with UL 514D.

1. Configuration: One piece cover as required for quantity and types of corresponding wiring devices.
 2. Size: Standard.
 3. Screws: Metal with slotted heads finished to match wall plate finish.
- B. Stainless Steel Wall Plates: Brushed satin finish, Type 302 stainless steel. Provide for receptacles in finished areas.
- C. Galvanized Steel Wall Plates: Rounded corners and edges, with corrosion resistant screws. Used in warehouse, maintenance, headframe, electrical/IT and other non-finished spaces.
- D. In-Use Weatherproof Cover Plates: Self-closing and weatherproof with cord and plug inserted into device. Product Hubbell WP26MH or approved equal.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate devices and conductors in accordance with NFPA 70.
- C. Verify that wall openings are neatly cut and will be completely covered by wall plates.
- D. Verify that final surface finishes are complete, including painting.
- E. Verify that floor boxes are adjusted properly.
- F. Verify that branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.
- G. Verify that conditions are satisfactory for installation prior to starting work.

3.2 PREPARATION

- A. Provide extension rings to bring outlet boxes flush with finished surface.
- B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.3 INSTALLATION

- A. Perform work in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards unless otherwise indicated.
- B. Coordinate locations of outlet boxes provided under Section 26 05 33.16 as required for installation of wiring devices provided under this section.
 1. Mounting Heights: Unless otherwise indicated, as follows:
 - a. Wall Switches: 48 inches (1200 mm) above finished floor.
 - b. Receptacles: Unless otherwise shown on plans 18 inches (450 mm) above finished floor or 6 inches (150 mm) above counter. 48 inches in unfinished spaces.

2. Orient outlet boxes for vertical installation of wiring devices unless otherwise indicated.
 3. Where multiple receptacles, wall switches, or wall dimmers are installed at the same location and at the same mounting height, gang devices together under a common wall plate.
 4. Locate wall switches on strike side of door with edge of wall plate 3 inches (80 mm) from edge of door frame. Where locations are indicated otherwise, notify Architect to obtain direction prior to proceeding with work.
- C. Install wiring devices in accordance with manufacturer's instructions.
- D. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.
- E. Where required, connect wiring devices using pigtails not less than 6 inches (150 mm) long. Do not connect more than one conductor to wiring device terminals.
- F. Connect wiring devices by wrapping conductor clockwise 3/4 turn around screw terminal and tightening to proper torque specified by the manufacturer. Where present, do not use push-in pressure terminals that do not rely on screw-actuated binding.
- G. Connect wiring device grounding terminal to outlet box with bonding jumper, except where equipment grounding conductor is present.
- H. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.
- I. Provide GFCI receptacles with integral GFCI protection at each location indicated. Do not use feed-through wiring to protect downstream devices.
- J. Install securely, in a neat and workmanlike manner, as specified in NECA 1.
- K. Install wiring devices plumb and level with mounting yoke held rigidly in place.
- L. Install wall switches with OFF position down.
- M. Mount grouped devices in a single continuous gang box. Use partitions where voltage between exposed live parts of adjacent switched may exceed 300 volts.
- N. Provide single coverplate for multi-gang boxes for switches shown grouped on the drawings.
- O. Install vertically mounted receptacles with grounding pole on top and horizontally mounted receptacles with grounding pole on left.
- P. Install wall plates to fit completely flush to wall with no gaps and rough opening completely covered without strain on wall plate. Repair or reinstall improperly installed outlet boxes or improperly sized rough openings. Do not use oversized wall plates in lieu of meeting this requirement.
- Q. Install blank wall plates on junction boxes and on outlet boxes with no wiring devices installed or designated for future use.
- R. Identify wiring devices in accordance with Section 26 05 53.
- S. Install receptacles with grounding pole oriented to the top.

- T. Install suspended outlet assembly in accordance with detail shown on drawings.
- U. Use jumbo size plates for outlets installed in masonry walls.
- V. Install galvanized steel plates on outlet boxes and junction boxes in unfinished areas, above accessible ceilings, and on surface mounted outlets.

3.4 FIELD QUALITY CONTROL

- A. See Section 01 40 00 - Quality Requirements, for additional requirements.
- B. Inspect each wiring device for damage and defects.
- C. Perform field inspection in accordance with Quality Requirements.
- D. Operate each wall switch, wall dimmer, and fan speed controller with circuit energized to verify proper operation.
- E. Verify that each receptacle device is energized.
- F. Test each receptacle to verify operation and proper polarity.
- G. Test each GFCI receptacle for proper tripping operation according to manufacturer's instructions.
- H. Correct wiring deficiencies and replace damaged or defective wiring devices.

3.5 ADJUSTING

- A. Adjust devices and wall plates to be flush and level.
- B. Adjust devices and boxes as required to assure that device coverplates seat firmly to wall surface.

3.6 CLEANING

- A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

END OF SECTION

SECTION 08 71 00 - DOOR HARDWARE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Mechanical door hardware for the following:
 - a. Swinging doors.
2. Cylinders for door hardware specified in other Sections.
3. Electrified door hardware.

1.2 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
- B. Keying Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For electrified door hardware.
 1. Include diagrams for power, signal, and control wiring.
 2. Include details of interface of electrified door hardware and building safety and security systems.
- C. Samples: For each exposed product in each finish specified.
- D. Door hardware schedule.
- E. Keying schedule.

1.4 INFORMATIONAL SUBMITTALS

- A. Sample warranty.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance data.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: Supplier of products and an employer of workers trained and approved by product manufacturers and of an Architectural Hardware Consultant who is available during the course of the Work to consult Contractor, Architect, and Owner about door hardware and keying.
 - 1. Scheduling Responsibility: Preparation of door hardware and keying schedule.
 - 2. Engineering Responsibility: Preparation of data for electrified door hardware, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.
- B. Architectural Hardware Consultant Qualifications: A person who is experienced in providing consulting services for door hardware installations that are comparable in material, design, and extent to that indicated for this Project and who is currently certified by DHI as an Architectural Hardware Consultant (AHC) and an Electrified Hardware Consultant (EHC).

1.7 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: Five years from date of Substantial Completion unless otherwise indicated below:

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Electrified Door Hardware: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Means of Egress Doors: Latches do not require more than 15 lbf (67 N) to release the latch. Locks do not require use of a key, tool, or special knowledge for operation.

2.2 HINGES

- A. Hinges: BHMA A156.1. Provide template-produced hinges for hinges installed on hollow-metal doors and hollow-metal frames.

2.3 SELF-CLOSING HINGES AND PIVOTS

- A. Self-Closing Hinges and Pivots: BHMA A156.17.

2.4 CONTINUOUS HINGES

- A. Continuous Hinges: BHMA A156.26; minimum 0.120-inch- (3.0-mm-) thick, hinge leaves with minimum overall width of 4 inches (102 mm); fabricated to full height of door and frame and to template screw locations; with components finished after milling and drilling are complete.
- B. Continuous, Gear-Type Hinges: Extruded-aluminum, pinless, geared hinge leaves joined by a continuous extruded-aluminum channel cap; with concealed, self-lubricating thrust bearings.

2.5 MECHANICAL LOCKS AND LATCHES

- A. Lock Functions: As indicated in door hardware schedule.
- B. Lock Throw: Comply with testing requirements for length of bolts required for labeled fire doors, and as follows:
 - 1. Bored Locks: Minimum 1/2-inch (13-mm) latchbolt throw.
 - 2. Mortise Locks: Minimum 3/4-inch (19-mm) latchbolt throw.
 - 3. Deadbolts: Minimum 1-inch (25-mm) bolt throw.
- C. Lock Backset: 2-3/4 inches (70 mm) unless otherwise indicated.
- D. Lock Trim:
 - 1. Levers: Cast.
 - 2. Escutcheons (Roses): Forged.
 - 3. Dummy Trim: Match lever lock trim and escutcheons.
- E. Strikes: Provide manufacturer's standard strike for each lock bolt or latchbolt complying with requirements indicated for applicable lock or latch and with strike box and curved lip extended to protect frame; finished to match lock or latch.
 - 1. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.
 - 2. Extra-Long-Lip Strikes: For locks used on frames with applied wood casing trim.
 - 3. Aluminum-Frame Strike Box: Manufacturer's special strike box fabricated for aluminum framing.
 - 4. Rabbet Front and Strike: Provide on locksets for rabbeted meeting stiles.
- F. Bored Locks: BHMA A156.2; Grade 1; Series 4000.
- G. Mortise Locks: BHMA A156.13; Operational Grade 1; stamped steel case with steel or brass parts; Series 1000.

2.6 AUXILIARY LOCKS

- A. Bored Auxiliary Locks: BHMA A156.36; Grade 1; with strike that suits frame.
- B. Mortise Auxiliary Locks: BHMA A156.36; Grade 1; with strike that suits frame.

- C. Narrow Stile Auxiliary Locks: BHMA A156.36; Grade 1; with strike that suits frame.

2.7 ELECTRIC STRIKES

- A. Electric Strikes: BHMA A156.31; Grade 1; with faceplate to suit lock and frame. Use Basis of Design product or approved equal.
 - 1. Recessed (standard) condition: Basis of Design product is HES 1006/1600.
 - 2. Surface (existing) condition: Basis of Design product is HES 9400/9600.

2.8 ELECTROMAGNETIC LOCKS

- A. Electromagnetic Locks: BHMA A156.23; electrically powered; with electromagnet attached to frame and armature plate attached to door; full-exterior or full-interior type, as required by application indicated.

2.9 ELECTROMECHANICAL LOCKS

- A. Electromechanical Locks: BHMA A156.25; Grade 1; motor or solenoid driven; with strike that suits frame.

2.10 SURFACE BOLTS

- A. Surface Bolts: BHMA A156.16.

2.11 MANUAL FLUSH BOLTS

- A. Manual Flush Bolts: BHMA A156.16; minimum 3/4-inch (19-mm) throw; designed for mortising into door edge.

2.12 AUTOMATIC AND SELF-LATCHING FLUSH BOLTS

- A. Automatic Flush Bolts: BHMA A156.3, Type 25; minimum 3/4-inch (19-mm) throw; with dust-proof strikes; designed for mortising into door edge.
- B. Self-Latching Flush Bolts: BHMA A156.3, Type 27; minimum 3/4-inch (19-mm) throw; with dust-proof strikes designed for mortising into door edge.

2.13 EXIT DEVICES AND AUXILIARY ITEMS

- A. Exit Devices and Auxiliary Items: BHMA A156.3.

2.14 LOCK CYLINDERS

- A. Lock Cylinders: Tumbler type, constructed from brass or bronze, stainless steel, or nickel silver.
- B. Standard Lock Cylinders: BHMA A156.5; Grade 1 permanent cores; face finished to match lockset.
 - 1. Core Type: Interchangeable. 300 Series Cores / KSP KM-300 SFIC 6 pin core cylinder

2.15 KEYING

- A. Keying System: Factory registered, complying with guidelines in BHMA A156.28, appendix. Provide one extra key blank for each lock. Incorporate decisions made in keying conference.
 - 1. Match Owner's Existing Master/Grandmaster (300 Master Key) System: Change keys and a master key operate cylinders.
 - a. Provide three cylinder change keys and five master keys.
 - 2. Existing System:
 - a. Master key or grand master key locks to Owner's existing system.
- B. 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.

2.16 KEY CONTROL SYSTEM

- A. Key Control Cabinet: BHMA A156.28; metal cabinet with baked-enamel finish; containing key-holding hooks, labels, two sets of key tags with self-locking key holders, key-gathering envelopes, and temporary and permanent markers; with key capacity of 150 percent of the number of locks.
 - 1. Wall-Mounted Cabinet: Grade 1 cabinet with hinged-panel door equipped with key-holding panels and pin-tumbler cylinder door lock.

2.17 OPERATING TRIM

- A. Operating Trim: BHMA A156.6; stainless steel unless otherwise indicated.

2.18 ACCESSORIES FOR PAIRS OF DOORS

- A. Coordinators: BHMA A156.3; consisting of active-leaf, hold-open lever and inactive-leaf release trigger; fabricated from steel with nylon-coated strike plates; with built-in, adjustable safety release; and with internal override.
- B. Carry-Open Bars: BHMA A156.3; prevent the inactive leaf from opening before the active leaf; provide polished brass or bronze carry-open bars with strike plate for inactive leaves of pairs of doors unless automatic or self-latching bolts are used.
- C. Astragals: BHMA A156.22.

2.19 SURFACE CLOSERS

- A. Surface Closers: BHMA A156.4; rack-and-pinion hydraulic type with adjustable sweep and latch speeds controlled by key-operated valves and forged-steel main arm. Comply with manufacturer's written instructions for size of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Provide factory-sized closers, adjustable to meet field conditions and requirements for opening force.

2.20 CONCEALED CLOSERS

- A. Concealed Closers: BHMA A156.4; rack-and-pinion hydraulic type with adjustable sweep and latch speeds controlled by key-operated valves. Comply with manufacturer's written instructions for size of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Provide factory-sized closers, adjustable to meet field conditions and requirements for opening force.

2.21 MECHANICAL STOPS AND HOLDERS

- A. Wall- and Floor-Mounted Stops: BHMA A156.16.

2.22 OVERHEAD STOPS AND HOLDERS

- A. Overhead Stops and Holders: BHMA A156.8.

2.23 DOOR GASKETING

- A. Door Gasketing: BHMA A156.22; with resilient or flexible seal strips that are easily replaceable and readily available from stocks maintained by manufacturer.
- B. Maximum Air Leakage: When tested according to ASTM E283 with tested pressure differential of 0.3-inch wg (75 Pa), as follows:
 - 1. Smoke-Rated Gasketing: 0.3 cfm/sq. ft. (3 cu. m per minute/sq. m) of door opening.
 - 2. Gasketing on Single Doors: 0.3 cfm/sq. ft. (3 cu. m per minute/sq. m) of door opening.
 - 3. Gasketing on Double Doors: 0.50 cfm per ft. (0.000774 cu.) m/s per m) of door opening.

2.24 THRESHOLDS

- A. Thresholds: BHMA A156.21; fabricated to full width of opening indicated.

2.25 METAL PROTECTIVE TRIM UNITS

- A. Metal Protective Trim Units: BHMA A156.6; fabricated from 0.050-inch- (1.3-mm-) thick stainless steel; with manufacturer's standard machine or self-tapping screw fasteners.

2.26 AUXILIARY DOOR HARDWARE

- A. Auxiliary Hardware: BHMA A156.16.

2.27 FINISHES

- A. Provide finishes complying with BHMA A156.18 as indicated in door hardware schedule.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Mounting Heights: Mount door hardware units at heights indicated on Drawings or to comply with the following unless otherwise indicated or required to comply with governing regulations.
 - 1. Standard Steel Doors and Frames: ANSI/SDI A250.8.
 - 2. Custom Steel Doors and Frames: HMMA 831.
 - 3. Wood Doors: DHI's "Recommended Locations for Architectural Hardware for Wood Flush Doors."
- B. Install each door hardware item to comply with manufacturer's written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work. Do not install surface-mounted items until finishes have been completed on substrates involved.
- C. Hinges: Install types and in quantities indicated in door hardware schedule, but not fewer than the number recommended by manufacturer for application indicated or one hinge for every 30 inches (750 mm) of door height, whichever is more stringent, unless other equivalent means of support for door, such as spring hinges or pivots, are provided.
- D. Intermediate Offset Pivots: Where offset pivots are indicated, provide intermediate offset pivots in quantities indicated in door hardware schedule, but not fewer than one intermediate offset pivot per door and one additional intermediate offset pivot for every 30 inches (750 mm) of door height greater than 90 inches (2286 mm).
- E. Lock Cylinders: Install construction cores to secure building and areas during construction period.

1. Replace construction cores with permanent cores as directed by Owner.
 2. Furnish permanent cores to Owner for installation.
- F. Key Control Cabinet: Tag keys and place them on markers and hooks in key control system cabinet, as determined by final keying schedule.
- G. Boxed Power Supplies: Locate power supplies as indicated or, if not indicated, in equipment room. Verify location with Architect.
1. Configuration: Provide one power supply for each door opening or least number of power supplies required to adequately serve doors with electrified door hardware.
- H. Thresholds: Set thresholds for exterior doors and other doors indicated in full bed of sealant complying with requirements specified in Section 079200 "Joint Sealants."
- I. Stops: Provide floor stops for doors unless wall or other type stops are indicated in door hardware schedule. Do not mount floor stops where they will impede traffic.
- J. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.
1. Do not notch perimeter gasketing to install other surface-applied hardware.
- K. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.
- L. Door Bottoms: Apply to bottom of door, forming seal with threshold when door is closed.
- 3.2 ADJUSTING
- A. Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

DOOR HARDWARE SCHEDULE –

1. Hardware Group 100 – Typical at Condition A
 - a. Electric Strike – surface mounted
 - b. Panic with cylinder on opposite side
 - c. Pull
 - d. Cover plates as needed to cover existing machining of door and frame
2. Hardware Group 110 – At door A300
 - a. Hardware Group 100
 - b. Closer

Hardware Groups continue on next page

3. Hardware Group 200 – Typical at Condition B
 - a. Hollow metal frame section to match cut out of existing hollow metal frame and strike;
 - b. Electric Strike – recessed and integral with partial hollow metal frame replacement
 - c. Lever lockset – storage function
 - d. Cover plates as needed to cover existing machining of door
4. Hardware Group 300 – Typical at Condition C
 - a. Electrified removeable mullion
 - b. Electric strike for access controlled door leaf
 - c. Regular strike for non-access controlled door leaf
 - d. Pull for access controlled door leaf
 - e. Cover plates as needed to cover existing machining of door
5. Hardware Group 400 – Typical at Condition D
 - a. Hinges
 - b. Hinge door stop
 - c. Electric Strike – surface mounted
 - d. Panic with cylinder on opposite side
 - e. Pull
 - f. Closer
6. Hardware Group 500 – Typical at Condition E
 - a. Remove existing 9VDC electro-mechanical mortise lockset
 - 1) Existing is compatible with Corbin Russwin Access 800 series system
 - b. Replace with 24VDC electro-mechanical mortise lockset comparable to existing quality and compatible with new access control system
7. Hardware Group 600 – at door A100
 - a. Door position switch (DS) to be provided by others
8. Hardware Group 700 – at door A240
 - a. Remove existing access control lockset
 - b. Lever lockset
 - c. Cover plates as needed to cover existing machining of door

END OF SECTION 08 71 00

