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**PART 1 - GENERAL****1.01 SUMMARY**

- A. Section includes but is not limited to:
  - 1. Cutting, fitting and patching for asphalt.
  - 2. Asphaltic concrete paving.

**1.02 REFERENCES**

- A. The following is a list of standards referenced in this Section:
  - 1. ASTM D 3549 – Standard Test Method for Thickness or Height of Compacted Bituminous Paving Mixture Specimens.
  - 2. Washington State Department of Transportation 2016 Standard Specifications M41-10.

**1.03 DEFINITIONS**

- A. ACP: Asphalt concrete pavement.
- B. ACPO: Asphalt concrete pavement overlay.
- C. ATB: Asphalt treated base.
- D. Cementitious Materials: Portland cement alone, or in combination with one (1) or more of blended hydraulic cement, fly ash and other pozzolans, ground granulated blast-furnace slag, and silica fume
- E. CSBC: Crushed surfacing base course.

**1.04 SUBMITTALS**

- A. General: Submit the following:
- B. Mix Designs:
  - 1. Submit mix designs prepared by the asphalt producers laboratory.
  - 2. Conform to requirements of Washington State Department of Transportation 2016 Standard Specifications M41-10. Materials shall meet the requirements of this Section.
  - 3. Include test results of aggregates.
  - 4. Include proposed batch plant weight within the required values.
- C. Material Certificates: Signed by manufacturers certifying that each of the following items complies with requirements:
  - 1. Cementitious materials and aggregates. Include mill certificates for cement.
  - 2. Admixtures.

**1.05 PROJECT/SITE CONDITIONS**

- A. Coordinate with City of Fife and comply with their standards when doing work in the public right of way.
- B. After uncovering work, inspect conditions affecting performance of the Work, including installation of materials, items, products and assemblies.

- C. Report unsatisfactory and questionable conditions in written form to the Project Representative.
  - 1. Do not proceed with cutting, fitting and patching without direction from the Project Representative.
- D. Environmental Requirements:
  - 1. Apply tack coat when ambient temperature is above fifty (50) degrees Fahrenheit.
  - 2. Tack coat applied when temperature has been less than thirty-five (35) degrees Fahrenheit in the prior twelve (12) hours before application is not acceptable.

## **PART 2 - PRODUCTS**

### **2.01 MATERIALS**

- A. Comply with the requirements for materials and mix designs accepted by the Washington State Department of Transportation 2016 Standard Specifications M41-10.
- B. ACP: Plant-mixed, hot mixed asphalt composed of asphalt binder and mineral materials.
- C. ATB: Compacted base course of material composed of asphalt, anti-stripping additive, and aggregate.
- D. Tack Coat: Provide emulsified asphalt.
- E. Hot Bitumen: Provide medium-curing liquid asphalt showing no signs of carbonaceous matter, and no separation of components.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that conditions are satisfactory to receive work of this Section. Do not commence work until unsatisfactory conditions have been corrected.
- B. Beginning work constitutes acceptance of conditions.

### **3.02 PREPARATION**

- A. Field Measurements: Verify on job before beginning work.
- B. Protect surrounding areas and surfaces from damage prior to beginning work of this Section.
- C. Protection: Erect barriers and signage to direct others, including construction traffic away from the work area.
- D. Surface Preparation for Existing Paved Areas:
  - 1. Sweep and clean existing paved areas to be overlaid.
  - 2. Cut out and replace damaged areas of ACP.
  - 3. Extend removal activities to damaged or non-existent areas of ATB, sub-base, and CSBC when directed by the Owner Representative.
  - 4. Seal joints of patched areas before proceeding with installation.

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**3.03 INSTALLATION**

- A. CSBC: Install in accordance with the requirements of Washington State Department of Transportation 2016 Standard Specifications M41-10.
- B. Tack Coat:
  - 1. Apply to contact surfaces of previously constructed ACP, concrete, and to surfaces abutting, adjacent to, or projecting into areas indicated to receive ACP.
  - 2. Allow to dry prior to attempting to place ACP.
  - 3. Use care to prevent tracking and smearing bituminous materials.
- C. ATB: Install in accordance with the requirements of Washington State Department of Transportation 2016 Standard Specifications M41-10.
- D. ACP: Install in accordance with the requirements of Washington State Department of Transportation 2016 Standard Specifications M41-10.
  - 1. Install each course to the required thickness:
  - 2. Small patches less than four (4) square feet: Use six (6) inch thick ACP on existing compacted subgrade.
  - 3. Larger patches: Use four (4) inch ACP on four (4) inch new compacted aggregate subgrade.
- E. Manufacturer's Instructions:
  - 1. Comply with manufacturer's instructions, including technical bulletins and product catalog data.
  - 2. Contact the product representative to confirm appropriate procedures prior to beginning installation.
  - 3. Retain manufacturer's written installation instructions at the Project Site.

**3.04 REPAIR AND RESTORATION**

- A. Replace ACP and ATB damaged as a result of Contractor's activities after placement.
- B. Blend new paving into adjacent existing paving.
  - 1. Saw cut edges for clean joints.
  - 2. Plane and grind to knock down edges, and produce smooth transitions.
  - 3. Seal edges.
- C. Remove and replace defective paving, and paving mixed with foreign materials.
  - 1. Cut out defectives areas.
  - 2. Tack edges using the indicated tack coating.
  - 3. Fill the cut out areas with fresh asphalt concrete paving.
  - 4. Compact by rolling to achieve specified surface density and surface smoothness.
  - 5. Join old work into new with smooth edges and transitions.
  - 6. Conform to slopes.
  - 7. Seal joints with hot bitumen.

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D. Planning and Grinding:

1. Perform planning and grinding in accordance with the requirements of Washington State Department of Transportation 2016 Standard Specifications M41-10.
2. Repair damage beyond the planning limits, and any other damage resulting from planning activities.

**3.05 FIELD QUALITY CONTROL**

A. General:

1. Test in-place ACP paving courses for compliance with Standard Specification requirements for compaction, thickness, and surface smoothness.
2. Testing is to be performed by the testing laboratory under contract with the Owner.
3. Repair and replace defective Work of this Section when directed by the Project Representative, and to eliminate any ponded water.

B. Thickness:

1. Measure in-place compacted sub base and ALP thicknesses in accordance with requirements of ASTM D 3549.
2. Variations in excess of one-quarter (1/4) inch are not acceptable.

C. Surface Smoothness:

1. Test finished areas of each paving course for smoothness in accordance with requirements of Washington State Department of Transportation 2016 Standard Specifications M41-10.

**3.06 PROTECTION**

- A. Protect work of this Section from damage and deterioration until completion and acceptance by Owner.
- B. Do not permit traffic on freshly paved surfaces for at least six (6) hours after placement.
  1. Freshly paved surfaces are to have cooled and hardened prior to allowing exposure to traffic.

**END OF SECTION**

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**PART 1 - GENERAL****1.01 SUMMARY**

- A. Work included:
  - 1. Raceway system for extension of existing card access system control panel to new gate access card readers. Card Reader

**1.02 RELATED SECTIONS**

- A. Contents of Division 28, Electronic Safety apply to this Section.

**1.03 REFERENCES AND STANDARDS**

- A. References and Standards as required by Division 28, Electronic Safety and Security.

**1.04 SUBMITTALS**

- A. Submittals as required by Division 28, Electronic Safety and Security.

**1.05 QUALITY ASSURANCE**

- A. Quality assurance as required by Division 28, Electronic Safety and Security.

**1.06 WARRANTY**

- A. Warranty of materials and workmanship as required by Division 28, Electronic Safety and Security.

**PART 2 - PRODUCTS****2.01 MANUFACTURERS****2.02 CARD READER**

- A. Provide raceway systems to support the extension of the existing card access system, and make connections to new card access devices.

**PART 3 - EXECUTION****3.01 GENERAL INSTALLATION REQUIREMENTS**

- A. This specification is to be used in conjunction with the Drawings. There may be circumstances where a device listed here is not present or required on the project Drawings.
- B. Coordinate conduit installation with the general electrical contractor performing the fencing, gate, and vehicle detection loop installation..
- C. Preparation:
  - 1. Order required parts and equipment upon notification of award of the work.
  - 2. Verify the availability of power where required. If a new source of power is required, a licensed electrician is required to install it.
- D. Carefully follow the instructions in the manufacturer's Installation Manual to ensure steps have been taken to provide a reliable, easy to operate system.

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- E. Perform work as indicated in the Drawings and Specifications.
  - F. Install conduit to designated card readers and controllers.
  - G. Ensure minimum separation requirements are met between communications cables and power circuits.
  - H. Workmanship:
    - 1. Comply with highest industry standards, except when specified requirements indicate more rigid standards or more precise workmanship.
    - 2. Perform work with persons experienced and qualified to produce workmanship specified.
    - 3. Maintain quality control over suppliers and Subcontractors.
  - I. Grounding: Provide earth-grounding of equipment as required by equipment manufacturer. Earth ground to be connected to ground rod or approved cold water pipe. Do not use electrical or telephone ground connections as earth grounds. Do not use connections to mounting posts or building structural steel as earth grounds.
  - J. Cutting and Patching: Responsible for cutting, fitting or patching that may be required to complete the work.

### **3.02 CARD READER**

- A. Reference 3.01, General Installation Requirements.
- B. Install per manufacturer's instructions and recommendations.

**END OF SECTION**

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**PART 1 - GENERAL****1.01 SECTION INCLUDES**

- A. Work included in 28 00 02, Electronic Security Basic Requirements applies to Division 28, Electronic Safety and Security work to provide materials, labor, tools, permits, incidentals, and other services to provide and make ready for Owner's use of electronic security systems for proposed project.
- B. Contract Documents include, but are not limited to, Specifications, Drawings, Addenda, Owner/Architect Agreement, and Owner/Contractor Agreement. Confirm requirements before commencement of work.
- C. Definitions:
  - 1. Provide: To furnish and install, complete and ready for intended use.
  - 2. Furnish: Supply and deliver to project site, ready for unpacking, assembly and installation.
  - 3. Install: Includes unloading, unpacking, assembling, erecting, installing, applying, finishing, protecting, cleaning and similar operations at project site as required to complete items of work furnished.
  - 4. Approved or Approved Equivalent: To possess the same performance qualities and characteristics and fulfill the utilitarian function without any decrease in quality, durability or longevity. For equipment/products defined by the Contractor as "equivalent," substitution requests must be submitted to Engineer for consideration and approved by the Engineer prior to submitting bids for substituted items.
  - 5. Authority Having Jurisdiction (AHJ): Indicates reviewing authorities having jurisdiction, including local fire marshal, Owner's insurance underwriter, Owner's representative, and other reviewing entity whose approval is required to obtain systems acceptance.

**1.02 RELATED SECTIONS:**

- A. Contents of Section apply to Division 28, Electronic Safety and Security Contract Documents.
- B. Related Work:
  - 1. Additional conditions apply to this Division including, but not limited to:
    - a. Specifications
    - b. Drawings
    - c. Addenda
    - d. Owner/Architect Agreement
    - e. Owner/Contractor Agreement
    - f. Codes, Standards, Public Ordinances and Permits
- C. Contents of Division 26, Electrical apply to this Section.

**1.03 REFERENCES AND STANDARDS**

- A. References and Standards per individual Division 28, Electronic Safety and Security Sections and those listed in this Section.
- B. Codes to include latest adopted editions, including current amendments, supplements and local jurisdiction requirements in effect as of the date of the Contract Documents, of/from:
  - 1. State of Washington:

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- |    |      |                                |
|----|------|--------------------------------|
| a. | IBC  | International Building Code    |
| b. | IFC  | International Fire Code        |
| c. | IMC  | International Mechanical Code  |
| d. | SEC  | Seattle Energy Code            |
| e. | UPC  | Uniform Plumbing Code          |
| f. | WAC  | Washington Administrative Code |
| g. | WSEC | Washington State Energy Code   |
- C. General: Reference standards and guidelines include but are not limited to the latest adopted editions from:
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| 1.  | ABA    | Architectural Barriers Act  |
| 2.  | ADA    | Americans with Disabilities Act   |
| 3.  | ANSI   | American National Standards Institute                                     |
| 4.  | ASCE   | American Society of Civil Engineers                                       |
| 5.  | ASHRAE | American Society of Heating, Refrigerating and Air-Conditioning Engineers |
| 6.  | ASHRAE | Guideline 0, the Commissioning Process                                    |
| 7.  | ASME   | American Society of Mechanical Engineers                                  |
| 8.  | ASTM   | ASTM International  |
| 9.  | CFR    | Code of Federal Regulations   |
| 10. | CSA    | CSA International   |
| 11. | EPA    | Environmental Protection Agency   |
| 12. | ETL    | Electrical Testing Laboratories   |
| 13. | FM     | FM Global   |
| 14. | ISO    | International Organization for Standardization                            |
| 15. | LEED   | Leadership in Energy and Environmental Design                             |
| 16. | NEC    | National Electric Code  |
| 17. | NEMA   | National Electrical Manufacturers Association                             |
| 18. | NFPA   | National Fire Protection Association                                      |
| 19. | OSHA   | Occupational Safety and Health Administration                             |
| 20. | SMACNA | Sheet Metal and Air Conditioning Contractors' National Association        |
| 21. | UL     | Underwriters Laboratories Inc.  |
| 22. | USDA   | United States Department of Agriculture                                   |
- D. See Division 28, Electronic Safety and Security individual Sections for additional references.
- E. Where code requirements are at variance with Contract Documents, meet code requirements as a minimum requirement and include costs necessary to meet these in Contract.
- F. Machinery and equipment are to comply with OSHA requirements, as currently revised and interpreted for equipment manufacturer requirements. Install equipment provided per manufacturer recommendations.

- G. Whenever this Specification calls for material, workmanship, arrangement or construction of higher quality and/or capacity than that required by governing codes, higher quality and/or capacity take precedence.

#### 1.04 SUBMITTALS

A. Submittal procedures:

1. "No Exception Taken" constitutes that review is for general conformance with the design concept expressed in the Contract Documents for the limited purpose of checking for conformance with information given. Any action is subject to the requirements of the Contract Documents. Contractor is responsible for the dimensions and quantity and will confirm and correlate at the job site, fabrication processes and techniques of construction, coordination of the work with that of all other trades, and the satisfactory performance of the work.
2. Provide product submittals and shop drawings in electronic format only. Electronic format must be submitted via zip file via e-mail. For electronic format, provide one zip file per specification division containing a separate file for each specification Section. Individual submittals sent piecemeal in a per Specification Section method will be returned without review or comment. Copy Architect on all transmissions/submissions.
3. Product Data: Provide manufacturer's descriptive literature for products specified in Division 28, Electronic Safety and Security Sections.
4. Identify/mark each submittal in detail. Note what difference, if any, exist between the submitted item and the specified item. Failure to identify the differences will be considered cause for disapproval. If differences are not identified and/or not discovered during the submittal review process, Contractor remains responsible for providing equipment and materials that meet the specifications and drawings.
  - a. Label submittal to match numbering/references as shown in Contract Documents. Highlight and label applicable information to individual equipment or cross out/remove extraneous data not applicable to submitted model. Clearly note options and accessories to be provided, including field installed items. Highlight connections by/to other trades.
  - b. Include technical data, installation instructions and dimensioned drawings for products, equipment and devices installed, furnished or provided. Reference individual Division 28, Electronic Safety and Security specification Sections for specific items required in product data submittal outside of these requirements.
  - c. See Division 28, Electronic Safety and Security individual Sections for additional submittal requirements outside of these requirements.
5. Maximum of two reviews of complete submittal package. Arrange for additional reviews and/or early review of long-lead items; Bear costs of additional reviews at Engineer's hourly rates. Incomplete submittal packages/submittals will be returned to contractor without review.
6. Structural/Seismic: Provide weights, dimensions, mounting requirements and like information required for mounting, seismic bracing, and support. Indicate manufacturer's installation and support requirements to meet ASCE 7-10 requirements for non-structural components. Provide engineered seismic drawings and equipment seismic certification. Equipment Importance Factor as specified in Part 3 of this Section.
7. Trade Coordination: Include physical characteristics, electrical characteristics, device layout plans, wiring diagrams, and connections as required per Division 28, Electronic Safety and Security Coordination Documents. For equipment with electrical connections,

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furnish copy of approved submittal for inclusion in Division 26, Electrical and Division 28, Electronic Safety and Security submittals.

8. Make provisions for openings in building for admittance of equipment prior to start of construction or ordering of equipment.
9. Substitutions and Variation from Basis of Design:
  - a. The Basis of Design designated product establishes the qualities and characteristics for the evaluation of any comparable products by other listed acceptable manufacturers if included in this Specification or included in an approved Substitution Request as judged by the Design Professional.
  - b. If substitutions and/or equivalent equipment/products are being proposed, it is the responsibility of parties concerned, involved in, and furnishing the substitute and/or equivalent equipment to verify and compare the characteristics and requirements of that furnished to that specified and/or shown. If greater capacity and/or more materials and/or more labor are required for the rough-in, circuitry or connections than for the item specified and provided for, then provide compensation for additional charges required for the proper rough-in, circuitry and connections for the equipment being furnished. No additional charges above the Base Bid, including resulting charges for work performed under other Divisions, will be allowed for such revisions. Coordinate with the requirements of "Submittals." For any product marked "or approved equivalent," a substitution request must be submitted to Engineer for approval prior to purchase, delivery or installation.
  - c. Where manufacturer equipment or model numbers are indicated with no exceptions, substitutions will be rejected.
10. Resubmission Requirements:
  - a. Make any corrections or change in submittals when required by Architect/Engineer review comments. Provide submittals as specified. The engineer will not be required to edit and/or interpret the Contractor's submittals. Indicate changes for the resubmittal in a cover letter with reference to page(s) changed and reference response to comment. Cloud changes in the submittals.
    - 1) Resubmit for review until review indicates no exceptions taken or "make corrections noted."
    - 2) When submitting drawings for Engineers re-review, clearly indicate changes on drawings and "cloud" any revisions. Submit a list describing each change.
11. Operation and Maintenance Manuals, Owners Instructions:
  - a. Reference individual Division 28, Electronic Safety and Security Specification Sections for additional requirements for operations and maintenance manuals.
  - b. Submit, at one time, electronic files (PDF format) on CD/DVD of manufacturer's operation and maintenance instruction manuals and parts lists for equipment or items requiring servicing. Submit data when work is substantially complete and in same order format as submittals. Include name and location of source parts and service for each piece of equipment.
    - 1) Include copy of approved submittal data along with submittal review letters received from Engineer. Data to clearly indicate installed equipment model numbers. Delete or cross out data pertaining to other equipment not specific to this project.
    - 2) Include copy of manufacturer's standard Operations and Maintenance for equipment. At front of each tab, provide routine maintenance documentation for scheduled equipment. Include manufacturer's recommended maintenance

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schedule and highlight maintenance required to maintain warranty. Furnish list of routine maintenance parts, including part numbers, sizes and quantities relevant to each piece of equipment.

- 3) Include copy of complete parts list for equipment. Include available exploded views of assemblies and sub-assemblies.
  - 4) Include Warranty per Section 28 00 02, Electronic Security Basic Requirements and individual Sections.
  - 5) Include product certificates of warranties and guarantees.
  - 6) Include copy of start-up and test reports specific to each piece of equipment.
  - 7) Include commissioning reports.
  - 8) Engineer will return incomplete documentation without review.
  - 9) Engineer will provide one set of review comments in Submittal Review format. Arrange for additional reviews; Bear costs for additional reviews at Engineer's hourly rates.
- c. Thoroughly instruct Owner in proper operation of equipment and systems. Where noted in individual Sections, training will include classroom instruction with applicable training aids and systems demonstrations. Field instruction per Section 28 00 02, Electronic Security Basic Requirements Article titled "Demonstration."
- d. Copies of certificates of code authority inspections, acceptance, code required acceptance tests, and other special guarantees, certificates of warranties, specified elsewhere or indicated on Drawings.
12. Record Drawings:
- a. Maintain at site at least one set of drawings for recording "as-constructed" conditions. Indicate on drawings changes to original documents by referencing revision document, and include buried elements and location of concealed items. Include items changed by addenda, field orders, supplemental instructions, and constructed conditions.
  - b. Record Drawings are to include equipment locations, calculations, and schedules that accurately reflect "as constructed or installed" for project.
  - c. At completion of project, input changes to original project on CAD Drawings and make one set of black-line drawings created from CAD Files in version/release equal to contract drawings. Submit CAD disk and drawings upon substantial completion.
  - d. See Division 28, Electronic Safety and Security individual Sections for additional items to include in Record Drawings.

### 1.05 QUALITY ASSURANCE

- A. Regulatory Requirements: Work and materials to conform to all local, State, Federal and other applicable laws and regulations.
- B. Drawings are intended to be diagrammatic and reflect the Basis of Design manufacturer's equipment. They are not intended to show every item in its exact dimensions, or details of equipment or proposed systems layout. Verify actual dimensions of systems (e.g. cable tray, panels, etc.) and equipment proposed to assure that systems and equipment will fit in available space. Contractor is responsible for design and construction costs incurred for equipment other than Basis of Design, including, but not limited to, architectural, structural, electrical, HVAC, fire sprinkler, and plumbing systems.

- C. Manufacturer's Instructions: Follow manufacturer's written instructions. If in conflict with Contract Documents, obtain clarification. Notify Engineer/Architect, in writing, before starting work.
- D. Items shown on Drawings are not necessarily included in Specifications or vice versa. Confirm requirements in all Contract Documents.
- E. Provide products which are UL listed.

#### **1.06 WARRANTY**

- A. Provide written warranty covering the work for a period of one year from date of Substantial Completion in accordance with Section 28 00 02, Electronic Security Basic Requirements and individual Division 28, Electronic Safety and Security Sections.
- B. Sections under this Division can require additional and/or extended warranties that apply beyond basic warranty. Confirm requirements in all Contract Documents.

### **PART 2 - PRODUCTS**

#### **2.01 MANUFACTURERS**

- A. Provide like items from one manufacturer, including but not limited to panels, devices and equipment unless otherwise specified in individual Division 28, Electronic Safety and Security Sections.

#### **2.02 MATERIALS**

- A. Base contract upon furnishing materials as specified. Materials, equipment, and fixtures used for construction are to be new, latest products as listed in manufacturer's printed catalog data and are to be UL or FM approved or have adequate approval or be acceptable by state, county, and city authorities.
- B. Articles, fixtures, and equipment of a kind to be standard product of one manufacturer.
- C. Names and manufacturer's names denote character and quality of equipment desired and are not to be construed as limiting competition.
- D. Hazardous Materials:
  - 1. Comply with local, State of Washington, and Federal regulations relating to hazardous materials.
  - 2. Do not use any materials containing a hazardous substance. If hazardous materials are encountered, do not disturb; immediately notify Owner and Architect. Hazardous materials will be removed by Owner under separate contract.

#### **2.03 ACCESS PANELS**

- A. See Division 08, Openings for products and installation requirements.
- B. Confirm Access Panel requirements in Division 08, Openings and individual Division 28, Electronic Safety and Security Sections. In absence of specific requirements, comply with the following:
  - 1. Provide flush mounting access panels for systems and individual components, service of electronic security systems equipment and junction boxes requiring maintenance, inspection or servicing. Where access panels are located in fire-rated assemblies of building, rate access panels accordingly.

- a. Ceiling access panels to be minimum of 24-inch by 24-inch required and approved size.
- b. Wall access panels to be minimum of 12-inch by 12-inch required and approved size.
- c. Provide screwdriver operated catch.
- d. Manufacturers and Models:
  - 1) Drywall: Karp KDW.
  - 2) Plaster: Karp DSC-214PL.
  - 3) Masonry: Karp DSC-214M.
  - 4) 2 hour rated: Karp KPF-350FR.
  - 5) Manufacturers: Karp, Milco, Elmdor, Acudor, or approved equivalent.

### **PART 3 - EXECUTION**

#### **3.01 ACCESSIBILITY AND INSTALLATION**

- A. Confirm Accessibility and Installation requirements in Section 28 00 02, Electronic Security Basic Requirements and individual Division 28, Electronic Safety and Security Sections.
- B. Install equipment having components requiring access (i.e., devices, equipment, electrical boxes, panels, etc.) so that they may be serviced, reset, replaced or recalibrated by service people with normal service tools and equipment. Do not install equipment in obvious passageways, doorways, scuttles or crawlspaces which would impede or block intended usage.
- C. Install equipment and products complete as directed by manufacturer's installation instructions. Obtain installation instructions from manufacturer prior to rough-in of equipment and examine instructions thoroughly. When requirements of installation instructions conflict with Contract Documents, request clarification from Architect prior to proceeding with installation. This includes proper installation methods, sequencing and coordination with other trades and disciplines.
- D. Earthwork:
  1. Confirm Earthwork requirements in Contract Documents. In absence of specific requirements, comply with individual Division 28, Electronic Safety and Security Sections and the following:
    - a. Perform excavation, dewatering, shoring, bedding, and backfill required for installation of work in this Division in accordance with related earthwork divisions. Contact utilities and locate existing utilities prior to excavation. Repair any work damaged during excavation or backfilling.
    - b. Excavation: Do not excavate under footings, foundation bases, or retaining walls.
    - c. Provide protection of underground systems. Review the project Geotechnical Report for references to corrosive or deleterious soils which will reduce the performance or service life of underground systems materials.
- E. Firestopping:
  1. Confirm Firestopping requirements in Division 07, Thermal and Moisture Protection. In absence of specific requirements, comply with individual Division 28, Electronic Safety and Security Sections and the following:
    - a. Coordinate location and protection level of fire and/or smoke rated walls, ceilings, and floors. When these assemblies are penetrated, seal around conduit, raceway and

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equipment with approved firestopping material. Install firestopping material complete as directed by manufacturer's installation instructions. Meet requirements of ASTM E814, Standard Test Method for Fire Tests of Through-Penetration Fire Stops.

F. Plenums:

1. In plenums, provide plenum rated materials that meet the requirements to be installed in plenums.

### 3.02 SEISMIC CONTROL

- A. Confirm Seismic Control requirements in Section 28 00 02, Electronic Security Basic Requirements and individual Division 28 Electronic Security Sections.
- B. Equipment Importance Factor: 1.5.
- C. General:
  1. Seismic Design Category: C.
  2. Building Occupancy Category: II.
  3. Confirm Building Occupancy Category and Seismic Design Category with Architect.
  4. Earthquake resistant designs for electronic safety and security systems (Division 28) equipment and distribution, i.e. equipment, etc. conform to regulations of Authority Having Jurisdiction (AHJ).
  5. Restraints which are used to prevent disruption of function of piece of equipment because of application of horizontal force to be such that forces are carried to frame of structure in such a way that frame will not be deflected when apparatus is attached to a mounting base and equipment pad, or to structure in normal way, utilizing attachments provided. Secure equipment and distribution systems to withstand a force in direction equal to value defined by Authority Having Jurisdiction (AHJ).
  6. Equipment:
    - a. Provide means to prohibit excessive motion of equipment during earthquake.

### 3.03 REVIEW AND OBSERVATION

- A. Confirm Review and Observation requirements in Section 28 00 02, Electronic Security Basic Requirements and individual Division 28, Electronic Safety and Security Sections.
- B. Notify Architect, in writing, at following stages of construction so that they may, at their option, visit site for review and construction observation:
  1. Underground conduit and wire installation prior to backfilling.
  2. Prior to covering walls when electronic security system installation is started.
  3. Prior to ceiling cover/installation.
  4. When main systems, or portions of, are being tested and ready for inspection by AHJ.
- C. Final Punch: Costs incurred by additional trips required due to incomplete systems will be the responsibility of the Contractor.

### 3.04 CONTINUITY OF SERVICE

- A. Confirm requirements in individual Division 28, Electronic Safety and Security Sections and the following:
  1. During remodeling or addition to existing structures, while existing structure is occupied, current services to remain intact until new construction, facilities or equipment is installed.

2. Prior to changing over to new system, verify that every item is thoroughly prepared. Install new wiring to point of connection.
3. Coordinate transfer time to new service with Owner. If required, perform transfer during off peak hours. Once changeover is started, pursue to its completion to keep interference to a minimum.
  - a. If overtime is necessary, there will be no allowance made by Owner for extra expense for such overtime or shift work.
4. Organize work to minimize duration of power interruption.

### **3.05 CUTTING AND PATCHING**

- A. Confirm Cutting and Patching Requirements in individual Division 28, Electronic Safety and Security Sections and the following:
  1. Proposed floor cutting/core drilling/sleeve locations to be approved by project Structural Engineer. Submit proposed locations to Architect/Project Structural Engineer. Where slabs are of post tension construction, perform x-ray scan of proposed penetration locations and submit scan results including proposed penetration locations to project Structural Engineer/Architect for approval. Where slabs are of waffle type construction, show column cap extent and cell locations relative to proposed penetration(s).
  2. Cutting, patching and repairing for work specified in this Division including plastering, masonry work, concrete work, carpentry work, and painting included under this Section will be performed by skilled craftsmen of each respective trade in conformance with appropriate Division of Work.
  3. Additional openings required in building construction to be made by drilling or cutting. Use of jack hammer is specifically prohibited. Patch openings in and through concrete and masonry with grout.
  4. Restore new or existing work that is cut and/or damaged to original condition. Patch and repair specifically where existing items have been removed. This includes repairing and painting walls, ceilings, etc. where existing conduit and devices are removed as part of this project. Where alterations disturb lawns, paving, and walks, repair, refinish and leave in condition matching existing prior to commencement of work.
  5. Additional work required by lack of proper coordination will be provided at no additional cost to the Owner.

### **3.06 EQUIPMENT SELECTION AND SERVICEABILITY**

- A. Replace or reposition equipment which is too large or located incorrectly to permit servicing, at no additional cost to Owner.

### **3.07 DELIVERY, STORAGE AND HANDLING**

- A. Confirm requirements in individual Division 28, Electronic Safety and Security Sections and the following:
  1. Handle materials delivered to project site with care to avoid damage. Store materials on site inside building or protected from weather, dirt and construction dust.
  2. Protect equipment and pipe to avoid damage. Close conduit openings with caps or plugs. Keep motors and bearings in watertight and dustproof covers during entire course of installation.
  3. Protect devices, panels and similar items until in service.

4. Products and/or materials that become damaged due to water, dirt and/or dust as a result of improper storage to be replaced before installation.

### **3.08 DEMONSTRATION**

- A. Confirm Demonstration requirements in Section 28 00 02, Electronic Security Basic Requirements and individual Division 28, Electronic Safety and Security Sections.
- B. Upon completion of work and adjustment of equipment, test systems, demonstrate to Owner's Representative, Architect and Engineer that equipment furnished and installed or connected under provisions of these Specifications functions in manner required. Provide field instruction to Owner's Staff as specified in individual Division 28, Electronic Safety and Security Sections.
- C. Manufacturer's Field Services: Furnish services of a qualified factory certified instructor at time approved by Owner, to instruct maintenance personnel, correct defects or deficiencies, and demonstrate to satisfaction of Owner that entire system is operating in satisfactory manner and complies with requirements of other trades that may be required to complete work. Complete instruction and demonstration prior to final job site observations.

### **3.09 CLEANING**

- A. Confirm cleaning requirements in Section 28 00 00, Electronic Security Basic Requirements and individual Division 28 Sections.
- B. Upon completion of installation, thoroughly clean exposed portions of equipment, removing temporary labels and traces of foreign substances. Throughout work, remove construction debris and surplus materials accumulated during work.

### **3.10 INSTALLATION**

- A. Confirm Installation requirements in Section 28 00 02, Electronic Security Basic Requirements and individual Division 28, Electronic Safety and Security Sections.
- B. Install equipment in accordance with manufacturer's installation instructions, plumb and level and firmly anchored to building structure. Maintain manufacturer's recommended clearances.
- C. Start up equipment, in accordance with manufacturer's start-up instructions, and in presence of manufacturer's representative. Test controls and demonstrate compliance with requirements. Replace damaged or malfunctioning controls and equipment.
- D. Provide miscellaneous supports required for installation of equipment, conduit and wiring.

### **3.11 PAINTING**

- A. Confirm Painting requirements in individual Division 28, Electronic Safety and Security Sections and the following:
  1. Ferrous Metal: After completion of work, thoroughly clean and paint exposed supports constructed of ferrous metal surfaces, i.e. hangers, hanger rods, equipment stands, with one coat of black asphalt varnish for exterior or black enamel for interior suitable for hot surfaces.
  2. In electrical and mechanical room, on roof or other exposed areas, equipment not painted with enamel to receive two coats of primer and one coat of rustproof enamel, colors as selected by Architect.
  3. See individual equipment Specifications for other painting.
  4. Structural Steel: Repair damage to structural steel finishes or finishes of other materials damaged by cutting, welding or patching to match original.

5. Conduit: Clean, primer coat and paint interior conduit exposed in finished areas with two coats paint suitable for metallic surfaces. Color selected by Architect.

### **3.12 ACCESS PANELS**

- A. Confirm Access Panel requirements in individual Division 28, Electronic Safety and Security Sections and the following:
  1. Coordinate locations/sizes of access panels with Architect prior to work.

### **3.13 ACCEPTANCE**

- A. Confirm requirements in individual Division 28, Electronic Safety and Security Sections and the following:
  1. System cannot be considered for acceptance until work is completed and demonstrated to Architect that installation is in strict compliance with Specifications, Drawings and manufacturer's installation instructions, particularly in reference to following:
    - a. Cleaning
    - b. Operation and Maintenance Manuals
    - c. Training of Operating Personnel
    - d. Record Drawings
    - e. Warranty and Guaranty Certificates
    - f. Start-up/test Documents and Commissioning Reports

### **3.14 FIELD QUALITY CONTROL**

- A. Confirm requirements in individual Division 28, Electronic Safety and Security Sections and the following:
  1. Tests:
    - a. Conduct tests of equipment and systems to demonstrate compliance with requirements specified. Reference individual Specification Sections for required tests. Document tests and include in Closeout Documents.
    - b. During site evaluations by Architect or Engineer, provide appropriate personnel with tools to remove and replace trims, covers, and devices so that proper evaluation of installation can be performed.

**END OF SECTION**

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**PART 1 - GENERAL****1.01 SUMMARY**

- A. Work Included:
  - 1. Fuses
  - 2. Molded Case Circuit Breakers

**1.02 RELATED SECTIONS**

- A. Contents of Division 26, Electrical apply to this Section.

**1.03 REFERENCES AND STANDARDS**

- A. References and Standards as required by Section 26 00 00, Electrical Basic Requirements.

**1.04 SUBMITTALS**

- A. Submittals as required by Section 26 00 00, Electrical Basic Requirements.
- B. In addition, provide:
  - 1. Product data and instantaneous let-through current curves and average melting time current curves for fuses supplied to project.
  - 2. Product data and time/current trip curves for circuit breakers supplied to project.

**1.05 QUALITY ASSURANCE**

- A. Quality assurance as required by Section 26 00 00, Electrical Basic Requirements.

**1.06 WARRANTY**

- A. Warranty of materials and workmanship as required by Section 26 00 00, Electrical Basic Requirements.

**PART 2 - PRODUCTS****2.01 MANUFACTURERS**

- A. Fuses:
  - 1. Bussmann
  - 2. Ferraz-Shawmut
  - 3. Littelfuse
  - 4. McGraw-Edison
  - 5. Or approved equivalent.
- B. Molded Case Circuit Breakers:
  - 1. Eaton Electrical
  - 2. General Electric
  - 3. Siemens
  - 4. Schneider Electric/Square D

- 
5. Or approved equivalent.

## 2.02 FUSES

- A. Characteristics:
  1. Dual element, time delay, current limiting, nonrenewable type, rejection feature.
  2. Combination Loads: UL Class RK5, 1/10 to 600 amp. UL Class L, above 600 amps.
  3. Motor Loads: UL Class RK5, 1/10 to 600 amp.
  4. Fuse pullers for complete range of fuses.

## 2.03 MOLDED CASE CIRCUIT BREAKERS

- A. 1-, 2- or 3-pole bolt-on, single handle common trip, 600VAC or 250VAC as indicated on Drawings.
- B. Overcenter toggle-type mechanism, quick-make, quick-break action. Trip indication is by handle position.
- C. Calibrate for operation in 40 degrees C ambient temperature.
- D. 15 to 150 Amp Breakers: Permanent trip unit containing individual thermal and magnetic trip elements in each pole.
- E. 151 to 400 Amp Breakers: Adjustable magnetic trip elements. Provide push-to-trip button on cover of breaker for mechanical tripping.
- F. Greater than 401 Amp: Electronic trip type with adjustments for long-time, instantaneous, and short-time functions.
- G. Provide ground fault function for breakers greater than 800 amps where applied at 480 volts line-to-line; and where indicated on drawings.
- H. Combination AFCI Breaker: UL 1699 compliant. Integral 30mA GFCI trip. Manual test button for AFCI mechanism.

## PART 3 - EXECUTION

### 3.01 GENERAL INSTALLATION REQUIREMENTS

- A. Coordination:
  1. Obtain and review the submitted product data for equipment furnished by the Owner, and furnished under other Divisions of this contract, particularly under Divisions 22 and 23.
  2. Confirm the equipment nameplate maximum overcurrent protection (MOCP) and make accommodations and adjustments to overcurrent protective devices as necessary to coordinate with the nameplate rating.
- B. Install all items in accordance with manufacturers written instructions.

### 3.02 FUSES

- A. Fuses: For each class and ampere rating of fuse installed, provide the following quantities of spares for quantity of fuses installed:
  1. 0 to 24: Provide 6 spare.
  2. 25 to 48: Provide 9 spare.
  3. 49 and Above: Provide 12 spare.

**3.03 MOLDED CASE CIRCUIT BREAKERS**

- A. Provide testing of ground fault interrupting breakers.
- B. Provide circuit breakers, as specified and on Drawings, for installation in panelboards, individual enclosures or combination motor starters.
- C. Provide ground fault interrupter circuit breakers for equipment in damp or wet locations.
- D. Provide device on handle to lock breaker in "ON" position for breakers feeding time switches, night lights and similar circuits required to be continuously energized.
- E. Shunt Trip Circuit Breakers: Provide wiring to remote trip switch/contacts as indicated on Drawings.
- F. Provide multi-pole branch circuit breakers for multiwire branch circuits for simultaneous disconnection of circuits.

**END OF SECTION**

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**PART 1 - GENERAL****1.01 SUMMARY**

- A. Work Included:
  - 1. Outlet Boxes
  - 2. Pull and Junction Boxes
  - 3. Conduit Fittings
  - 4. Weatherproof Outlet Boxes
- B. Provide electrical boxes and fittings for a complete installation. Include but not limited to outlet boxes, junction boxes, pull boxes, bushings, locknuts and other necessary components.

**1.02 RELATED SECTIONS**

- A. Contents of Division 26, Electrical apply to this Section.
- B. In addition, reference the following:
  - 1. Section 26 05 33, Raceways
  - 2. Section 26 05 53, Identification for Electrical Systems

**1.03 REFERENCES AND STANDARDS**

- A. References and Standards as required by Section 26 00 00, Electrical Basic Requirements.

**1.04 SUBMITTALS**

- A. Submittals as required by Section 26 00 00, Electrical Basic Requirements.

**1.05 QUALITY ASSURANCE**

- A. Quality assurance as required by Section 26 00 00, Electrical Basic Requirements.

**1.06 WARRANTY**

- A. Warranty of materials and workmanship as required by Section 26 00 00, Electrical Basic Requirements.

**PART 2 - PRODUCTS****2.01 MANUFACTURERS**

- A. Outlet Boxes:
  - 1. Bowers
  - 2. Hubbell
  - 3. Raco
  - 4. Steel City
  - 5. Thomas & Betts
  - 6. Or approved equivalent.
- B. Pull and Junction Boxes:

- 
1. B-Line
  2. Hoffman
  3. Or approved equivalent.
- C. Conduit Fittings:
1. Killark
  2. O-Z Gedney
  3. Raco
  4. Steel City
  5. Thomas & Betts
  6. Or approved equivalent.
- D. Weatherproof Outlet Boxes:
1. Pass and Seymour
  2. Bell
  3. Red Dot
  4. Carlon
  5. Or approved equivalent.

## 2.02 OUTLET BOXES

- A. Luminaire Outlet: 4-inch octagonal box, 1-1/2-inches deep with 3/8-inch luminaire stud if required. Provide raised covers on bracket outlets and on ceiling outlets.
- B. Device Outlet: Installation of one or two devices at common location, minimum 4-inches square, minimum 1-1/2-inches deep. Single- or two-gang flush device raised covers.
- C. Multiple Devices: Three or more devices at common location. Install one-piece gang boxes with one-piece device cover. Install one device per gang.
- D. Masonry Boxes: Outlets in concrete.
- E. Construction: For interior locations, provide galvanized steel outlet wiring boxes, of the type, shape and size, including depth of box, to suit each respective location and installation; constructed with stamped knockouts in back and sides, and with threaded holes with screws for securing box covers or wiring devices.
- F. Accessories: Provide outlet box accessories for each installation, including mounting brackets, wallboard hangers, extension rings, luminaire studs, cable clamps and metal straps for supporting outlet boxes, compatible with outlet boxes being used and meeting requirements of individual wiring situations.
- G. Noise Control: Provide acoustic putty pad to back side of each outlet box installed in acoustic rated walls.

## 2.03 PULL AND JUNCTION BOXES

- A. Construction: Provide ANSI 49 gray enamel painted sheet steel junction and pull boxes, with screw-on covers; of type shape and size, to suit each respective location and installation; with welded seams and equipped with stainless steel nuts, bolts, screws and washers.
- B. Location:

1. Provide junction boxes above accessible ceilings for drops into walls for receptacle outlets from overhead.
  2. Provide junction boxes and pull boxes to facilitate installation of conductors and limiting accumulated angular sum of bends between boxes, cabinets and appliances to 270 degrees.
- C. Fiberglass Handholes: Die molded glass fiber hand holes:
1. Cable Entrance: Pre-cut 2- x 2-inch cable entrance at center bottom of each side.
  2. Cover: Fiberglass weatherproof cover with nonskid finish.
  3. Cover Legend: ELECTRIC.

## 2.04 CONDUIT FITTINGS

- A. Requirements: Provide corrosion-resistant punched-steel box knockout closures, conduit locknuts and plastic conduit bushings of the type and size to suit each respective use and installation.

## 2.05 WEATHERPROOF OUTLET BOXES

- A. Construction: Provide corrosion-resistant cast metal weatherproof outlet wiring boxes, of the type, shape and size, including depth of box, with threaded conduit ends, cast metal faceplate with spring-hinged waterproof cap suitably configured for each application, including faceplate, gasket, blank plugs and corrosion proof fasteners. Weatherproof boxes to be constructed to have smooth sides, gray finish.

## PART 3 - EXECUTION

### 3.01 GENERAL INSTALLATION REQUIREMENTS

- A. Coordinate locations of floor boxes and wall mounted wiring device boxes with architectural and structural floor plans prior to rough-in.
- B. Install boxes securely, in a neat and workmanlike manner, as specified in NECA 1, Standard Practice of Good Workmanship in Electrical Construction.
- C. Secure boxes rigidly to substrate upon which they are being mounted, or solidly embed boxes in concrete or masonry.
- D. Install in locations as shown on Drawings, and as required for splices, taps, wire pulling, equipment connections, and as required by NFPA 70. Locate boxes and conduit bodies so as to ensure accessibility of electrical wiring.
- E. Set wall mounted boxes at elevations to accommodate mounting heights specified in this Section.
- F. Electrical boxes are shown on drawings in approximate locations unless dimensioned.
  1. Adjust box locations up to 10-feet if required to accommodate intended purpose.
- G. Install boxes to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Division 07, Thermal and Moisture Protection.
- H. Locate flush mounting box in masonry wall to require cutting of masonry unit corner only. Coordinate masonry cutting to achieve neat opening.
- I. Install flush mounting box without damaging wall insulation or reducing its effectiveness.

- J. Support boxes independently of conduit, except cast box that is connected to two rigid metal conduits both supported within 12-inches of box.
- K. Box Color Coding and Marking: Reference Section 26 05 53, Identification for Electrical Systems.
- L. Adjust boxes to be parallel with building lines. Boxes not plumb to building lines are not acceptable.
- M. Install knockout closures in unused box openings.
- N. Clean interior of boxes to remove dust, debris, and other material.
- O. Clean exposed surfaces and restore finish.

### 3.02 OUTLET BOXES INSTALLATION

- A. Mount outlet boxes, unless otherwise required by ADA, or noted on drawings, following distances above finished floor:
  - 1. Control Switches:
    - a. 48-inches to the top of outlet box.
    - b. 4-inches above top of backsplash at countertops/workstations, not-to-exceed 44-inches above finished floor to the top of outlet box per ADA requirements.
  - 2. Receptacles: 15-inches to the bottom of outlet box.
  - 3. Other Outlets: As indicated in other Sections of specifications or as detailed on drawings.
- B. Inaccessible Ceiling Areas: Install outlet and junction boxes no more than 6-inches from ceiling access panel or from removable recessed luminaire.
- C. Flush Outlets in Insulated Spaces: Maintain integrity of insulation and vapor barrier.
- D. Coordinate electrical device locations and elevations (switches and receptacles) with architectural drawings to prevent mounting devices in mirrors, back splashes, and behind cabinets.
- E. Locate outlet boxes to allow luminaires positioned as shown on reflected ceiling plan.
- F. Align adjacent wall mounted outlet boxes for switches, thermostats, and similar devices. Adjacent boxes not aligned vertically to be adjusted at no additional cost to Owner.
- G. Use flush mounting outlet box in finished areas.
- H. Apply acoustic putty pad on outlet box prior to installation of acoustical blanket.
- I. Secure flush mounting box to interior wall and partition studs. Accurately position to allow for surface finish thickness.
- J. Use stamped steel bridges to fasten flush mounting outlet box between studs.
- K. Use adjustable steel channel fasteners for hung ceiling outlet box.
- L. Use gang box where more than one device is mounted together. Do not use Sectional box.
- M. Use gang box with plaster ring for single device outlets.
- N. Adjust flush-mounting outlets to make front flush with finished wall material.

### 3.03 PULL AND JUNCTION BOXES INSTALLATION

- A. Install pull boxes and junction boxes above accessible ceilings and in unfinished areas only.

- 
- B. Inaccessible Ceiling Areas: Install outlet and junction boxes no more than 6-inches from ceiling access panel or from removable recessed luminaire.
  - C. Do not fasten boxes to ceiling support wires.
  - D. Large Pull Boxes: Use hinged enclosure in interior dry locations, surface-mounted cast metal box in other locations.

#### **3.04 CONDUIT FITTINGS INSTALLATION**

- A. Install set-screw fittings so the screws can be seen from below.
- B. Tighten compression fittings per manufacturer instructions.

#### **3.05 WEATHERPROOF OUTLET BOXES INSTALLATION**

- A. Use cast outlet box in exterior locations exposed to weather and wet locations.
- B. Install gaskets.

**END OF SECTION**

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**PART 1 - GENERAL****1.01 SUMMARY**

- A. Work Included:
  - 1. Rigid Metal Conduit (RMC)
  - 2. Electrical Metallic Tubing (EMT)
  - 3. Liquidtight Flexible Metal Conduit (LFMC)
  - 4. Electrical Polyvinyl Chloride (PVC) Conduit
  - 5. Conduit Fittings
- B. Provide a complete system of conduit and fittings, with associated couplings, connectors, and fittings, as shown on drawings and described in these specifications.

**1.02 RELATED SECTIONS**

- A. Contents of Division 26, Electrical apply to this Section.
- B. In addition, reference the following:
  - 1. Section 26 05 29, Hangers and Supports for Electrical Systems and Equipment
  - 2. Section 26 05 34, Boxes

**1.03 REFERENCES AND STANDARDS**

- A. References and Standards as required by Section 26 00 00, Electrical Basic Requirements.

**1.04 SUBMITTALS**

- A. Submittals as required by Section 26 00 00, Electrical Basic Requirements.

**1.05 QUALITY ASSURANCE**

- A. Quality assurance as required by Section 26 00 00, Electrical Basic Requirements.

**1.06 WARRANTY**

- A. Warranty of materials and workmanship as required by Section 26 00 00, Electrical Basic Requirements.

**1.07 DEFINITIONS**

- A. Raceway system is defined as consisting of conduit, tubing, duct, and fittings including but not limited to connectors, couplings, offsets, elbows, bushings, expansion/deflection fittings, and other components and accessories. Complete electrical raceway installation before starting the installation of conductors and cables.

**PART 2 - PRODUCTS****2.01 MANUFACTURERS**

- A. Rigid Metal Conduit (RMC):
  - 1. Allied Tube & Conduit
  - 2. Beck Manufacturing Inc.

3. Picoma
  4. Wheatland Tube Company
  5. Or approved equivalent.
- B. Electrical Metallic Tubing (EMT):
1. Allied Tube & Conduit
  2. Beck Manufacturing WL
  3. Picoma
  4. Wheatland Tube Company
  5. Or approved equivalent.
- C. Liquidtight Flexible Metal Conduit (LFMC):
1. AFC Cable Systems Inc.
  2. Electri-Flex Company
  3. International Metal Hose
  4. Or approved equivalent.
- D. Electrical Polyvinyl Chloride (PVC) Conduit:
1. AFC Cable Systems Inc.
  2. Electri-Flex Company
  3. International Metal Hose
  4. JM Eagle
  5. Or approved equivalent.
- E. Conduit Fittings:
1. Bushings:
    - a. Insulated type for Threaded Rigid, IMC, or EMT without Factory Installed Plastic Throat Conductor Protection:
      - 1) Thomas & Betts 1222 Series
      - 2) O-Z Gedney B Series
      - 3) Or approved Equivalent.
  2. Raceway Connectors and EMT Couplings:
    - a. Thomas & Betts Series
    - b. O-Z Gedney Series
    - c. Or approved Equivalent.
  3. Expansion/Deflection Fittings:
    - a. EMT, O-Z Gedney Type TX
    - b. RMC, O-Z Gedney Type AX, DX and AXDX, Crouse & Hinds XD
    - c. Or approved equivalent.

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**2.02 RIGID METAL CONDUIT (RMC)**

- A. UL 6, ANSI C80.1. Hot dipped galvanized steel conduit after thread cutting.
  - 1. Fittings: NEMA FB2.10.

**2.03 ELECTRICAL METALLIC TUBING (EMT)**

- A. Description: UL 797, ANSI C80.3; steel galvanized tubing.
- B. Fittings: NEMA FB 1; steel, compression type.

**2.04 LIQUIDTIGHT FLEXIBLE METAL CONDUIT (LFMC)**

- A. Description: UL 360, inner core made from spiral wound strip of heavy gauge, hot dipped galvanized low carbon steel. 3/4-inch through 1-1/4-inch trade sizes have a square lock core and contain an integral bonding strip of copper. 1-1/2-inch and larger have fully interlocked core. Jacket material is moisture, oil and sunlight resistant flexible PVC.
- B. Fittings: NEMA FB 2.20.

**2.05 ELECTRICAL POLYVINYL CHLORIDE (PVC) CONDUIT**

- A. Description: UL 651, NEMA TC 2; Schedule 40 PVC.
- B. Fittings: NEMA TC 3.

**2.06 CONDUIT FITTINGS**

- A. Bushings:
  - 1. Insulated type for threaded rigid IMC conduit without factory installed plastic throat conductor protection.
  - 2. Insulated grounding type for threaded rigid IMC conduit.
- B. Raceway Connectors and EMT Couplings:
  - 1. Steel connectors, couplings, and conduit bodies, with hot-dip galvanized.
  - 2. Connector locknuts are steel, with threads meeting ASTM tolerances. Locknuts are hot-dip galvanized.
  - 3. Connector throats (EMT, flexible conduit, metal clad cable and cordset connectors) have factory installed plastic inserts permanently installed. For normal cable or conductor exiting angles from raceway, the cable jacket or conductor insulation bears only on plastic throat insert.
  - 4. Steel gland, Tomic or Breagle connectors and couplings are recognized for this Contract as having acceptable raceway to fitting electrical conductance.
  - 5. Set screw connectors and couplings, without integral compression glands, are recognized for this contract as not having acceptable raceway to fitting electrical conductance. A ground conductor sized per this Specification must be included and bonded within raceway assembly utilizing this type connector or coupling.
- C. Provide expansion/deflection fittings for EMT.

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**PART 3 - EXECUTION****3.01 GENERAL INSTALLATION REQUIREMENTS**

- A. Finished Surfaces: Schedule raceway installation to avoid conflict with installed wall and ceiling surfaces. If unavoidable, coordinate work and repairs with Architect.
- B. Conduit Size:
  - 1. Minimum Size: 1/2-inch for power and control, unless otherwise noted. 3/4-inch for communication/data, unless otherwise noted. 1/2-inch for signal systems, unless otherwise noted.
- C. Underground Installations:
  - 1. More than 5-feet from Foundation Wall: Use PVC.
  - 2. Minimum Size: 1-inch.
- D. Provide two pull strings/tapes in empty conduits. Types:
  - 1. Utility Company Conduit: Polyester measure/pulling tape, Greenlee 4436 or approved equivalent. Coordinate exact requirements with utility company.
  - 2. Feeders: Polyester measure/pulling tape, Greenlee 4436 or approved.
  - 3. Branch circuits and low voltage: Greenlee Poly Line 431 or approved.
  - 4. If fish tape is used for pulling line or low voltage wiring, fiberglass type to be used. Metal fish tapes will not be allowed.
  - 5. Secure pull string/tape at each end.
  - 6. Provide caps on ends of empty conduit to be used in future.
  - 7. Label both ends of empty conduits with location of opposite end.
- E. Elbows: Fiberglass or PVC coated RMC acceptable for underground installations.
- F. Elbow for Low Energy Signal Systems: Use long radius factory ells where linking sections of raceway for installation of signal cable.
- G. Verify that field measurements are as shown on drawings.
- H. Plan locations of conduit runs in advance of the installation and coordinate with ductwork, plumbing, ceiling and wall construction in the same areas.
- I. Locate penetrations and holes in advance where they are proposed in the structural sections such as footings, beams, and walls. Penetrations are acceptable only when the following occurs:
  - 1. Where shown on the structural drawings.
  - 2. As approved by the Structural Engineer prior to construction, and after submittal of drawing showing location, size, and position of each penetration.
- J. Verify routing and termination locations of conduit prior to rough-in.
- K. Conduit routing is shown on drawings in approximate locations unless dimensioned. Route as required to complete wiring system.
- L. Install raceways securely, in neat and workmanlike manner, as specified in NECA 1, Standard Practices for Good Workmanship in Electrical Construction.
- M. Install steel conduit as specified in NECA 101, Standard for Installing Steel Conduits.

- 
- N. Install nonmetallic conduit in accordance with manufacturer's instructions.
  - O. Inserts, anchors and sleeves.
    - 1. Coordinate location of inserts and anchor bolts for electrical systems prior to concrete pour.
    - 2. Coordinate location of sleeves with consideration for other building systems prior to concrete pour.
  - P. Conduit Supports:
    - 1. Arrange supports to prevent misalignment during wiring installation.
    - 2. Support conduit using coated steel or malleable iron straps, lay-in adjustable hangers, clevis hangers, and split hangers.
    - 3. Group related conduits; support using conduit rack. Construct rack using steel channel. Provide space on each for 25 percent additional conduits.
    - 4. Do not support conduit with wire or perforated pipe straps. Remove wire used for temporary supports.
    - 5. Do not attach conduit to ceiling support wires.
  - Q. Flexible steel conduit length not-to-exceed 6-feet, 3-feet in concealed walls. Provide sufficient slack to reduce the effect of vibration.
  - R. Install conduit seals at boundaries where ambient temperatures differ by 10 degrees F or more as shown on the drawings. Install seals on warm side of partition.
  - S. Seal raceways stubbing up into electrical equipment. Plug raceways with conductors with duct-seal. Cap spare raceways and plug PVC raceway products with plastic plugs as made by Underground Products, or equal, shaped to fit snugly into the stubup.
  - T. Seal raceways penetrating an exterior building wall to prevent moisture and vermin from entering into the electrical equipment.
  - U. Use suitable caps on spare and empty conduits to protect installed conduit against entrance of dirt and moisture.
  - V. Keep 277/480 volt wiring independent of 120/208 volt wiring. Keep power wiring independent of communication system wiring.
  - W. Keep emergency system wiring independent of other wiring systems per NEC 700.
  - X. Arrange conduit to maintain headroom and present neat appearance.
  - Y. Do not install conduits on surface of building exterior, along vapor barrier, across roof, on top of parapet walls, or across floors, unless otherwise noted on drawings.
  - Z. Exposed conduits are permitted only in following areas:
    - 1. Mechanical rooms, electrical rooms or spaces where walls, ceilings and floors will not be covered with finished material.
    - 2. Existing walls that are concrete or block construction.
    - 3. Where specifically noted on Drawings.
    - 4. Route exposed conduit parallel and perpendicular to walls, tight to finished surfaces and neatly offset into boxes.
  - AA. Do not install conduits or other electrical equipment in obvious passages, doorways, scuttles or crawl spaces which would impede or block area passage's intended usage.
  - AB. Install continuous conduit and raceways for electrical power wiring and signal systems wiring.

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**AC. Below Grade Conduit:**

1. Place minimum 3-inch cover of sand or clean earth fill around conduit. Lay conduit on smooth level trench bottom, so that contact is made for its entire length.
2. Remove water from trench before conduit is installed.
3. When three or more conduits are in a single trench, use conduit spacers that will maintain 3-inch spacing between conduits. Provide spacers on 5-foot centers.
4. Provide PVC coated galvanized rigid conduit for elbows larger than 30 degrees or 1-inch diameter.
5. Provide trenching, backfilling, compaction, repaving or other site restoration as required by work done in this division.
6. Slope underground conduits which enter building to drain away from building and to be water sealed to prevent moisture from passing through conduit into building. Joints threaded and taped or glued to prevent entry of water into conduits.
7. Provide watertight conduit sleeves and rubber seals for conduit entering building below grade, Link-Seal system by Thunderline Corporation or approved equivalent.

AD. Route conduit installed above accessible ceilings parallel and perpendicular to walls.

AE. Maintain adequate clearance between conduit and piping.

AF. Keep conduits a minimum of 12-inches away from steam or hot water radiant heating lines (at or above 104 degrees F) or 3-inches away from waste or water lines.

AG. Cut conduit square using saw or pipecutter; deburr cut ends.

AH. Bring conduit to shoulder of fittings; fasten securely.

AI. Use conduit hubs to fasten conduit to cast boxes in damp and wet locations.

AJ. Install no more than the 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 factory elbows for bends in metal conduit larger than 2-inch size.

AK. Avoid moisture traps; provide junction box with drain fitting at low points in conduit system.

AL. Provide suitable fittings to accommodate expansion and deflection where conduit crosses seismic, control, and expansion joints.

AM. Conduit Terminations for Signal Systems: Provide a plastic bushing on the end of conduit used for signal system wiring.

AN. Feeders: Do not combine or change feeder runs.

AO. Install conduit to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Division 07, Thermal and Moisture Protection.

AP. 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 and installer.

**3.02 RIGID METAL CONDUIT (RMC) INSTALLATION**

A. Outdoor Locations Above Grade: Use RMC.

B. Damp Locations: RMC up to 2-inches in diameter.

C. Dry Locations:

1. Concealed: RMC.

- 2. Exposed: RMC.
- D. Dry, Protected: RMC.
- E. In areas exposed to severe mechanical damage: RMC.
- F. For security conduits installed exposed and subject to tampering: RMC.
- G. In hazardous areas per CEC 501: RMC.

### **3.03 ELECTRICAL METALLIC TUBING (EMT) INSTALLATION**

- A. Damp Locations: EMT up to 2-inches in diameter.
- B. Dry Locations:
  - 1. Concealed: EMT.
  - 2. Exposed: EMT.
- C. Dry, Protected: EMT.

### **3.04 LIQUIDTIGHT FLEXIBLE METAL CONDUIT (LFMC) INSTALLATION**

- A. Motors and equipment connections subject to movement or vibration and subjected to any of following conditions; exterior location, moist or humid atmosphere, water spray, oil, or grease use PVC coated liquidtight flexible metallic conduit.
- B. Flexible Conduit: Install 12-inch minimum slack loop on liquidtight flexible metallic conduit.

### **3.05 ELECTRICAL POLYVINYL CHLORIDE (PVC) CONDUIT INSTALLATION**

- A. Underground Installation: Emergency System (Life Safety and Critical) per NEC 517.30(c)(1): Schedule 80 PVC.

### **3.06 CONDUIT FITTINGS INSTALLATION**

- A. Conduit Joints: Assemble conduits continuous and secure to boxes, panels, luminaires and equipment with fittings to maintain continuity. Provide watertight joints where embedded in concrete, below grade or in damp locations. Seal PVC conduit joints with solvent cement and metal conduit with metal thread primer. Rigid conduit connections to be threaded, clean and tight (metal to metal). Threadless connections are not permitted for RMC and IMC. Seal conduits where penetrating below raised floor area.
- B. 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.
- C. Use set screw type fittings only in dry locations. When set screw fittings are utilized provide insulated continuous equipment ground conductor in conduit, from overcurrent protection device to outlet.
- D. Use compression fittings in dry locations, damp and rain-exposed locations. Maximum size permitted in damp locations and locations exposed to rain is 2-inches in diameter.
- E. Use threaded type fittings in wet locations, hazardous locations, and damp or rain-exposed locations where conduit size is greater than 2-inches.
- F. Use PVC coated RMC 36-inch radius ells for power service conduits and 48-inch radius ells for telephone service conduits.
- G. Use insulated type bushings with ground provision at switchboards, panelboards, safety disconnect switches, junction boxes that have feeders 60 amperes and greater.

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- H. Condulets and Conduit Bodies:
1. Do not use condulets and conduit bodies in conduits for signal wiring, in feeders 100 amp and larger, or for conductor splicing.
- I. Sleeves and Chases - Floor, Ceiling and Wall Penetrations: Provide necessary rigid conduit sleeves, openings and chases where conduits or cables are required to pass through floors, ceilings or walls.
- J. Expansion Joints:
1. Provide conduits crossing expansion joints where cast in concrete with expansion-deflection fittings, equivalent to OZ/Gedney AXDX, installed per manufacturers recommendations.
  2. Secure conduits 3-inches and larger to building structure on opposite sides of a building expansion joint with an expansion-deflection fitting across joint installed per manufacturer's recommendations.
  3. Provide conduits less than 3-inches where not cast in concrete with junction boxes securely fastened on both sides of expansion joint, connected together with 15-inches of slack (minimum of 15-inches longer than straight line length) flexible conduit and copper green ground bonding jumper. In lieu of this flexible conduit, an expansion-deflection fitting, as indicated for conduits 3-inch and larger may be installed.
  4. Verify expansion/deflection requirements with Structural Engineer prior to installation.
- K. Seismic Joints:
1. No conduits cast in concrete allowed to cross seismic joint.
  2. Provide conduits with junction boxes securely fastened on both sides of seismic joint, connected together with 15-inches of slack (minimum of 15-inches longer than straight line length) flexible conduit and copper green ground bonding jumper. Prior to installation, verify with Architect that 15-inches is adequate for designed movement, and if not, increase this length as required.
  3. Provide conduits less than 3-inches where not cast in concrete with junction boxes securely fastened on both sides of expansion joint, connected together with 15-inches of slack (minimum of 15-inches longer than straight line length) flexible conduit and copper green ground bonding jumper. In lieu of this flexible conduit, an expansion-deflection fitting, as indicated for conduits 3-inch and larger may be installed.
- L. Provide rigid conduit coupling flush with surface of slab or wall for conduit stubbed in concrete slab or wall to serve electrical equipment or an outlet under table or to supply shop tool, etc. Provide plug where conduit is to be used in future.

**END OF SECTION**

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## **PART 1 - GENERAL**

### **1.01 SUMMARY**

- A. Work Included:
  - 1. Anchors, Threaded Rod and Fasteners

### **1.02 RELATED SECTIONS**

- A. Contents of Division 26, Electrical apply to this Section.

### **1.03 REFERENCES AND STANDARDS**

- A. References and Standards as required by Section 26 00 00, Electrical Basic Requirements.

### **1.04 SUBMITTALS**

- A. Submittals as required by Section 26 00 00, Electrical Basic Requirements.
- B. Submittals not required for this Section.

### **1.05 QUALITY ASSURANCE**

- A. Quality assurance as required by Section 26 00 00, Electrical Basic Requirements.
- B. In addition, meet the following:
  - 1. Manufacturers regularly engaged in the manufacture of bolted metal framing support systems, whose products have been in satisfactory use in similar service for not less than 10 years.
  - 2. Support systems to be supplied by a single manufacturer.
  - 3. Engineering Responsibility: Design and preparation of Shop Drawings and calculations for each multiple pipe support, trapeze, equipment hangers/supports, and seismic restraint by a qualified Structural Professional Engineer.
    - a. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of hangers and supports that are similar to those indicated for this Project in material, design, and extent.

### **1.06 WARRANTY**

- A. Warranty of materials and workmanship as required by Section 26 00 00, Electrical Basic Requirements.

### **1.07 PERFORMANCE REQUIREMENTS**

- A. General: Provide conduit and equipment hangers and supports in accordance with the following:
  - 1. When supports, anchorages, and seismic restraints for equipment and supports, anchorages and seismic restraints for conduit, cable tray and equipment are not shown on the Drawings, the Contractor is responsible for their design.
  - 2. Connections to structural framing shall not introduce twisting, torsion, or lateral bending in the framing members. Provide supplementary steel as required.
- B. Engineered Support Systems: The following support systems to be designed, detailed, and bear the seal of a professional engineer registered in the State of Washington.

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1. Support frames such as conduit racks or stanchions for conduit and equipment which provide support from below.
  2. Equipment and piping support frame anchorage to supporting slab or structure.
  - C. Provide channel support systems, for conduits to support multiple conduits capable of supporting combined weight of support systems and system contents.
  - D. Provide heavy-duty steel trapezes for piping to support multiple conduit capable of supporting combined weight of supported systems and system contents.
  - E. Provide seismic restraint hangers and supports for conduit and equipment.
  - F. Obtain approval from AHJ for seismic restraint hanger and support system to be installed for piping and equipment.

## **PART 2 - PRODUCTS**

### **2.01 MANUFACTURERS**

- A. Anchors, Threaded Rod and Fasteners:
  1. Anchor It
  2. Epcon System
  3. Hilti-Hit System
  4. Power Fast System
  5. Or approved equivalent.

### **2.02 ANCHORS, THREADED ROD AND FASTENERS:**

- A. Anchors, Threaded Rod and Fasteners - General: Corrosion-resistant materials of size and type adequate to carry the loads of equipment and conduit, including weight of wire in conduit.
- B. Concrete Inserts: Cast in concrete for support fasteners for loads up to 800 lbs.
- C. Anchor Bolts for Area Luminaire Poles: As supplied by area luminaire pole manufacturer.
- D. Anchors and Fasteners:
  1. Do not use powder-actuated anchors.
  2. Obtain permission from Architect before using powder-actuated anchors.
  3. Concrete Structural Elements: Use precast inserts.
  4. Steel Structural Elements: Use beam clamps.
  5. Concrete Surfaces: Use self-drilling anchors.
  6. Hollow Masonry, Plaster, and Gypsum Board Partitions: Use toggle bolts.
  7. Solid Masonry Walls: Use expansion anchors.
  8. Sheet Metal: Use sheet metal screws.
  9. Wood Elements: Use wood screws.
- E. Fasteners: Provide fasteners of types as required for assembly and installation of fabricated items; surface-applied fasteners are specified elsewhere.
- F. Bolts: Low carbon steel externally and internally threaded fasteners conforming with requirements of ASTM A307; include necessary nuts and plain hardened washers. For

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structural steel elements supporting mechanical material or equipment from building structural members or connection thereto, use fasteners conforming to ASTM A325.

- G. Miscellaneous Materials: Provide incidental accessory materials, tools, methods, and equipment required for fabrication.

## **PART 3 - EXECUTION**

### **3.01 GENERAL INSTALLATION REQUIREMENTS**

#### **A. Fabrication - Miscellaneous Metals**

1. General: Verify dimensions prior to fabrication. Form metal items to accurate sizes and configurations as indicated on Drawings and otherwise required for proper installation; make with lines straight and angles sharp, clean and true; drill, countersink, tap, and otherwise prepare items for connections with work of other trades, as required. Fabricate to detail of structural shapes, plates and bars; weld joints where practicable; provide bolts and other connection devices required. Include anchorages; clip angles, sleeves, anchor plates, and similar devices. Hot dipped galvanize after fabrication items installed in exterior locations. Set accurately in position as required and anchor securely to building construction. Construct items with joints formed for strength and rigidity, accurately machining for proper fit; where exposed to weather, form to exclude water.
2. Finishes:
  - a. Ferrous Metal: After fabrication, but before erection, clean surfaces by mechanical or chemical methods to remove rust, scale, oil, corrosion, or other substances detrimental to bonding of subsequently applied protective coatings. For metal items exposed to weather or moisture, galvanize in manner to obtain G90 zinc coating in accordance with ASTM A123. Provide other non-galvanized ferrous metal with one coat of approved rust-resisting paint primer, in manner to obtain not less than 1.0 mil dry film thickness. Touch-up damaged areas in primer with same material, before installation. Apply zinc coatings and paint primers uniformly and smoothly; leave ready for finish painting as specified elsewhere.
  - b. Metal in contact with Concrete, Masonry and Other Dissimilar Materials: Where metal items are to be erected in contact with dissimilar materials, provide contact surfaces with coating of an approved zinc-chromate primer in manner to obtain not less than 1.0 mil dry film thickness, in addition to other coatings specified in these specifications.
  - c. For Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and apply galvanizing repair paint to comply with ASTM A780.

### **3.02 ANCHORS, THREADED ROD AND FASTENERS INSTALLATION:**

- A. Safety factor of 4 required for every fastening device or support for electrical equipment installed. Supports to withstand four times the weight of equipment it supports.
- B. Do not use other trade's fastening devices as supporting means for electrical luminaires, equipment or materials.
- C. Do not fasten supports to pipes, ducts, mechanical equipment, or conduit.
- D. Do not use supports or fastening devices to support other than one particular item.
- E. Securely suspend junction boxes, pull boxes or other conduit terminating housings located above suspended ceiling from floor above or roof structure to prevent sagging and swaying.
- F. Provide seismic bracing per IBC requirements.

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- G. Install surface-mounted cabinets and panelboards with minimum of four anchors.
  - H. Use spring lock washers under fastener nuts for strut.
  - I. Cutting and Drilling
    - 1. Do not drill or cut structural members without prior permission from Architect.

**END OF SECTION**

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## **PART 1 - GENERAL**

### **1.01 SUMMARY**

- A. Work Included:
  - 1. Lugs and Pads
  - 2. Wires and Cables
  - 3. Splices
  - 4. Connectors

### **1.02 RELATED SECTIONS**

- A. Contents of Division 26, Electrical apply to this Section.
- B. In addition, reference the following:

### **1.03 REFERENCES AND STANDARDS**

- A. References and Standards as required by Section 26 00 00, Electrical Basic Requirements.

### **1.04 SUBMITTALS**

- A. Submittals as required by Section 26 00 00, Electrical Basic Requirements.
- B. In addition, provide:
  - 1. Cable insulation test reports in project closeout documentation.

### **1.05 QUALITY ASSURANCE**

- A. Quality assurance as required by Section 26 00 00, Electrical Basic Requirements.

### **1.06 WARRANTY**

- A. Warranty of materials and workmanship as required by Section 26 00 00, Electrical Basic Requirements.

## **PART 2 - PRODUCTS**

### **2.01 MANUFACTURERS**

- A. Lugs and Pads:
  - 1. Anderson
  - 2. IlSCO
  - 3. Panduit
  - 4. Thomas & Betts
  - 5. 3M
  - 6. Or approved equivalent.
- B. Wires and Cables:
  - 1. General
    - a. Carol

- b. General Cable
  - c. Okonite
  - d. Southwire
  - e. Or approved equivalent.
- C. Splices:
- 1. Branch Circuit Splices:
    - a. Ideal
    - b. Scotch-Lock
    - c. 3M
    - d. Or approved equivalent.
  - 2. Feeder Splices:
    - a. Not allowed.
- D. Connectors:
- 1. Stranded conductors by Anderson.
  - 2. Burndy
  - 3. IIsco
  - 4. 3M
  - 5. Thomas & Betts
  - 6. Or approved equivalent.

**2.02 LUGS AND PADS**

- A. Ampacity: Cross-Sectional area of pad for multiple conductor terminations to match ampere rating of panelboard bus or equipment line terminals.
- B. Copper Pads: Drilled and tapped for multiple conductor terminals.
- C. Lugs: Compression type for use with stranded branch circuit or control conductors; mechanical lugs for use with solid branch and feeder circuit conductors.

**2.03 WIRES AND CABLES**

- A. Copper, 600 volt rated throughout. Conductors 12 AWG and 10 AWG, solid or stranded. Conductors 8 AWG and larger, stranded. 12 AWG minimum conductor size. Minimum insulation rating of 90 degrees C. Insulation Type: THWN-2, XHHW-2 or THHN-2.
- B. Annealed copper, Class "B" strand, designed to ensure tensile strength under fire conditions. 2-hour fire-resistive cable. 600 volt rated throughout. Conductors 8 AWG through 750 KCMIL. Insulation type: Thermoset, low smoke zero halogen (LS2H) silicone rubber. Jacket: Cross-linked polyolefin (XLPO), low smoke, zero halogen. UL 44 listed and certified to UL 2196.
- C. Phase color to be consistent at feeder terminations; A-B-C, top to bottom, left to right, front to back.
- D. Color Code Conductors as Follows:

<b>PHASE</b>	<b>208 VOLT WYE</b>	<b>240 VOLT DELTA</b>	<b>480 VOLT</b>
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A	Black	Black	Brown
B	Red	Orange (High Leg)	Orange
C	Blue	Blue	Yellow
Neutral	White	White	Gray
Ground	Green	Green	Green
Isolated Ground	Green w/yellow trace	N/A	N/A

- E. MC Cable: Not allowed.
- F. AC Cable (Armored Cable): Not allowed.
- G. NMB Cable: Not allowed.
- H. SO Cord: Annealed copper conductors, 600 volt rated. Minimum size No. 12 AWG with ground wire. Maximum of six conductors and ground per cable. 90 degrees C rated thermoset jacket.

**2.04 SPLICES**

- A. Feeders: Compression barrel splice with two layers Scotch 23 and four layers Scotch 33+ as vapor barrier.

**2.05 CONNECTORS**

- A. Split bolt connectors not allowed.
- B. Conductor Branch Circuits: Wire nuts with integral spring connectors for conductors 12 AWG through 8 AWG. Push-in type connectors where conductors are not required to be twisted together are not acceptable.

**PART 3 - EXECUTION**

**3.01 GENERAL INSTALLATION REQUIREMENTS**

- A. Install per manufacturer instructions, and the NEC

**3.02 LUGS AND PADS**

- A. Thoroughly clean surfaces to remove all dirt, oil, great or paint.
- B. Use torque wrench to tighten per manufacturer's directions.

**3.03 WIRES AND CABLES**

- A. General:
  1. Do not install or handle thermoplastic insulated wire and cable in temperatures below +14 degrees F (-10 C).
  2. Install conductors in raceways having adequate, code size cross-Sectional area for wires indicated.
  3. Install conductors with care to avoid damage to insulation.
  4. Do not apply greater tension on conductors than recommended by manufacturer during installation.
  5. Use of pulling compounds is permitted. Clean residue from exposed conductors and raceway entrances after conductor installation. Do not use pulling compounds for installation of conductors connected to GFCI circuit breakers or GFCI receptacles.

6. Conductor Size and Quantity:
  - a. Install no conductors smaller than 12 AWG unless otherwise shown.
  - b. Provide required conductors for a fully operable system.
7. Provide dedicated neutrals (one neutral conductor for each phase conductor) in all 120V circuits
8. Conductors in Cabinets:
  - a. Cable and tree wires in panels and cabinets for power and control. Use plastic ties in panels and cabinets.
  - b. Tie and bundle feeder conductors in wireways of panelboards.
  - c. Hold conductors away from sharp metal edges.
9. Homeruns:
  - a. Do not change intent of branch circuit homeruns without approval. Homeruns for 20A branch circuits may be combined to a maximum of six current carrying conductors including neutral conductors in homeruns. Apply derating factors as required per NEC. Increase conductor size as needed.
10. Identify wire and cable under the provisions of Section 26 05 53, Identification for Electrical Systems. Identify each conductor with its panel and circuit number as indicated.
11. Exposed cable is not allowed.
12. Exposed cable must be run parallel or perpendicular to building lines and hidden from view when possible.

#### **3.04 SPLICES**

- A. Make up splices complete and promptly after wire installation. Provide single wire pigtails for luminaire and device connections. Wirenuts may be used for luminaire wire connections to single wire circuit conductor pigtails.
- B. Make splices for No. 8 and larger wires with mechanically applied pressure type connectors. Make all taped joints with Scotch 33+ or equal, applied in half-lap layers without stretching to deform.
- C. Remove insulation with a stripping tool designed specifically for that purpose. A pocket knife is not an acceptable tool. Leave all conductors nick-free.

#### **3.05 CONNECTORS**

- A. Install to assure a solid and safe connection.
- B. Do not connect copper and aluminum wiring without UL listed connectors that are listed for the purposes.

**END OF SECTION**

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**PART 1 - GENERAL****1.01 SUMMARY**

- A. Work Included:
  - 1. Equipment connections, whether furnished by Owner or other Divisions of the Contract.
  - 2. Equipment grounding.

**1.02 RELATED SECTIONS**

- A. Contents of Division 26, Electrical apply to this Section.

**1.03 REFERENCES AND STANDARDS**

- A. References and Standards as required by Section 26 00 00, Electrical Basic Requirements.

**1.04 SUBMITTALS**

- A. Submittals as required by Section 26 00 00, Electrical Basic Requirements.
- B. In addition:
  - 1. Verify mechanical and utilization equipment electrical characteristics with Drawings and equipment submittals prior to ordering equipment. Submit confirmation of this verification as a part of, or addendum to, the electrical product submittals.

**1.05 QUALITY ASSURANCE**

- A. Quality assurance as required by Section 26 00 00, Electrical Basic Requirements.

**1.06 WARRANTY**

- A. Warranty of materials and workmanship as required by Section 26 00 00, Electrical Basic Requirements.

**PART 2 - PRODUCTS****2.01 MATERIALS**

- A. Materials and Equipment for Equipment Wiring: As specified in individual Sections.

**2.02 GENERAL**

- A. Unless otherwise noted, the following voltage and phase characteristics apply to motors:
  - 1. 3/4 HP and Under: 120 volt, 1 phase.
  - 2. 1 HP and Over: 208 volt, 3 phase.
  - 3. 1 HP and Over: 480 volt, 3 phase.
- B. Safety Switches: Provide as required by NEC and as specified in Section 26 28 16, Enclosed Switches and Circuit Breakers.

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**PART 3 - EXECUTION****3.01 EXAMINATION**

- A. Prior to submittal of product data for electrical distribution equipment, obtain and examine product data and shop drawings for equipment furnished by the Owner and by other trades on the project. Update the schedule of equipment electrical connections accordingly, noting proper ratings for overcurrent devices, fuses, safety disconnect switches, conduit and wiring, and the like. As a minimum, this requirement applies to equipment furnished by Owner and equipment furnished under the following divisions of work under this contract:
  - 1. Division 11, Equipment
  - 2. Division 28, Electronic Safety and Security

**3.02 INSTALLATION**

- A. Do not install unrelated electrical equipment or wiring on mechanical equipment without prior approval of Architect.
- B. Provide moisture tight equipment wiring and switches in ducts or plenums used for environmental air.
- C. Connect motor and appliance/utilization equipment complete from panel to motor/equipment as required by code.
- D. Install motor starters and controllers for equipment furnished by others.
- E. Appliance/Utilization Equipment:
  - 1. Provide appropriate cable and cord cap for final connection unless equipment is provided with same. Provide receptacle configured to receive cord cap.
  - 2. Verify special purpose outlet NEMA configuration and ampere rating with equipment supplier prior to ordering wiring devices and coverplates.

**3.03 FIELD QUALITY CONTROL**

- A. Perform field inspection and testing in accordance with Contract Documents.

**3.04 SYSTEMS STARTUP**

- A. Provide field representative to prepare and start equipment.
  - 1. Test and correct for proper rotation of polyphase motors.
- B. Adjust for proper operation within manufacturer's published tolerances.
- C. Demonstrate proper operation of equipment to Owner's designated representative.

**END OF SECTION**

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**PART 1 - GENERAL****1.01 SECTION INCLUDES**

- A. Work included in 26 00 00, Electrical Basic Requirements applies to Division 26, Electrical work to provide materials, labor, tools, permits, incidentals, and other services to provide and make ready for Owner's use of electrical systems for proposed project.
- B. Contract Documents include, but are not limited to, Specifications, Drawings, Addenda, Owner/Architect Agreement, and Owner/Contractor Agreement. Confirm requirements before commencement of work.
- C. Definitions:
  - 1. Provide: To furnish and install, complete and ready for intended use.
  - 2. Furnish: Supply and deliver to project site, ready for unpacking, assembly and installation.
  - 3. Install: Includes unloading, unpacking, assembling, erecting, installation, applying, finishing, protecting, cleaning and similar operations at project site as required to complete items of work furnished.
  - 4. Approved or Approved Equivalent: To possess the same performance qualities and characteristics and fulfill the utilitarian function without any decrease in quality, durability or longevity. For equipment/products defined by the Contractor as "equivalent", substitution requests must be submitted to Engineer for consideration and approved by the Engineer prior to submitting bids for substituted items.
  - 5. Authority Having Jurisdiction (AHJ): Indicates reviewing authorities, including local fire marshal, Owner's insurance underwriter, Owner's representative, and other reviewing entity whose approval is required to obtain systems acceptance.

**1.02 RELATED SECTIONS:**

- A. Contents of Section applies to Division 26, Electrical Contract Documents.
- B. Related Work:
  - 1. Additional conditions apply to this Division including, but not limited to:
    - a. Specifications
    - b. Drawings
    - c. Addenda
    - d. Owner/Architect Agreement
    - e. Owner/Contractor Agreement
    - f. Codes, Standards, Public Ordinances and Permits

**1.03 REFERENCES AND STANDARDS**

- A. References and Standards per individual Division 26, Electrical Sections and those listed in this Section.
- B. Codes to include latest adopted editions, including current amendments, supplements and local jurisdiction requirements in effect as of the date of the Contract Documents, of/from:
  - 1. State of Washington:
    - a. IBC International Building Code
    - b. IFC International Fire Code

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- c. IMC International Mechanical Code
  - d. SEC Seattle Energy Code
  - e. UPC Uniform Plumbing Code
  - f. WAC Washington Administrative Code
  - g. WSEC Washington State Energy Code
  - h. Guidelines for Design and Construction of Health Care Facilities
- C. General: Reference standards and guidelines include but are not limited to the latest adopted editions from:
- 1. ABA Architectural Barriers Act
  - 2. ADA Americans with Disabilities Act
  - 3. ANSI American National Standards Institute
  - 4. APWA American Public Works Association
  - 5. ASCE American Society of Civil Engineers
  - 6. ASHRAE Guideline 0, the Commissioning Process
  - 7. ASTM ASTM International
  - 8. CFR Code of Federal Regulations
  - 9. CSA CSA International
  - 10. EEMAC Electrical Equipment Manufacturers Association of Canada
  - 11. EPA Environmental Protection Agency
  - 12. ETL Electrical Testing Laboratories
  - 13. FCC Federal Communications Commission
  - 14. FDA Food & Drug Administration
  - 15. FM FM Global
  - 16. IBC International Building Code
  - 17. IEC International Electrotechnical Commission
  - 18. IEEE Institute of Electrical and Electronics Engineers
  - 19. IES Illuminating Engineering Society
  - 20. ISO International Organization for Standardization
  - 21. LEED Leadership in Energy and Environmental Design
  - 22. MSS Manufacturers Standardization Society
  - 23. NEC National Electric Code
  - 24. NECA National Electrical Contractors Association
  - 25. NEMA National Electrical Manufacturers Association
  - 26. NETA National Electrical Testing Association
  - 27. NFPA National Fire Protection Association
  - 28. OSHA Occupational Safety and Health Administration
  - 29. UBC Uniform Building Code

- 30. UL Underwriters Laboratories Inc.
- 31. USDA United States Department of Agriculture
- D. See Division 26, Electrical individual Sections for additional references.
- E. Where code requirements are at variance with Contract Documents, meet code requirements as a minimum requirement and include costs necessary to meet these in Contract. Machinery and equipment are to comply with OSHA requirements, as currently revised and interpreted for equipment manufacturer requirements. Install equipment provided per manufacturer recommendations.
- F. Whenever this Specification calls for material, workmanship, arrangement or construction of higher quality and/or capacity than that required by governing codes, higher quality and/or capacity take precedence.

#### 1.04 SUBMITTALS

- A. See individual Division 26, Electrical Sections.
- B. Provide drawings in format and software release equal to the design documents. Drawings to be the same sheet size and scale as the Contract Documents.
- C. In addition:
  - 1. "No Exceptions Taken" constitutes that review is for general conformance with the design concept expressed in the Contract Documents for the limited purpose of checking for conformance with information given. Any action is subject to the requirements of the Contract Documents. Contractor is responsible for the dimensions and quantity and will confirm and correlate at the job site, fabrication processes and techniques of construction, coordination of the work with that of all other trades, and the satisfactory performance of the work.
  - 2. Provide product submittals and shop drawings in electronic format only. Electronic format must be submitted via zip file via e-mail. For electronic format, provide one zip file per specification division containing a separate file for each specification Section. Individual submittals sent piecemeal in a per Specification Section method will be returned without review or comment. All transmissions/submissions to be submitted to Architect.
  - 3. Product Data: Provide manufacturer's descriptive literature for products specified in Division 26, Electrical Sections.
  - 4. Identify/mark each submittal in detail. Note what differences, if any, exist between the submitted item and the specified item. Failure to identify the differences will be considered cause for disapproval. If differences are not identified and/or not discovered during the submittal review process, Contractor remains responsible for providing equipment and materials that meet the specifications and drawings.
    - a. Label submittal to match numbering/references as shown in Contract Documents. Highlight and label applicable information to individual equipment or cross out/remove extraneous data not applicable to submitted model. Clearly note options and accessories to be provided, including field installed items. Highlight connections by/to other trades.
    - b. Include technical data, installation instructions and dimensioned drawings for products, fixtures, equipment and devices installed, furnished or provided. Reference individual Division 26, Electrical specification Sections for specific items required in product data submittal outside of these requirements.
    - c. See Division 26, Electrical individual Sections for additional submittal requirements outside of these requirements.

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5. Maximum of two reviews of complete submittal package. Arrange for additional reviews and/or early review of long-lead items; Bear costs of these additional reviews at Engineer's hourly rates. Incomplete submittal packages/submittals will be returned to contractor without review.
  6. Structural/Seismic: Provide weights, dimensions, mounting requirements and like information required for mounting, seismic bracing, and support. Indicate manufacturer's installation and support requirements to meet ASCE 7-10 requirements for non-structural components. Provide engineered seismic drawings and equipment seismic certification. Equipment Importance Factor as specified in Part 3 of this Section.
    - a. Special Seismic Certification to be provided for the following equipment and components that are part of the designated seismic system pursuant to Section 13.2.2, ASCE/SEI (Structural Engineers Institute).
      - 1) Emergency and standby power systems equipment including generators, automatic paralleling switchgear, fuel tanks, and automatic transfer switches.
      - 2) Switchgear.
      - 3) Motor Control Centers.
      - 4) Transformers.
      - 5) Electrical substations.
      - 6) UPS and associated batteries/racks.
      - 7) Distribution panels including electrical panelboards, control panels, including fire alarm, and auxiliary or remote power supplies.
  7. Trade Coordination: Include physical characteristics, electrical characteristics, device layout plans, wiring diagrams, and connections as required per Division 26, Electrical Coordination Documents. For equipment with electrical connections, furnish copy of approved submittal for inclusion in Division 26, Electrical submittals.
  8. Make provisions for openings in building for admittance of equipment prior to start of construction or ordering of equipment.
  9. Substitutions and Variation from Basis of Design:
    - a. The Basis of Design designated product establishes the qualities and characteristics for the evaluation of any comparable products by other listed acceptable manufacturers if included in this Specification or included in an approved Substitution Request as judged by the Design Professional.
    - b. If substitutions and/or equivalent equipment/products are being proposed, it is the responsibility of parties concerned, involved in, and furnishing the substitute and/or equivalent equipment to verify and compare the characteristics and requirements of that furnished to that specified and/or shown. If greater capacity and/or more materials and/or more labor is required for the rough-in, circuitry or connections than for the item specified and provided for, then provide compensation for additional charges required for the proper rough-in, circuitry and connections for the equipment being furnished. No additional charges above the Base Bid, including resulting charges for work performed under other Divisions, will be allowed for such revisions. Coordinate with the requirements of "Submittals". For any product marked "or approved equivalent", a substitution request must be submitted to Engineer for approval prior to purchase, delivery or installation.
  10. Shop Drawings: Provide coordinated shop drawings which include physical characteristics of all systems, device layout plans, and control wiring diagrams. Reference individual
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Division 26, Electrical specification Sections for additional requirements for shop drawings outside of these requirements.

- a. Provide Shop Drawings indicating access panel locations, size and elevation for approval prior to installation.
11. Samples: Provide samples when requested by individual Sections.
  12. Resubmission Requirements:
    - a. Make any corrections or change in submittals when required. Provide submittals as specified. The engineer will not be required to edit and/or interpret the Contractor's submittals. Indicate changes for the resubmittal in a cover letter with reference to page(s) changed and reference response to comment. Cloud changes in the submittals.
    - b. Resubmit for review until review indicates no exceptions taken or "make corrections as noted".
  13. Operation and Maintenance Manuals, Owners Instructions:
    - a. Submit, at one time, electronic files (PDF format) on CD/DVD of manufacturer's operation and maintenance instruction manuals and parts lists for equipment or items requiring servicing. Submit data when work is substantially complete and in same order format as submittals. Include name and location of source parts and service for each piece of equipment.
      - 1) Include copy of approved submittal data along with submittal review letters received from Engineer. Data to clearly indicate installed equipment model numbers. Delete or cross out data pertaining to other equipment not specific to this project.
      - 2) Include copy of manufacturer's standard Operations and Maintenance for equipment. At front of each tab, provide routine maintenance documentation for scheduled equipment. Include manufacturer's recommended maintenance schedule and highlight maintenance required to maintain warranty. Furnish list of routine maintenance parts, including part numbers, sizes, quantities, relevant to each piece of equipment.
      - 3) Include Warranty per Section 26 00 00, Electrical Basic Requirements and individual Division 26, Electrical Sections.
      - 4) Include product certificates of warranties and guarantees.
      - 5) Include copy of complete parts list for equipment. Include available exploded views of assemblies and sub assemblies.
      - 6) Include commissioning reports.
      - 7) Include copy of startup and test reports specific to each piece of equipment.
      - 8) Engineer will return incomplete documentation without review. Engineer will provide one set of review comments in Submittal Review format. Contractor must arrange for additional reviews; Contractor to bear costs for additional reviews at Engineer's hourly rates.
    - b. Thoroughly instruct Owner in proper operation of equipment and systems. Where noted in individual Sections, training will include classroom instruction with applicable training aids and systems demonstrations. Field instruction per Section 26 00 00, Electrical Basic Requirements, Demonstration.
    - c. Copies of certificates of code authority inspections, acceptance, code required acceptance tests, and other special guarantees, certificates of warranties, specified elsewhere or indicated on Drawings.

**14. Record Drawings:**

- a. Maintain at site at least one set of drawings for recording "As-constructed" conditions. Indicate on drawings changes to original documents by referencing revision document, and include buried elements, location of conduit, and location of concealed electrical items. Include items changed by field orders, supplemental instructions, and constructed conditions.
- b. Record Drawings are to include equipment and fixture/connection schedules that accurately reflect "as constructed or installed" for project.
- c. At completion of project, input changes to original project on CAD Drawings and make one set of black-line drawings created from CAD Files in version/release equal to contract drawings. Submit CAD disk and drawings upon substantial completion.
- d. See Division 26, Electrical individual Sections for additional items to include in record drawings.

**1.05 QUALITY ASSURANCE**

- A. Regulatory Requirements: Work and materials installed to conform with all local, State and Federal codes, and other applicable laws and regulations.
- B. Drawings are intended to be diagrammatic and reflect the Basis of Design manufacturer's equipment. They are not intended to show every item in its exact dimensions, or details of equipment or proposed systems layout. Verify actual dimensions of systems (i.e. distribution equipment, duct banks, light fixtures, etc.) and equipment proposed to assure that systems and equipment will fit in available space. Contractor is responsible for design and construction costs incurred for equipment other than Basis of Design, including, but not limited to, architectural, structural, electrical, HVAC, fire sprinkler, and plumbing systems.
- C. Manufacturer's Instructions: Follow manufacturer's written instructions. If in conflict with Contract Documents, obtain clarification. Notify Engineer/Architect, in writing, before starting work.
- D. Items shown on Drawings are not necessarily included in Specifications or vice versa. Confirm requirements in all Contract Documents.
- E. UL and CSA Compliance: Provide products which are UL listed

**1.06 WARRANTY**

- A. Provide written warranty covering the work for a period of one year from date of Substantial Completion in accordance with Section 26 00 00, Electrical Basic Requirements and individual Division 26, Electrical Sections.
- B. Sections under this Division can require additional and/or extended warranties that apply beyond basic warranty. Confirm requirements in all Contract Documents.

**PART 2 - PRODUCTS****2.01 MANUFACTURERS**

- A. Provide like items from one manufacturer.

**2.02 MATERIALS**

- A. Base contract upon furnishing materials as specified. Materials, equipment, and fixtures used for construction are to be new, latest products as listed in manufacturer's printed catalog data and are to be UL approved or have adequate approval or be acceptable by state, county, and

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city authorities. Equipment/fixture supplier is responsible for obtaining State, County, and City acceptance on equipment/fixtures that are not UL approved or are not listed for installation.

- B. Articles, fixtures, and equipment of a kind to be standard product of one manufacturer.
- C. Names and manufacturer's names denote character and quality of equipment desired and are not to be construed as limiting competition.
- D. Hazardous Materials:
  - 1. Comply with local, State of Washington, and Federal regulations relating to hazardous materials.
  - 2. Do not use any materials containing a hazardous substance. If hazardous materials are encountered, do not disturb; immediately notify Owner and Architect. Hazardous materials will be removed by Owner under separate contract.

### 2.03 ACCESS PANELS

- A. See Division 08, Openings for products and installation requirements.
- B. Confirm Access Panel requirements in Division 26, Electrical Sections. In the absence of specific requirements, comply with the following:
  - 1. Provide flush mounting access panels for service of systems and individual components requiring maintenance or inspection. Where access panels are located in fire-rated assemblies of building, rate access panels accordingly.
    - a. Ceiling access panels to be minimum of 24-inch by 24-inch.
    - b. Wall access panels to be minimum of 12-inch by 12-inch.
    - c. Provide screwdriver operated catch.
    - d. Manufacturers and Models:
      - 1) Drywall: Karp KDW.
      - 2) Plaster: Karp DSC-214PL.
      - 3) Masonry: Karp DSC-214M.
      - 4) 2 hour rated: Karp KPF-350FR.
      - 5) Manufacturers: Milcor, Elmdor, Acudor, or approved equivalent.

## PART 3 - EXECUTION

### 3.01 ACCESSIBILITY AND INSTALLATION

- A. Confirm Accessibility and Installation requirements in Section 26 00 00, Electrical Basic Requirements and individual Division 26, Electrical Sections.
- B. Install equipment requiring access (i.e., junction boxes, light fixtures, power supplies, motors, etc.) so that they may be serviced, reset, replaced or recalibrated by service people with normal service tools and equipment. Do not install equipment in passageways, doorways, scuttles or crawlspaces which would impede or block the intended usage.
- C. Install equipment and products complete as directed by manufacturer's installation instructions. Obtain installation instructions from manufacturer prior to rough-in of equipment and examine instructions thoroughly. When requirements of installation instructions conflict with Contract Documents, request clarification from Architect prior to proceeding with installation. This includes proper installation methods, sequencing, and coordination with other trades and disciplines.

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**D. Earthwork:**

1. Confirm Earthwork requirements in Contract Documents. In the absence of specific requirements, comply with individual Division 26, Electrical Sections and the following:
  - a. Perform excavation, dewatering, shoring, bedding, and backfill required for installation of work in this Division in accordance with related earthwork Sections. Contact utilities and locate existing utilities prior to excavation. Repair any work damaged during excavation or backfilling.
  - b. Excavation: Do not excavate under footings, foundation bases, or retaining walls.
  - c. Provide protection of underground systems. Review the project Geotechnical Report for references to corrosive or deleterious soils which will reduce the performance or service life of underground systems materials.

**E. Firestopping:**

1. Confirm requirements in Division 07, Thermal and Moisture Protection. In the absence of specific requirements, comply with individual Division 26, Electrical Sections and the following:
  - a. Coordinate location and protection level of fire and/or smoke rated walls, ceilings, and floors. When these assemblies are penetrated, seal around piping and equipment with approved firestopping material. Install firestopping material complete as directed by manufacturer's installation instructions. Meet requirements of ASTM E814, Standard Test Method for Fire Tests of Through-Penetration Fire Stops.

**F. Plenums:**

1. In plenums, provide plenum rated materials that meet the requirements to be installed in plenums. Immediately notify Architect/Engineer of discrepancy.

**G. Start up equipment, in accordance with manufacturer's start-up instructions, and in presence of manufacturer's representative. Test controls and demonstrate compliance with requirements. Replace damaged or malfunctioning controls and equipment.****H. Provide miscellaneous supports/metals required for installation of equipment and conduit.****3.02 SEISMIC CONTROL****A. Confirm Seismic Control requirements in Section 26 00 00, Electrical Basic Requirements and individual Division 26 Electrical Sections.****B. Equipment Importance Factor: 1.5.****C. General:**

1. Seismic Design Category: C.
2. Building Occupancy Category: II.
3. Confirm Building Occupancy Category and Seismic Design Category with Architect.
4. Earthquake resistant designs for Electrical (Division 26, Electrical) equipment and distribution, i.e. power distribution equipment, generators, UPS, etc. to conform to regulations of jurisdiction having authority.
5. Restraints which are used to prevent disruption of function of piece of equipment because of application of horizontal force to be such that forces are carried to frame of structure in such a way that frame will not be deflected when apparatus is attached to a mounting base and equipment pad, or to structure in normal way, utilizing attachments provided. Secure equipment and distribution systems to withstand a force in direction equal to value defined by jurisdiction having authority.

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6. Provide stamped shop drawings from licensed Structural Engineer of seismic bracing and seismic movement assemblies for conduit and equipment. Submit shop drawings along with equipment submittals.
  7. Provide stamped shop drawings from licensed Structural Engineer of seismic flexible joints for conduit crossing building expansion or seismic joints. Submit shop drawings along with seismic bracing details. Coordinate exact design requirements with project Structural Engineer.
- D. Equipment:
1. Provide means to prohibit excessive motion of electrical equipment during earthquake.

### 3.03 REVIEW AND OBSERVATION

- A. Confirm Review and Observation requirements in Section 26 00 00, Electrical Basic Requirements and individual Division 26, Electrical Sections.
- B. Notify Architect, in writing, at following stages of construction so that they may, at their option, visit site for review and construction observation:
  1. Underground conduit installation prior to backfilling.
  2. Prior to covering walls.
  3. Prior to ceiling cover/installation.
  4. When main systems, or portions of, are being tested and ready for inspection by AHJ.
- C. Final Punch:
  1. Costs incurred by additional trips required due to incomplete systems will be the responsibility of the Contractor.

### 3.04 CONTINUITY OF SERVICE

- A. Confirm requirements in individual Division 26, Electrical Sections and the following:
  1. During remodeling or addition to existing structure, while existing structure is occupied, present services to remain intact until new construction, facilities or equipment is installed.
  2. Prior to changing over to new service, verify that every item is thoroughly prepared. Install new wiring, and wiring to point of connection.
  3. Coordinate transfer time to new service with Owner. If required, perform transfer during off-peak hours. Once changeover is started, pursue to its completion to keep interference to a minimum.
    - a. If overtime is necessary, there will be no allowance made by Owner for extra expense for such overtime or shift work.
  4. No interruption of services to any part of existing facilities will be permitted without express permission in each instance from Owner. Requests for outages must state specific dates, hours and maximum durations, with outages kept to these specific dates, hours and maximum durations. Obtain written permission from Owner for any interruption of power, lighting or signal circuits and systems.
    - a. Organize work to minimize duration of power interruption.
    - b. Coordinate utility service outages with utility company.

### 3.05 CUTTING AND PATCHING

- A. Confirm requirements in individual Division 26, Electrical Sections and the following:

1. Proposed floor cutting/core drilling/sleeve locations to be approved by project Structural Engineer. Submit proposed locations to Architect/Project Structural Engineer. Where slabs are of post tension construction, perform x-ray scan of proposed penetration locations and submit scan results including proposed penetration locations to Project Structural Engineer/Architect for approval. Where slabs are of waffle type construction, show column cap extent and cell locations relative to proposed penetration(s).
2. Cutting, patching and repairing for work specified in this Division including plastering, masonry work, concrete work, carpentry work, and painting included under this Section will be performed by skilled craftsmen of each respective trade in conformance with appropriate Division of Work.
3. Additional openings required in building construction to be made by drilling or cutting. Use of jack hammer is specifically prohibited. Patch openings in and through concrete and masonry with grout.
4. Restore new or existing work that is cut and/or damaged to original condition. Patch and repair specifically where existing items have been removed. This includes repairing and painting walls, ceilings, etc. where existing conduit and devices are removed as part of this project. Where alterations disturb lawns, paving, and/or walks, surfaces to be repaired, refinished and left in condition matching existing prior to commencement of work.
5. Additional work required by lack of proper coordination will be provided at no additional cost to the Owner.

### **3.06 EQUIPMENT SELECTION AND SERVICEABILITY**

- A. Replace or reposition equipment which is too large or located incorrectly to permit servicing, at no additional cost to Owner.

### **3.07 DELIVERY, STORAGE AND HANDLING**

- A. Confirm requirements in individual Division 26, Electrical Sections and the following:
  1. Handle materials delivered to project site with care to avoid damage. Store materials on site inside building or protected from weather, dirt and construction dust. Products and/or materials that become damaged due to water, dirt, and/or dust as a result of improper storage and handling to be replaced before installation.
  2. Protect equipment to avoid damage. Close conduit openings with caps or plugs. Keep motors and bearings in watertight and dustproof covers during entire course of installation.
  3. Protect bus duct and similar items until in service.

### **3.08 DEMONSTRATION**

- A. Confirm Demonstration requirements in individual Division 26, Electrical Sections.
- B. Upon completion of work and adjustment of equipment, test systems and demonstrate to Owner's Representative, Architect, and Engineer that equipment furnished and installed or connected under provisions of these Specifications functions in manner required. Provide field instruction to Owner's Maintenance Staff as specified in individual Division 26, Electrical Sections.
- C. Manufacturer's Field Services: Furnish services of a qualified person at time approved by Owner, to instruct maintenance personnel, correct defects or deficiencies, and demonstrate to satisfaction of Owner that entire system is operating in satisfactory manner and complies with requirements of other trades that may be required to complete work. Complete instruction and demonstration prior to final job site observations.

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### 3.09 CLEANING

- A. Confirm Cleaning requirements in individual Division 26, Electrical Sections.
- B. Upon completion of installation, thoroughly clean electrical equipment, removing dirt, debris, dust, temporary labels and traces of foreign substances. Throughout work, remove construction debris and surplus materials accumulated during work.

### 3.10 INSTALLATION

- A. Confirm Installation requirements in individual Division 26, Electrical Sections.
- B. Install equipment and fixtures in accordance with manufacturer's installation instructions, plumb and level and firmly anchored to vibration isolators. Maintain manufacturer's recommended clearances.
- C. Start up equipment, in accordance with manufacturer's start-up instructions, and in presence of manufacturer's representative. Test controls and demonstrate compliance with requirements. Replace damaged or malfunctioning controls and equipment.
- D. Provide miscellaneous supports/metals required for installation of equipment.

### 3.11 PAINTING

- A. Confirm requirements in individual Division 26, Electrical Sections and the following:
  - 1. Ferrous Metal: After completion of work, thoroughly clean and paint exposed supports constructed of ferrous metal surfaces (i.e., hangers, hanger rods, equipment stands, etc.) with one coat of black asphalt varnish for exterior or black enamel for interior, suitable for hot surfaces.
  - 2. In Electrical Room, on roof or other exposed areas, equipment not painted with enamel to receive two coats of primer and one coat of rustproof enamel, colors as selected by Architect.
  - 3. See individual equipment Specifications for other painting.
  - 4. Structural Steel: Repair damage to structural steel finishes or finishes of other materials damaged by cutting, welding or patching to match original.
  - 5. Conduit: Clean, primer coat and paint interior/exterior conduit exposed in public areas with two coats paint suitable for metallic surfaces. Color selected by Architect.
  - 6. Covers: Covers such as manholes, vaults and the like will be furnished with finishes which resist corrosion and rust.

### 3.12 ACCESS PANELS

- A. Confirm Access Panel requirements in individual Division 26, Electrical Sections and the following:
  - 1. Coordinate locations/sizes of access panels with Architect prior to work.

### 3.13 ACCEPTANCE

- A. Confirm requirements in individual Division 26, Electrical Sections and the following:
  - 1. System cannot be considered for acceptance until work is completed and demonstrated to Architect that installation is in strict compliance with Specifications, Drawings and manufacturer's installation instructions, particularly in reference to following:
    - a. Cleaning

- b. Operation and Maintenance Manuals
- c. Training of Operating Personnel
- d. Record Drawings
- e. Warranty and Guaranty Certificates
- f. Start-up/Test Document and Commissioning Reports

### **3.14 FIELD QUALITY CONTROL**

- A. Confirm Field Quality Control requirements in individual Division 26, Electrical Sections.
- B. Tests:
  - 1. Conduct tests of equipment and systems to demonstrate compliance with requirements specified. Reference individual Specification Sections for required tests. Document tests and include in operation and maintenance manuals.
  - 2. During site evaluations by Architect or Engineer, provide appropriate personnel with tools to remove and replace trims, covers, and devices so that proper evaluation of installation can be performed.

### **3.15 SALVAGED EQUIPMENT AND RECYCLED MATERIAL**

- A. Salvage the following equipment not being reused and return to Owner:
  - 1. Luminaires
  - 2. Panelboards
  - 3. Breakers
  - 4. Transformers
- B. Electrical equipment that cannot be salvaged for reuse sell/give to recycling company. Recycle following excess, removed, or demolished electrical material:
  - 1. Copper or aluminum conductors, buses, and motor/transformer windings.
  - 2. Steel and aluminum from raceways, boxes, enclosures, and housings.
  - 3. Acrylic and glass from luminaire lenses/refractors.
- C. Provide separate on-site storage space for recycled, recycled and salvaged, or salvaged material. Clearly label space.
- D. Confirm additional salvaged equipment and recycled materials in the Contract Documents.

**END OF SECTION**

**PART 1 - GENERAL****1.01 SUMMARY**

A. Section includes but is not limited to:

1. Fencing.
2. Barb wire.
3. Posts.
4. Cantilever Gates.
5. Swinging Gates.
6. Walk Gates.
7. Access Controls.
8. Bollards.
9. Concrete.

**1.02 REFERENCES**

A. Comply with the requirements referenced in this Section.

1. ASTM A 392 – Specification for Zinc-Coated Steel Chain-Link Fence Fabric.
2. ASTM C 33 – Standard Specification for Concrete Aggregates.
3. ASTM C 150 – Standard Specification for Portland Cement.
4. ASTM C 289 – Standard Test Method for Potential Alkali-Silica Reactivity of Aggregates (Chemical Method).
5. ASTM C 618 – Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.
6. ASTM F 567 – Standard Practice for Installation of Chain-Link Fence.
7. ASTM F 626 – Standard Specification for Fence Fittings.
8. ASTM F 900 – Standard Specification for Industrial and Commercial Swing Gates.
9. ASTM F 1083 – Standard Specification for Pipe, Steel, Hot-Dipped Zinc Coated Welded, for Fence Structures.
10. ASTM F 1184 – Specification for Industrial and Commercial Horizontal Slide Gates.
11. ASTM F2200 – Standard Specification for Automated Vehicular Gate Construction.
12. Chain Link Fence Manufacturers Institute – Product Manual.

**1.03 SHOP DRAWINGS, SAMPLES AND SUBMITTALS**

A. Submit Shop Drawings giving details of construction and installation, including materials, dimensions, gate operator, layouts and locations, fastenings, finishes, hardware, connections and other information. In addition:

1. Provide operator designs for the specific type of gate.

2. Provide locations of operators and access controls.

B. Maintenance Data:

1. Provide Operation and Maintenance Manual (O&M Manual) for all Access Controls.

#### **1.04 WARRANTY**

A. Provide manufacturer's written warranty against defects in materials and workmanship, and agreeing to repair or replace components that fail during the warranty period.

B. Warranty period for work of this Section is five (5) years commencing on the date of Substantial Completion.

#### **1.05 SYSTEM DESCRIPTION**

A. Location 1 and Location 2A: Automated keypad access control sliding cantilever chain link access gate topped with barb wire and in-ground automatic exit operator. Perimeter chain link fencing topped with barb wire supported by metal posts. Magnetic lock chain link walk gate with electronic access controls and exit push button, topped with barb wire. All posts embedded in concrete.

B. Location 2B: Manual chain link swing gates topped with barb wire, manual latch with padlock holes for each gate, chain link fencing topped with barb wire supported by metal posts. All posts embedded in concrete.

#### **1.06 QUALITY ASSURANCE**

A. Manufacturer's Qualifications:

1. A minimum of three (3) years experience manufacturing hydraulic gate operators specified in this Section.

B. Installer Qualifications:

1. A minimum of three (3) years experience installing similar equipment.

C. Test Reports:

1. Each operator shall bear a label indicating that the operator mechanism has been tested for full power and pressure of all hydraulic components, full stress tests of mechanical components and electrical tests of all overload devices.

D. Source Limitations:

1. Provide products of same manufacturer for each type of automated system.

#### **1.07 DELIVERY, STORAGE AND HANDLING**

A. Store in original protective package until time of installation, in a covered and protected location.

### **PART 2 - PRODUCTS**

#### **2.01 MANUFACTURERS**

A. Available gate operator manufacturers. Subject to compliance with requirements, manufacturers of gate operators that may be incorporated in the Work include the following:

1. Hy-Security (800) 321-9947.

2. Viking Access Systems (800) 908-0884.

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3. Nortek Security and Control (800) 421-1587.
  4. Hoover Fence Co. (800) 355-2335.
  5. Or Approved Equal.
- B. Available access control manufacturers: Subject to compliance with requirements, manufacturers of access controls that may be incorporated in the Work include the following:
1. HID Global (800) 872-5359.
  2. American Access System (303) 799-9757.
  3. Nortek Security and Control (800) 421-1587.
  4. Or Approved Equal.

## 2.02 MANUFACTURED UNITS

- A. Fencing:
1. Type: Chain link per ASTM A 392.
  2. Fence fabrics are to be fabricated from continuous lengths unless otherwise indicated on the approved Shop Drawings.
  3. Mesh size: Two (2) inch maximum.
  4. Gauge: Nine (9) gauge.
  5. Finish: Hot dip galvanized with zinc metal.
- B. Posts:
1. Material: ASTM F 1083 Schedule 40, hot dip galvanized, and conforming to ASTM F 1083.
  2. Dimensions: As indicated on the Drawings.
  3. Footings: Provide cast-in-place concrete post footings.
  4. Anchorage: Embed posts directly in concrete.
- C. Barbed Wire:
1. Barb type: Four (4) point with four (4) inch spacing.
  2. Material: Steel, hot dip galvanized
  3. Gauge: Twelve and one-half (12 ½) gauge.
  4. Finish: Hot dip galvanized with zinc metal.
  5. Mounting Configuration: As indicated on the Drawings.
- D. Cantilever Gates:
1. Type: Cantilever horizontal sliding gate.
  2. Construction in accordance with ASTM F 1184 Type II, Class 1 and ASTM F 2200 Class III.
  3. Mesh: Nine (9) gauge chain link, two (2) inch maximum opening, hot-dip galvanized finish per ASTM A 392.

4. Frame, Bracing, and Guides: Schedule 40 pipe, hot dip galvanized conforming to requirements of ASTM F 1083
  5. Maximum Weight: Fifteen-hundred (1500) pounds.
  6. Wheels: Nylon cantilever roller, without cover, six (6) inch nominal diameter.
  7. Operator:
    - a. Type: Hy-Security 'Slide Smart DC10F' or Approved Equal.
    - b. Drive: Electric.
    - c. Gate Panel Capacity: Fifteen-hundred (1500) pounds.
    - d. Speed: One (1) foot per second.
    - e. Power: Operates on twenty-four (24) VDC with battery backup.
- E. Swinging Gates:
1. Type: Double swing gate, each opening has two (2) independent swinging gates, with drop rod at center.
  2. Construction in accordance with ASTM F 900.
  3. Mesh: Nine (9) gauge chain link, two (2) inch maximum opening.
  4. Material: Schedule 40 pipe, hot dip galvanized conforming to requirements of ASTM F 1083.
  5. Manual fork latch with padlock holes for each pair of gates.
  6. Drop rod with concrete base for each pair of gates.
  7. Hinge: Box hinge.
  8. In accordance with ASTM F 900
- F. Walk Gates:
1. Type: Single direction swinging gate with stop.
  2. Construction in accordance with ASTM F 900.
  3. Mesh: Nine (9) gauge chain link, two (2) inch maximum opening.
  4. Frame Material: Schedule 40 pipe, hot dip galvanized conforming to requirements of ASTM F 1083.
  5. Hinges: Spring-loaded, self-closing.
- G. Access Controls:
1. Cantilever Gates:
    - a. Weatherproof, outdoor, high use.
    - b. Programmable RFID card reader/keypad.
    - c. Remote: push-button radio access at locations indicated on Drawings.
    - d. Recessed free exit loops.
    - e. Connect to gate operator.
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f. Mounting post: Schedule 40 pipe, hot dip galvanized conforming to requirements of ASTM F 1083.

g. Mounting plate: Per selected manufacturer.

2. Walk Gates:

a. Card reader/keypad with exit button of same operation and manufacturer as Cantilever Gates in this section.

b. Magnetic lock.

H. Bollards:

1. Material: Schedule 40 pipe, hot dip galvanized conforming to requirements of ASTM F 1083, dimensions as indicated on the Drawings.

2. Embed pipe in concrete.

3. Paint: Rust-Oleum, 'High Performance Traffic Zone Striping Paint'.

4. Color: Rust-Oleum '2348 Yellow.'

5. Prepare surfaces to receive paint, prime, and apply paint using manufacturer's written instructions.

6. Application: Field apply paint and primer using brush.

### 2.03 ACCESSORIES

A. Fittings: Provide fittings conforming to requirements of ASTM F 626.

B. Post Caps:

1. Materials: Of the same material as the respective fence system.

2. Provide weather-tight post color caps made for the purpose and sized to the fit the posts.

3. 3-line barb wire stanchion.

C. Tension and Stretcher Bars: Minimum cross section of three-sixteenth (3/16) inch by three-quarter (3/4) inch.

D. Hardware:

1. Finish: Hot dip galvanized.

E. Fasteners:

1. Finish: Hot dip galvanized.

### 2.04 MIXES

A. Class 3000 Concrete:

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

2. Fly Ash: ASTM C 618, Type F.

3. Rate: 15.0 percent by volume required.

4. Normal Weight Aggregate: ASTM C 33; and in accordance with the following:

5. ASTM C 289: Test innocuous for potential reactivity.
6. Use natural, smooth, rounded stone.
7. Maximum loss per Los Angeles Test: Not more than thirty-five (35) percent loss after five-hundred (500) revolutions.
8. Water: Clean, and free from any deleterious material.
9. General Admixtures: Admixtures containing chloride ions are not to be used.

## **2.05 FABRICATION**

### **A. All Gates:**

1. Fabricate gates to fit the openings, widths, heights and other conditions indicated on the Drawings.
2. Design gates to accommodate the existing site conditions.
3. Coordinate gate installation to perform correctly with roadway profiles, slopes, and transitions.
4. Coordinate configurations with the requirements and locations indicated on the Drawings.
5. Fabricate all gates to be true and square.
6. Use tension rods and bracing to prevent warp or sag in mesh material and frame.
7. Maximum opening at any point of gate surface area is two (2) inches except barbed wire installed as indicated on the Drawings.

## **PART 3 PRODUCTS**

### **3.01 INSTALLERS**

- A. Installer is required to be experienced in work of the scope and quality indicated, with a record of successful in-service performance.

### **3.02 EXAMINATION**

- A. Verify that conditions are satisfactory to receive work of this Section. Do not commence work until unsatisfactory conditions have been corrected.
- B. Beginning work constitutes acceptance of conditions.

### **3.03 PREPARATION**

- A. Field Measurements: Verify on job before beginning work.
- B. Prepare the areas to receive the work, including, but not limited to: Removal of portions of landscaping, trenching, saw-cutting, curb-cuts, electrical power source, data power source.
- C. Protect surrounding areas and surfaces from damage prior to beginning work of this Section.

### **3.04 INSTALLATION**

- A. General: Install materials of this Section in close conformance with ASTM F 567.
- B. Manufacturer's Instructions:

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1. Comply with manufacturer's instructions, including technical bulletins and product catalog data.
  2. Contact the manufacturer's product representative to confirm appropriate procedures prior to beginning installation.
  3. Retain manufacturer's written installation instructions at the Project Site.
- C. Posts:
1. Install posts plumb.
  2. Allow concrete to develop strength prior to stretching fence fabric; installing other items; and imposing load on posts.
- D. Gates:
1. Install gates in locations indicated on the Drawings.
  2. Coordinate attachment of wheels, hinges, and other items with the particular characteristics and conditions of each location.
  3. Field verify clearances in the full range of motion for each gate.
  4. Install manufacturer recommended devices to limit travel of gates.
- E. Gate Operators:
1. Install gate operators in accordance with the manufacturer's written instructions.
  2. Coordinate locations of operators with contract Drawings and Approved Shop Drawings.
- 3.05 ADJUSTING**
- A. Adjust for unencumbered, smooth operation and verify mechanisms function properly.
  - B. Replace damaged or defective items.
- 3.06 FIELD QUALITY CONTROL**
- A. Test gate operator through ten (10) full cycles and adjust for operation without binding, scraping, or uneven motion.
  - B. Test limit switches for proper "at rest" gate position.
  - C. Concrete Temperature:
    1. Class 3000 Concrete: More than fifty (50) but less than eighty (80) degrees Fahrenheit.
- 3.07 CLEANING**
- A. Remove foreign materials including dust and dirt, and excess adhesive using materials and methods in accordance with manufacturer's written instructions.
  - B. Remove temporary labels and protective coverings.
- 3.08 PROTECTION**
- A. Protect work of this Section from damage and deterioration until completion and acceptance by Owner.

**END OF SECTION**