

**DIVISION 26: ELECTRICAL**

**26 0500 COMMON WORK RESULTS FOR ELECTRICAL**

26 0501 COMMON ELECTRICAL REQUIREMENTS

26 0519 LINE-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

**26 2000 LOW-VOLTAGE ELECTRICAL TRANSMISSION**

26 2816 ENCLOSED SWITCHES AND CIRCUIT BREAKERS

END OF TABLE OF CONTENTS

**SECTION 26 0501****COMMON ELECTRICAL REQUIREMENTS****PART 1 - GENERAL****1.1 SUMMARY**

## A. Includes But Not Limited To:

1. General electrical system requirements and procedures.
2. Perform excavating and backfilling work required by work of this Division as described in Contract Documents.
3. Make electrical connections to equipment provided under other Sections.
4. Furnish and install Penetration Firestop Systems at electrical system penetrations as described in Contract Documents.

## B. Products Furnished But Not Installed Under This Section:

1. Anchor bolts and templates for exterior lighting equipment bases.

## C. Related Requirements:

1. Section 07 8400: 'Firestopping' for quality of Penetration Firestop Systems to be used on Project and submittal requirements.
2. Section 31 2316: 'Excavation' for criteria for performance of excavating.
3. Section 31 2323: 'Fill' for criteria for performance of backfilling.

**1.2 REFERENCES**

## A. Reference Standards:

1. National Fire Protection Association / American National Standards Institute:
  - a. NFPA 70, 'National Electrical Code (NEC)' (2017 or most recent edition adopted by AHJ).
2. National Electrical Manufacturing Association Standards (NEMA):
  - a. NEMA 250-2018, 'Enclosure for Electrical Equipment (1000 Volts Maximum)'.

**1.3 SUBMITTALS**

## A. Action Submittals:

1. Product Data:
  - a. Provide following information for each item of equipment:
    - 1) Catalog Sheets.
    - 2) Assembly details or dimension drawings.
    - 3) Installation instructions.
    - 4) Manufacturer's name and catalog number.
    - 5) Name of local supplier.
  - b. Furnish such information for following equipment:
    - 1) Section 26 0520: 'Heating Cables' for heating cable equipment.
    - 2) Section 26 2417: 'Circuit-Breaker Panelboards'.
    - 3) Section 26 2418: 'Fusible Panelboards'.
    - 4) Section 26 2726: 'Wiring Devices' for lighting control and dimmer equipment.
    - 5) Section 26 2816: 'Enclosed Switches And Circuit Breakers'.
    - 6) Section 26 2913: 'Enclosed Controllers'.
    - 7) Section 26 5100: 'Interior Lighting Fixtures'.
    - 8) Section 26 5200: 'Emergency Lighting' for battery units.
    - 9) Section 26 5600: 'Exterior Lighting' for fixtures, poles, and associated control equipment.

- c. Do not purchase equipment before approval of product data.
- 2. Shop Drawings:
  - a. Submit on Panelboards:
  - b. Indicate precise equipment to be used, including all options specified. Indicate wording and format of nameplates where applicable. Submit in three-ring binder with hard cover.
- B. Informational Submittals:
  - 1. Test And Evaluation Reports:
    - a. Report of site tests, before Substantial Completion.
  - 2. Qualification Statement:
    - a. Electrical Subcontractor:
      - 1) Provide Qualification documentation if requested by Architect or Owner.
    - b. Installer:
      - 1) Provide Qualification documentation if requested by Architect or Owner.
- C. Closeout Submittals:
  - 1. Include following in Operations And Maintenance Manual specified in Section 01 7800:
    - a. Operations and Maintenance Data:
      - 1) Provide operating and maintenance instructions for each item of equipment submitted under Product Data.
    - b. Record Documentation:
      - 1) Manufacturers documentation:
        - a) Manufacturer's literature.
        - b) Include copy of approved shop drawings.

## 1.4 QUALITY ASSURANCE

- A. Regulatory Agency Sustainability Approvals:
  - 1. NEC and local ordinances and regulations shall govern unless more stringent requirements are specified.
  - 2. Material and equipment provided shall meet standards of NEMA or UL and bear their label wherever standards have been established and label service is available.
  - 3. Material and equipment provided shall meet standards of NEMA or UL, or ULC, CSA, or EEMAC and bear their label wherever standards have been established and label service is available.
- B. Qualifications: Requirements of Section 01 4301 applies, but not limited to following:
  - 1. Electrical Subcontractor:
    - a. Company specializing in performing work of this section.
      - 1) Minimum five (5) years experience in electrical installations.
      - 2) Minimum five (5) satisfactorily completed installations in past three (3) years of projects similar in size, scope, and complexity required for this project before bidding.
    - b. Upon request, submit documentation.
  - 2. Installer:
    - a. Licensed for area of Project.
    - b. Designate one (1) individual as project foremen who shall be on site at all times during installation and experienced with installation procedures required for this project.
    - c. Upon request, submit documentation.

## PART 2 - PRODUCTS

### 2.1 SYSTEMS

- A. Performance:
  - 1. Design Criteria:
    - a. Materials and equipment provided under following Sections shall be by same Manufacturer:

- 1) Section 26 2417: Panelboards.
- 2) Section 26 2418: Fusible Panelboards.
- 3) Section 26 2816: Enclosed Switches And Circuit Breakers.
- 4) Section 26 2913: Enclosed Controllers.

## **PART 3 - EXECUTION**

### **3.1 INSTALLERS**

#### **A. Acceptable Installers:**

1. Meet Quality Assurance Installer Qualifications as specified in Part 1 of this specification.

### **3.2 EXAMINATION**

#### **A. Verification Of Conditions:**

1. Confirm dimensions, ratings, and specifications of equipment to be installed and coordinate these with site dimensions and with other Sections.

### **3.3 INSTALLATION**

#### **A. General:**

1. Locations of electrical equipment shown on Drawings are approximate only. Field verify actual locations for proper installation.
2. Coordinate electrical equipment locations and conduit runs with those providing equipment to be served before installation or rough in.
  - a. Notify Architect of conflicts before beginning work.
  - b. Coordinate locations of power and lighting outlets in mechanical rooms and other areas with mechanical equipment, piping, ductwork, cabinets, etc, so they will be readily accessible and functional.
3. Work related to other trades which is required under this Division, such as cutting and patching, trenching, and backfilling, shall be performed according to standards specified in applicable Sections.

- #### **B. Install Penetration Firestop System appropriate for penetration at electrical system penetrations through walls, ceilings, and top plates of walls.**

### **3.4 FIELD QUALITY CONTROL**

#### **A. Field Tests:**

1. Test systems and demonstrate equipment as working and operating properly. Notify Architect before test. Rectify defects at no additional cost to Owner.
2. Measure current for each phase of each motor under actual final load operation, i.e. after air balance is completed for fan units, etc. Record this information along with full-load nameplate current rating and size of thermal overload unit installed for each motor.

### **3.5 CLOSEOUT ACTIVITIES**

#### **A. Training:**

1. Provide competent instructor for three (3) days to train Owner's maintenance personnel in operation and maintenance of electrical equipment and systems. Factory representatives shall assist this instruction as necessary. Schedule instruction period at time of final inspection.

**END OF SECTION**

**SECTION 26 0519****LINE-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES****PART 1 - GENERAL****1.1 SUMMARY**

## A. Includes But Not Limited To:

1. Quality of conductors used on Project except as excluded below.

## B. Related Requirements:

1. Section 23 0933: 'Electric and Electronic Control System for HVAC' for conductors and cables for temperature control system.
2. Section 26 0501: 'Common Electrical Requirements'.

**1.2 REFERENCES**

## A. Definitions:

1. Line Voltage: Over 70 Volts.

## B. Reference Standards:

1. National Fire Protection Association:
  - a. NFPA 70, 'National Electric Code (NEC)' (2017 or most recent edition adopted by AHJ including all applicable amendments and supplements).
    - 1) Article 334, "Nonmetallic-Sheathed Cable, Types NM, NMC And NMS".

**PART 2 - PRODUCTS****2.1 SYSTEMS**

## A. Line Voltage Conductors:

1. Copper with AWG sizes as shown:
  - a. Minimum size shall be No. 12 except where specified otherwise.
  - b. Conductor size No. 8 and larger shall be stranded.
2. Insulation:
  - a. Standard Conductor Size No. 10 And Smaller: 600V type THWN or XHHW (75 deg F (24 deg C)).
  - b. Standard Conductor Size No. 8 And Larger: 600V Type THW, THWN, or XHHW (75 deg F (24 deg C)).
  - c. Higher temperature insulation as required by NFPA 70 or local codes.
3. Colors:
  - a. 208Y / 120 V System:
    - 1) Black: Phase A.
    - 2) Red: Phase B.
    - 3) Blue: Phase C.
    - 4) Green: Ground.
    - 5) White: Neutral.
  - b. 480Y / 277 Volt System:
    - 1) Brown: Phase A.
    - 2) Orange: Phase B.
    - 3) Yellow: Phase C.
    - 4) Gray: Neutral.

- 5) Green: Ground.
  - c. Conductors size No. 10 and smaller shall be colored full length. Tagging or other methods for coding of conductors size No. 10 and smaller not allowed.
  - d. For feeder conductors larger than No. 10 at pull boxes, gutters, and panels, use painted or taped band or color tag color-coded as specified above.
- B. Line Voltage Cables:
1. Non-Metallic Sheathed Cable (NM) and Metal Clad Cable (MC) may be used as restricted below:
    - a. Copper conductors.
    - b. Sizes #12 through #8.
    - c. Use only in indoor dry locations where:
      - 1) Not subject to damage.
      - 2) Not in contact with earth.
    - d. Not in concrete.
    - e. Not where exposed or not concealed.
    - f. Not over suspended ceilings.
    - g. As restricted by NFPA 70 Article 334.
  2. Metal Clad Cable (MC) may be used as restricted below:
    - a. Copper conductors.
    - b. Sizes #12 through #8.
    - c. Use only in indoor dry locations where:
      - 1) Not subject to damage.
      - 2) Not in contact with earth.
      - 3) Not in concrete.
- C. Cord Sets For Ranges: Three pole, 4 wire grounding, 125/250V, NEMA 14-50P plug, 48 inch (1 200 mm) cord length minimum.
- D. Standard Connectors:
1. Conductors No. 8 And Smaller: Steel spring wire connectors.
  2. Conductors Larger Than No. 8: Pressure type terminal lugs.
  3. Connections Outside Building: Watertight steel spring wire connections with waterproof, non-hardening sealant.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. General:
1. Conductors and cables shall be continuous from outlet to outlet.
  2. Do not use direct burial cable.
- B. Line Voltage Conductors:
1. Install conductors in raceway where indicated on Contract Drawings. Run conductors of different voltage systems in separate conduits.
  2. Route circuits at own discretion, however, circuiting shall be as shown in Panel Schedules. Group circuit homeruns to panels as shown on Contract Drawings.
  3. Neutrals:
    - a. On three-phase, 4-wire systems, do not use common neutral for more than three circuits.
    - b. On single-phase, 3-wire systems, do not use common neutral for more than two circuits.
    - c. Run separate neutrals for each circuit where specifically noted on Contract Drawings.
    - d. Where common neutral is run for two or three home run circuits, connect phase conductors to breakers in panel which are attached to separate phase legs:
      - 1) Provide breaker tie so that all circuits that share common neutral are simultaneously disconnected.

- 2) Neutral conductors shall be of same size as phase conductors unless specifically noted otherwise.
  4. Pulling Conductors:
    - a. Do not pull conductors into conduit until raceway system is complete and cabinets and outlet boxes are free of foreign matter and moisture.
    - b. Do not use heavy mechanical means for pulling conductors.
    - c. Use only listed wire pulling lubricants.
- C. Line Voltage Cables:
1. Route circuits at own discretion, however, circuiting and numbering shall be as shown in Panel Schedules.
  2. Support cables using approved staples, cable ties, straps, hangers, or similar fittings, spaced as required.
  3. Where installing in framing, do not bore holes in joists or beams outside center 1/3 of member depth or within **24 inches (600 mm)** of bearing points. Do not bore holes in vertical framing members outside center 1/3 of member width. Holes shall be one inch diameter maximum.
  4. Conceal cables within ceilings and walls of finished areas. Cables may be exposed in unfinished areas but not run on floors of mechanical equipment spaces or in such a way that they obstruct access to, operation of, or servicing of equipment.
  5. Install exposed cables parallel to or at right angles to building structure lines.
  6. Keep cables **6 inches (150 mm)** minimum from hot water pipes.
  7. Do not support cables from mechanical ducts or duct supports without Architect's written approval.
  8. Prohibited procedures:
    - a. Boring holes for installation of cables in vertical truss members.
    - b. Notching of structural members for installation of cables.

**END OF SECTION**

**SECTION 26 2816****ENCLOSED SWITCHES AND CIRCUIT BREAKERS****PART 1 - GENERAL****1.1 SUMMARY**

## A. Includes But Not Limited To:

1. Furnish and install disconnects as described in Contract Documents, except those provided integral with equipment.

## B. Related Requirements:

1. Section 26 0501: 'Common Electrical Requirements'.

**PART 2 - PRODUCTS****2.1 ASSEMBLIES**

## A. Manufacturers:

1. Category Four Approved Manufacturers. See Section 01 6200 for definitions of Categories.
  - a. Disconnects: Same as Manufacturer of Project's main panelboard.
  - b. Fuses.
    - 1) Cooper Bussmann, Ellisville, IL [www.cooperbussmann.com](http://www.cooperbussmann.com).
    - 2) Edison Fuse, Ellisville, IL (314) 391-3443.
    - 3) Ferraz Shawmut, Newburyport, MA [www.ferrazshawmut.com](http://www.ferrazshawmut.com).
    - 4) Littelfuse Inc, Des Plaines, IL [www.littelfuse.com](http://www.littelfuse.com).

## B. Disconnects:

1. Heavy-duty quick-make, quick-break type, non-fused unless indicated otherwise.
2. Provide interlock to prevent opening of door when switch is in ON position.
3. Provide means to lock switch in OFF position with padlock.
4. Disconnects for motor circuits shall be horsepower rated.

**EDIT REQUIRED:** .Delete or edit paragraph below if no furnaces or unit heaters on Project. Paragraph applies if furnaces ARE NOT provided with internal overload devices. Paragraph does not apply if furnaces ARE provided with internal overload protection devices. Include following paragraph for Granger and Heritage 09T Meetinghouse Standard Plans.

5. Disconnects For Furnace Units And Unit Heaters: Provide manual starter with thermal overload relay. Provide overload relay to match motor full load amps.
6. Enclosures:
  - a. Interior: NEMA / CEMA Type 1.
  - b. Exterior: NEMA / CEMA Type 3R.
7. Fuses:
  - a. Fuse fused disconnects with dual-element time delay fuses and equip with rejection type fuse holders.
  - b. Fuses on Project shall be from single manufacturer.



**PART 3 - EXECUTION****3.1 INSTALLATION**

- A. Label disconnects to indicate equipment served, such as Condensing Unit CU-1. Use **1/16 inch (1.6 mm)** thick laminated plastic composition material with contrasting color core. Engraved letters shall be **1/4 inch (6 mm)** high. Attach labels with screws.
- B. Install furnace disconnects on furnace at location where it is accessible from front of unit and it does not interfere with unit's operation.

**END OF SECTION**

**END OF DIVISION 26**