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**SECTION 26 29 13**  
**ENCLOSED CONTROLLERS****PART 1 GENERAL****1.1 SECTION INCLUDES**

- A. Enclosed NEMA controllers for low-voltage (600 V and less) applications:
  - 1. Magnetic motor starters.
- B. Overcurrent protective devices for motor controllers, including overload relays.
- C. Control accessories:
  - 1. Auxiliary contacts.
  - 2. Pilot devices.
  - 3. Control and timing relays.
  - 4. Control power transformers.
  - 5. Control terminal blocks.

**1.2 RELATED REQUIREMENTS**

- A. Section 26 05 26 - Grounding and Bonding for Electrical Systems.
- B. Section 26 05 29 - Hangers and Supports for Electrical Systems.
- C. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.
- D. Section 26 28 13 - Fuses: Fuses for fusible switches.

**1.3 REFERENCE STANDARDS**

- A. IEEE C57.13 - IEEE Standard Requirements for Instrument Transformers 2016.
- B. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- C. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum) 2020.
- D. NEMA ICS 2 - Industrial Control and Systems Controllers, Contactors and Overload Relays Rated 600 Volts 2008 (Reaffirmed 2020).
- E. NEMA ICS 5 - Industrial Control and Systems: Control Circuit and Pilot Devices 2017.
- F. NEMA ICS 6 - Industrial Control and Systems: Enclosures 1993 (Reaffirmed 2016).
- G. NEMA KS 1 - Heavy Duty Enclosed and Dead-Front Switches (600 Volts Maximum) 2013.
- H. NETA ATS - Standard For Acceptance Testing Specifications For Electrical Power Equipment And Systems 2021.
- I. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- J. UL 98 - Enclosed and Dead-Front Switches Current Edition, Including All Revisions.
- K. UL 60947-1 - Low-Voltage Switchgear and Controlgear - Part 1: General Rules Current Edition, Including All Revisions.
- L. UL 60947-4-1 - Low-Voltage Switchgear and Controlgear - Part 4-1: Contactors and Motor-starters - Electromechanical Contactors and Motor-starters Current Edition, Including All Revisions.

**1.4 ADMINISTRATIVE REQUIREMENTS**

- A. Coordination:
  - 1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances required by NFPA 70.

2. Coordinate the work to provide motor controllers and associated overload relays suitable for use with the actual motors to be installed.
3. Coordinate the work to provide controllers and associated wiring suitable for interface with control devices to be installed.
4. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
5. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
6. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

#### **1.5 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for motor controllers, enclosures, overcurrent protective devices, and other installed components and accessories.
- C. Shop Drawings: Indicate dimensions, voltage, controller sizes, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.
  1. Include dimensioned plan and elevation views of enclosed controllers and adjacent equipment with all required clearances indicated.
  2. Include wiring diagrams showing all factory and field connections.
  3. Identify mounting conditions required for equipment seismic qualification.
- D. Manufacturer's equipment seismic qualification certification.
- E. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.
- F. Field Quality Control Test Reports.
- G. Project Record Documents: Record actual installed locations of controllers and final equipment settings.
  1. Include nameplate data of actual installed motors and associated overload relay selections and settings.
- H. Maintenance Data: Include information on replacement parts and recommended maintenance procedures and intervals.

#### **1.6 QUALITY ASSURANCE**

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

#### **1.7 DELIVERY, STORAGE, AND HANDLING**

- A. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

- B. Handle carefully in accordance with manufacturer's written instructions to avoid damage to internal components, enclosure, and finish.

### **1.8 FIELD CONDITIONS**

- A. Maintain field conditions within required service conditions during and after installation.

## **PART 2 PRODUCTS**

### **2.1 MANUFACTURERS**

- A. Eaton Corporation: [www.eaton.com/#sle](http://www.eaton.com/#sle).
- B. Schneider Electric; Square D Products: [www.schneider-electric.us/#sle](http://www.schneider-electric.us/#sle).
- C. Siemens Industry, Inc: [www.usa.siemens.com/#sle](http://www.usa.siemens.com/#sle).
- D. Substitutions: See Section 01 60 00 - Product Requirements.
- E. Source Limitations: Furnish enclosed motor controllers and associated components produced by a single manufacturer and obtained from a single supplier.

### **2.2 ENCLOSED CONTROLLERS**

- A. Provide enclosed controller assemblies consisting of all required components, control power transformers, instrumentation and control wiring, accessories, etc. as necessary for a complete operating system.
- B. Provide products listed, classified, and labeled as suitable for the purpose intended.
- C. Description: Enclosed controllers complying with NEMA ICS 2, and listed and labeled as complying with UL 60947-1 and UL 60947-4-1; ratings, configurations and features as indicated on the drawings.
- D. Service Conditions:
  - 1. Provide controllers and associated components suitable for operation under the following service conditions without derating:
    - a. Altitude:
      - 1) Class 1 Km Equipment (devices utilizing power semiconductors, e.g. variable frequency controllers): Less than 3,300 feet.
      - 2) Class 2 Km Equipment (electromagnetic and manual devices): Less than 6,600 feet.
    - b. Ambient Temperature: Between 32 degrees F and 104 degrees F.
  - 2. Provide controllers and associated components suitable for operation at indicated ratings under the service conditions at the installed location.
- E. Short Circuit Current Rating:
  - 1. Provide controllers with listed short circuit current rating not less than the available fault current at the installed location as indicated on the drawings.
- F. Conductor Terminations: Suitable for use with the conductors to be installed.
- G. Enclosures:
  - 1. Comply with NEMA ICS 6.
  - 2. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
    - a. Indoor Clean, Dry Locations: Type 1 or Type 12.
  - 3. Finish: Manufacturer's standard unless otherwise indicated.
- H. Instrument Transformers:
  - 1. Comply with IEEE C57.13.
  - 2. Select suitable ratio, burden, and accuracy as required for connected devices.

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3. Current Transformers: Connect secondaries to shorting terminal blocks.
  4. Potential Transformers: Include primary and secondary fuses with disconnecting means.
  - I. Magnetic Motor Starters: Combination type unless otherwise indicated.
    1. Combination Magnetic Motor Starters: NEMA ICS 2, Class A combination motor controllers with magnetic contactor(s), externally operable disconnect and overload relay(s).
    2. Configuration: Full-voltage non-reversing unless otherwise indicated.
    3. Disconnects: Disconnect switch type.
      - a. Disconnect Switches: Fusible type unless otherwise indicated.
      - b. Provide externally operable handle with means for locking in the OFF position. Provide safety interlock to prevent opening the cover with the disconnect in the ON position with capability of overriding interlock for testing purposes.
      - c. Provide auxiliary interlock for disconnection of external control power sources where applicable.
    4. Overload Relays: Bimetallic thermal type unless otherwise indicated.
    5. Pilot Devices Required:
      - a. Furnish local pilot devices for each unit as specified below unless otherwise indicated on drawings.
      - b. Single-Speed, Non-Reversing Starters:
        - 1) Pushbuttons: START-STOP.
        - 2) Selector Switches: HAND/OFF/AUTO.
        - 3) Indicating Lights: Red ON, Green OFF.

### **2.3 OVERCURRENT PROTECTIVE DEVICES**

- A. Overload Relays:
    1. Provide overload relays and, where applicable, associated current elements/heaters, selected according to actual installed motor nameplate data, in accordance with manufacturer's recommendations and NFPA 70; include consideration for motor service factor and ambient temperature correction, where applicable.
    2. Inverse-Time Trip Class Rating: Class 20 unless otherwise indicated or required.
    3. Trip-free operation.
    4. Visible trip indication.
    5. Resettable.
      - a. Employ manual reset unless otherwise indicated.
      - b. Do not employ automatic reset with two-wire control.
    6. Bimetallic Thermal Overload Relays:
      - a. Interchangeable current elements/heaters.
      - b. Adjustable trip; plus/minus 10 percent of nominal, minimum.
      - c. Trip test function.
  - B. Fusible Disconnect Switches:
    1. Description: Quick-make, quick-break, dead-front fusible switch units complying with NEMA KS 1, and listed and labeled as complying with UL 98; ratings, configurations, and features as indicated on the drawings.
    2. Fuse Clips: As required to accept indicated fuses.
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3. Provide externally operable handle with means for locking in the OFF position. Provide means for locking switch cover in the closed position. Provide safety interlock to prevent opening the cover with the switch in the ON position with capability of overriding interlock for testing purposes.

## **2.4 CONTROL ACCESSORIES**

- A. Auxiliary Contacts:
  1. Comply with NEMA ICS 5.
  2. Provide number and type of contacts indicated or required to perform necessary functions, including holding (seal-in) circuit and interlocking, plus one normally open (NO) and one normally closed (NC) spare contact for each magnetic motor starter, minimum.
- B. Pilot Devices:
  1. Comply with NEMA ICS 5; heavy-duty type.
  2. Nominal Size: 30 mm.
  3. Pushbuttons: Unless otherwise indicated, provide momentary, non-illuminated type with flush button operator; normally open or normally closed as indicated or as required.
  4. Selector Switches: Unless otherwise indicated, provide maintained, non-illuminated type with knob operator; number of switch positions as indicated or as required.
  5. Indicating Lights: Push-to-test type unless otherwise indicated.
  6. Provide LED lamp source for indicating lights and illuminated devices.
- C. Control and Timing Relays:
  1. Comply with NEMA ICS 5.
  2. Provide number and type of relays indicated or required to perform necessary functions.
  3. Timing Relays: Electronic.
    - a. Adjustable Timing Range: As required for application.
- D. Control Power Transformers:
  1. Size to accommodate burden of contactor coil(s) and all connected auxiliary devices.
  2. Include primary and secondary fuses.
- E. Control Terminal Blocks: Include 25 percent spare terminals.

## **PART 3 EXECUTION**

### **3.1 EXAMINATION**

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

### **3.2 INSTALLATION**

- A. Install products in accordance with manufacturer's instructions.
- B. Install controllers in accordance with NECA 1 (general workmanship).
- C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.
- D. Provide required support and attachment in accordance with Section 26 05 29.
- E. Install enclosed controllers plumb and level.
- F. Provide grounding and bonding in accordance with Section 26 05 26.
- G. Install all field-installed devices, components, and accessories.

- H. Provide fuses complying with Section 26 28 13 for fusible switches as indicated.
- I. Where accessories are not self-powered, provide control power source as indicated or as required to complete installation.
- J. Set field-adjustable controllers and associated components according to installed motor requirements, in accordance with manufacturer's recommendations and NFPA 70.
- K. Set field-adjustable circuit breaker tripping function settings as directed.
- L. Identify enclosed controllers in accordance with Section 26 05 53.

### **3.3 FIELD QUALITY CONTROL**

- A. Provide services of a manufacturer's authorized representative to observe installation and assist in inspection and testing. Include manufacturer's reports with submittals.
- B. Inspect and test in accordance with NETA ATS, except Section 4.
- C. Motor Starters: Perform inspections and tests listed in NETA ATS, Section 7.16.1.1. Tests listed as optional are not required.
- D. Fusible Switches: Perform inspections and tests listed in NETA ATS, Section 7.5.1.1.
- E. Correct deficiencies and replace damaged or defective enclosed controllers or associated components.

### **3.4 ADJUSTING**

- A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

### **3.5 CLEANING**

- A. Clean dirt and debris from controller enclosures and components according to manufacturer's instructions.
- B. Repair scratched or marred exterior surfaces to match original factory finish.

### **3.6 CLOSEOUT ACTIVITIES**

- A. Demonstration: Demonstrate proper operation of controllers to Owner, and correct deficiencies or make adjustments as directed.
- B. Training: Train Owner's personnel on operation, adjustment, and maintenance of enclosed controllers and associated devices.
  - 1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
  - 2. Provide minimum of two hours of training.
  - 3. Instructor: Manufacturer's authorized representative.
  - 4. Location: At project site.

### **3.7 PROTECTION**

- A. Protect installed enclosed controllers from subsequent construction operations.

**END OF SECTION 26 29 13**