

## **SECTION 26 28 16 - ENCLOSED SWITCHES AND CIRCUIT BREAKERS**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

- A. This Section includes the following individually mounted, enclosed switches and circuit breakers:
  - 1. Fusible switches.
  - 2. Nonfusible switches.
  - 3. Molded-case circuit breakers.
  - 4. Enclosures.

#### **1.2 SUBMITTALS**

- A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated.
- B. Shop Drawings: For each switch and circuit breaker.
  - 1. Dimensioned plans, elevations, sections, and details, including required clearances and service space around equipment. Show tabulations of installed devices, equipment features, and ratings. Include the following:
    - a. Enclosure types and details for types other than NEMA 250, Type 1.
    - b. Current and voltage ratings.
    - c. Short-circuit current rating.
    - d. Features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
  - 2. Wiring Diagrams: Power, signal, and control wiring. Differentiate between manufacturer-installed and field-installed wiring.
- C. Qualification Data: Submit data for testing agencies indicating that they comply with qualifications specified in "Quality Assurance" Article.
- D. Field Test Reports: Submit written test reports and include the following:
  - 1. Test procedures used.
  - 2. Test results that comply with requirements.
  - 3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.
- E. Manufacturer's field service report.

- F. Maintenance Data: For enclosed switches and circuit breakers and for components to include in maintenance manuals specified in Division 01. In addition to requirements specified in Division 01 Section "Closeout Procedures," include the following:
1. Routine maintenance requirements for components.
  2. Manufacturer's written instructions for testing and adjusting switches and circuit breakers.
  3. Time-current curves, including selectable ranges for each type of circuit breaker.

### 1.3 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with NFPA 70.

## PART 2 - PRODUCTS

### 2.1 FUSIBLE AND NONFUSIBLE SWITCHES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Eaton Corporation; Cutler Hammer Products
  2. General Electric Co.; Electrical Distribution & Protection Div.
  3. Siemens Energy & Automation, Inc.
- B. Enclosed, Fusible Switch, 800 A and Smaller: NEMA KS 1, Type HD, with clips or bolt pads to accommodate specified fuses, lockable handle with capability to accept two padlocks, and interlocked with cover in closed position. Interrupting capacity shall meet available fault currents, series rated equipment is not acceptable.
- C. Enclosed, Nonfusible Switch: NEMA KS 1, Type [GD] [HD], lockable handle with capability to accept two padlocks, and interlocked with cover in closed position. Interrupting capacity shall meet available fault currents, series rated equipment is not acceptable.
- D. Accessories:
1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
  2. Neutral Kit: Internally mounted; insulated, capable of being grounded, and bonded; and labeled for copper and aluminum neutral conductors.
  3. Auxiliary Contact Kit: Auxiliary set of contacts arranged to open before switch blades open.

## 2.2 MOLDED-CASE CIRCUIT BREAKERS AND SWITCHES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. General Electric Co.; Electrical Distribution & Control Division.
  - 2. Siemens Energy & Automation, Inc.
  - 3. Square D/Group Schneider.
- B. Molded-Case Circuit Breaker: NEMA AB 1, with interrupting capacity to meet available fault currents, series rated equipment is not acceptable.
  - 1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
  - 2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
  - 3. Electronic Trip Unit Circuit Breakers: RMS sensing; field-replaceable rating plug; with the following field-adjustable settings:
    - a. Instantaneous trip.
    - b. Long- and short-time pickup levels.
    - c. Long- and short-time time adjustments.
    - d. Ground-fault pickup level, time delay, and I<sup>2</sup>t response.
  - 4. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller and let-through ratings less than NEMA FU 1, RK-5.
  - 5. GFCI Circuit Breakers: Single- and two-pole configurations with 5 to 30 mA trip sensitivity.
  - 6. Molded-Case Switch: Molded-case circuit breaker without trip units.
  - 7. Molded-Case Circuit-Breaker Features and Accessories:
- C. Molded-Case Circuit-Breaker Features and Accessories: Standard frame sizes, trip ratings, and number of poles. The Molded-Case Circuit-Breakers shall have features as appropriate for the specific application used.
  - 1. Lugs: Mechanical or compression style suitable for number, size, trip ratings, and material of conductors.
  - 2. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HACR for heating, air-conditioning, and refrigerating equipment.
  - 3. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
  - 4. Communication Capability: Circuit-breaker-mounted communication module with functions and features compatible with power monitoring and control system.
  - 5. Under voltage Trip: Set to operate at 35 to 75 percent of rated voltage with field-adjustable 0.1- to 0.6-second time delay.
  - 6. Auxiliary Switch: One SPDT switch with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts, "b" contacts operate in reverse of circuit-breaker contacts.

7. Key Interlock Kit: Externally mounted to prohibit circuit-breaker operation; key shall be removable only when circuit breaker is in off position.
8. Zone-Selective Interlocking: Integral with electronic trip unit; for interlocking ground-fault protection function.

## 2.3 ENCLOSURES

- A. NEMA AB 1 and NEMA KS 1 to meet environmental conditions of installed location.
  1. Outdoor Locations: NEMA 250, Type 3R.
  2. Kitchen Areas: NEMA 250, Type 4X, stainless steel.
  3. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.
  4. Hazardous Areas Indicated on Drawings: NEMA 250, Type 7C.

## 2.4 FACTORY FINISHES

- A. Finish: Manufacturer's standard paint applied to factory-assembled and -tested enclosures before shipping.

# PART 3 - EXECUTION

## 3.1 INSTALLATION

- A. Coordinate size and location of concrete bases. Verify structural requirements with structural engineer.
- B. Concrete base is specified in Division 26 Section "Hangers and Supports for Electrical Systems," and concrete materials and installation requirements are specified in Division 03.
- C. Comply with applicable portions of NECA 1, NEMA PB 1.1, and NEMA PB 2.1 for installation of enclosed switches and circuit breakers.
- D. Mount individual wall-mounting switches and circuit breakers with tops at uniform height, unless otherwise indicated. Anchor floor-mounting switches to concrete base.
- E. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.
- F. Comply with mounting and anchoring requirements specified in Division 26 Section "Vibration and Seismic Controls for Electrical Systems."
- G. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

- H. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs as specified in Division 26 Section "Identification for Electrical Systems."

### 3.2 CONNECTIONS

- A. Install equipment grounding connections for switches and circuit breakers with ground continuity to main electrical ground bus.
- B. Install power wiring. Install wiring between switches and circuit breakers, and control and indication devices.
- C. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

### 3.3 FIELD QUALITY CONTROL

- A. Prepare for acceptance testing as follows:
  - 1. Inspect mechanical and electrical connections.
  - 2. Verify switch and relay type and labeling verification.
  - 3. Verify rating of installed fuses.
  - 4. Test insulation resistance for each enclosed switch, circuit breaker, component, and control circuit.
  - 5. Test continuity of each line- and load-side circuit.
- B. Testing Agency: Engage a qualified independent testing agency to perform specified testing.
- C. Testing: After installing enclosed switches and circuit breakers and after electrical circuitry has been energized, demonstrate product capability and compliance with requirements.
  - 1. Procedures: Perform each visual and mechanical inspection and electrical test indicated in NETA ATS, Section 7.5 for switches and Section 7.6 for molded-case circuit breakers. Certify compliance with test parameters.
  - 2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
- D. Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each enclosed switch and circuit breaker. Open or remove doors or panels so connections are accessible to portable scanner.
  - 1. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each unit 11 months after date of Substantial Completion.
  - 2. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
  - 3. Record of Infrared Scanning: Prepare a certified report that identifies switches and circuit breakers checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.4 ADJUSTING

- A. Set field-adjustable switches and circuit-breaker trip ranges.

3.5 CLEANING

- A. On completion of installation, inspect interior and exterior of enclosures. Remove paint splatters and other spots. Vacuum dirt and debris; do not use compressed air to assist in cleaning. Repair exposed surfaces to match original finish.

**END OF SECTION 26 28 16**