

## SECTION 26 2816 - ENCLOSED SWITCHES AND CIRCUIT BREAKERS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section Includes Separately Mounted:
  - 1. Fusible switches.
  - 2. Non-fusible switches.
  - 3. Molded-case circuit breakers (MCCBs).
  - 4. Molded-case switches.
  - 5. Enclosures.
- B. Related Sections:
  - 1. Division 26 Section "26 2813" for fusing requirements.

#### 1.3 DEFINITIONS

- A. NC: Normally closed.
- B. NO: Normally open.
- C. SPDT: Single pole, double throw.

#### 1.4 ACTION SUBMITTALS

- A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.
  - 1. Enclosure types and details for types other than NEMA 250, Type 1.
  - 2. Current and voltage ratings.
  - 3. Short-circuit current ratings (interrupting and withstand, as appropriate).
  - 4. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices, accessories, and auxiliary components.
  - 5. Include time-current coordination curves (average melt) for each type and rating of overcurrent protective device; include selectable ranges for each type of overcurrent protective device.

- B. Shop Drawings: For enclosed switches and circuit breakers. Include plans, elevations, sections, details, and attachments to other work.

- 1. Wiring Diagrams: For power, signal, and control wiring.

1.5 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

- 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.

- B. Manufacturer's field service report.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For enclosed switches and circuit breakers to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:

- 1. Manufacturer's written instructions for testing and adjusting enclosed switches and circuit breakers.
  - 2. Time-current coordination curves (average melt) for each type and rating of overcurrent protective device; include selectable ranges for each type of overcurrent protective device.

1.7 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

- 1. Fuses: 10%, but not no fewer than three (3) of each size and type.
  - 2. Fuse Pullers: one for each size and type.

1.8 QUALITY ASSURANCE

- A. Source Limitations: Obtain enclosed switches and circuit breakers, overcurrent protective devices, components, and accessories, within same product category, from single source from single manufacturer.

- B. Product Selection for Restricted Space: Drawings indicate maximum dimensions for enclosed switches and circuit breakers, including clearances between enclosures, and adjacent surfaces and other items. Comply with indicated maximum dimensions.

- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by UL and marked for intended location and application.

- D. Comply with NFPA 70.

- E. Comply with most current edition of the Northwestern University Design Standards.

- F. Use of "General Duty" switches or equipment is prohibited.
- G. Series rated equipment shall not be used.

#### 1.9 PROJECT CONDITIONS

- A. ***(Delete This Paragraph If Not Required)*** [Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by The University or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:
  - 1. **Notify the University no fewer than [two] calendar weeks in advance of proposed interruption of electric service.**
  - 2. **Indicate method of providing temporary electric service.**
  - 3. **Do not proceed with interruption of electrical service without the University's Chief Electrician's written permission.**
  - 4. **The University Lock-out/Tag-out procedures shall be used with Contractor controlled locks and tags.**
  - 5. **Comply with NFPA 70E.]**
- B. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:
  - 1. Ambient Temperature: Not less than minus 22 deg F (minus 30 deg C) and not exceeding 104 deg F (40 deg C).
  - 2. Altitude: Not exceeding 6600 feet (2010 m).

#### 1.10 COORDINATION

- A. Coordinate layout and installation of switches, circuit breakers, and components with equipment served and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels to comply with NEC Art. 110.

### PART 2 - PRODUCTS

#### 2.1 FUSIBLE SWITCHES

- A. Subject to compliance with requirements, provide products by one of the following:
  - 1. Eaton Corp. Electrical Group
  - 2. Siemens Industry Inc.
  - 3. Schneider (Square D)
- B. Type HD, Heavy Duty, Single Throw, **[240] [600]-V ac**, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate specified fuses, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.
- C. Accessories: ***(Edit For Project Requirements)***
  - 1. Equipment Ground Kit: Internally mounted and labeled for copper ground conductors.

2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper neutral conductors.
3. Isolated Ground Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper neutral conductors.
4. Class R Fuse Kit: Provides rejection of other fuse types when Class R fuses are specified.
5. Auxiliary Contact Kit: One NO/NC (Form "C") auxiliary contact(s), arranged to activate before switch blades open.
6. Hookstick Handle: Allows use of a hookstick to operate the handle.
7. Lugs: Mechanical type, suitable for number, size, and conductor material.
8. Service-Rated Switches: Labeled for use as service equipment.
9. Accessory Control Power Voltage: Remote mounted and powered; 120-V ac.

## 2.2 NONFUSIBLE SWITCHES

- A. Subject to compliance with requirements, provide products by one of the following:
1. Eaton Corp. Electrical Group.
  2. Siemens Industry Inc.
- B. Type HD, Heavy Duty, Single Throw, [240] [600]-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.
- C. Accessories: **(Edit For Project Requirements)**
1. Equipment Ground Kit: Internally mounted and labeled for copper ground conductors.
  2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper neutral conductors.
  3. Isolated Ground Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper neutral conductors.
  4. Auxiliary Contact Kit: One NO/NC (Form "C") auxiliary contact(s), arranged to activate before switch blades open.
  5. Hookstick Handle: Allows use of a hookstick to operate the handle.
  6. Lugs: Mechanical type, suitable for number, size, and conductor material.
  7. Accessory Control Power Voltage: Remote mounted and powered; 120-V ac.

## 2.3 MOLDED-CASE CIRCUIT BREAKERS

- A. Subject to compliance with requirements, provide products by one of the following:
1. Eaton Corp. Electrical Group.
  2. Siemens Industry Inc.
- B. General Requirements: Comply with UL 489, NEMA AB 1, and NEMA AB 3, fully rated with interrupting capacity to comply with available fault currents.
- C. Circuit breakers 250 Amps and larger shall be rated to carry 100% of their current rating continuously.
- D. 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 up to 400 A.

- E. Adjustable, Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
- F. Electronic Trip Circuit Breakers: 400 A and larger. Field-replaceable rating plug, rms sensing, with the following field-adjustable settings:
1. Instantaneous trip.
  2. Long- and short-time pickup levels.
  3. Long- and short-time time adjustments.
  4. Ground-fault pickup level, time delay, and I<sup>2</sup>t response.
- G. Ground-Fault, Circuit-Interrupter (GFCI) Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).
- H. Ground-Fault, Equipment-Protection (GFEP) Circuit Breakers: Single- and two-pole configurations with Class B ground-fault protection (30-mA trip).
- I. Features and Accessories:
1. Standard frame sizes, trip ratings, and number of poles.
  2. Lugs: Mechanical type, suitable for number, size, trip ratings, and conductor material.
  3. Application Listing: Appropriate for application.  
**(Edit For Project Requirements)**
  4. Ground-Fault Protection: Comply with UL 1053; integrally mounted, self-powered type with mechanical ground-fault indicator; relay with adjustable pickup and time-delay settings, push-to-test feature, internal memory, and shunt trip unit; and three-phase, zero-sequence current transformer/sensor.
  5. Communication Capability: Integral communication module with functions and features compatible with the University's SCADA system.
  6. Shunt Trip: Trip coil energized from separate circuit, with coil-clearing contact.
  7. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage without intentional time delay.
  8. Auxiliary Contacts: One SPDT switch with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts, "b" contacts operate in reverse of circuit-breaker contacts.
  9. Key Interlock Kit: Externally mounted to prohibit circuit-breaker operation; key shall be removable only when circuit breaker is in off position.
  10. Zone-Selective Interlocking: Integral with electronic trip unit; for interlocking ground-fault protection function.
  11. Electrical Operator: Provide remote control for on, off, and reset operations.
  12. Accessory Control Power Voltage: Integrally mounted, self-powered.
- J. New Circuit Breakers in Existing Panelboards:
1. Circuit breakers shall be of standard manufacture and match existing devices.
  2. Circuit breakers shall be "bolt-on" type.
  3. Circuit breakers shall have an AIC rating compatible with the Building's short circuit analysis report.

## 2.4 ACCESSORIES

- A. Communication modules: Where indicated provide communication modules, energy metering and control for circuit breakers and switches, with functions and features compatible with the

University's SCADA network. Communications link shall be via the University's energy management software.

## 2.5 ENCLOSURES

- A. Enclosed Switches and Circuit Breakers: NEMA AB 1, NEMA KS 1, NEMA 250, and UL 50, to comply with environmental conditions at installed location.
1. Indoor, Dry and Clean Locations: NEMA 250, Type 1.
  2. Outdoor Locations: NEMA 250, Type 3R.
  3. Kitchen, Wash-Down Areas, Other Wet or Damp Indoor Locations: NEMA 250, Type 4X, stainless steel.
  4. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: NEMA 250, Type 12.
  5. Hazardous Areas Indicated on Drawings: NEMA 250, [Type 7] [Type 9].

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated. Install switches and circuit breakers on walls by mounting on lightweight structural-steel channels such as "Uni-Strut" bolted to wall. Do not "stack" devices.
- B. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.
- C. Install wiring between circuit breakers and switches, and University's SCADA network.
1. Install all low voltage wiring (CAT. 6, twisted pair, etc.) between energy metering devices and the University's SCADA network.
- D. Install fuses in fusible devices in accordance with Manufacturer's recommendations or equipment nameplates.
- E. Provide GFI circuit breakers with 30 mA sensitivity trip for all freeze protection, temperature maintenance, and heat tracing circuits.
- F. Comply with NECA 1.

### 3.3 IDENTIFICATION

- A. Comply with requirements in Division 26 Section "Identification for Electrical Systems."

1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
2. Label each enclosure with engraved laminated-plastic nameplate.

### 3.4 FIELD QUALITY CONTROL

#### A. Perform tests and inspections.

1. **Manufacturer's Field Service:** Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

#### B. Acceptance Testing Preparation:

1. Test insulation resistance for each enclosed switch and circuit breaker, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

#### C. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. 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.
3. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.

#### D. Enclosed switches and circuit breakers will be considered defective if they do not pass tests and inspections.

#### E. Prepare test and inspection report, including a certified report that identifies enclosed switches and circuit breakers and that describes scanning results. Include notation of deficiencies detected, remedial action taken and observations after remedial action.

### 3.5 ADJUSTING

#### A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.

#### B. Set field-adjustable circuit-breaker trip ranges. Provide list of "as left" settings and submit to Electric Shop.

**END OF SECTION 26 2816**

NORTHWESTERN UNIVERSITY  
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