

**SECTION 16475**  
**OVERCURRENT PROTECTIVE DEVICES**

**PART 1 - GENERAL**

**1.1 SECTION INCLUDES**

- A. Thermal Magnetic Molded Case Circuit Breakers - Circuit breakers rated 400A or less shall be this type.
- B. Electronic Trip Molded Case Circuit Breakers - Circuit breakers rated over 400A shall be this type.
- C. Insulated Case Electronic Type Circuit Breakers - Main service disconnects shall be this type.
- D. Fusible switches and fuses - Furnish as specified herein.

**1.2 REFERENCES**

- A. The circuit breakers referenced herein shall be designed and manufactured according to the latest revision of the following standards.
  - 1. NEMA AB 1 - (National Electrical Manufacturers Association) Molded Case Circuit Breakers and Molded Case Switches
  - 2. UL 489 - (Underwriters Laboratories Inc.) Molded Case Circuit Breakers and Circuit Breaker Enclosures
  - 3. UL 943 - Standard for Ground Fault Circuit Interrupters
  - 4. CSA C22.2 No. 5.1 - M91 - (Canadian Standard Association) Molded Case Circuit Breakers
  - 5. Federal Specification W-C-375B/GEN - Circuit Breakers, Molded Case; Branch Circuit and Service
  - 6. Federal Specification W-C-865C - Fusible Switches
  - 7. National Fire Protection Association NFPA - 70 (National Electrical Code)

**1.3 QUALITY ASSURANCE**

- A. Devices shall be the latest approved design in conformity with applicable standards and UL listings as manufactured by Square D Company to match equipment provided in C Concourse Phase 2 Building Completion Package.

**1.4 COORDINATION STUDY**

- A. Provide a complete protective device coordination study for the affected parts of the electrical distribution system. Provide specific recommendations for circuit breaker settings (trip, time delays, etc.), relays and ground fault devices. The study shall be performed by a Registered Professional Engineer who has at least five (5) years experience in performing system studies. Submit qualifications with study. This requirement may be waived at ANC's discretion for work that involves only minor revisions to the existing power distribution systems (e.g., addition of Tenant panels downstream of ANC distribution system equipment). ANC will advise the Tenant after receiving the Coordination Submittal information required in Section 16010.

## 1.5 SHORT CIRCUIT CALCULATIONS

- A. Provide short circuit calculations for all new equipment added to the electrical distribution system.
- B. Provide coordination data to check protective devices. Provide electronic and hard copy time/current characteristic trip curves (and  $I_p$  &  $I^2t$  let through curves for current limiting circuit breakers) for each type of circuit breaker.
- C. All information required to verify compliance with the short-circuit withstand and interrupting ratings.

## PART 2 - PRODUCTS

### 2.1 MOLDED CASE CIRCUIT BREAKERS – 400 A OR LESS

- A. Circuit breakers rated 400 A or less shall be molded case circuit breakers.
- B. General
  - 1. Circuit breaker/circuit breaker combinations for series connected interrupting ratings shall be listed by UL as recognized component combinations. Any series rated combination used shall be marked on the end use equipment along with the statement "Caution - Series Rated System xx,xxx Amps Available. Identical Replacement Component Required".
  - 2. Circuit breaker handle accessories shall provide provisions for locking handle in the ON and OFF position.
  - 3. Lugs shall be UL Listed to accept solid (not larger than #8 AWG) and/or stranded copper and aluminum conductors. Lugs shall be suitable for 75 degrees C rated wire or 90 degrees C rated wire, sized according to the 75 degrees C temperature rating in the National Electrical Code.
- C. Thermal-Magnetic Circuit Breakers
  - 1. Circuit protective devices shall be Square D molded case circuit breakers. Amp ratings and amp interrupting ratings (AIR) shall be as required by the application.
  - 2. Circuit breakers shall have a permanent trip unit containing individual thermal and magnetic trip elements in each pole.
  - 3. Thermal trip elements shall be factory preset and sealed. Thermal elements shall be factory calibrated to operate in a 40 degrees C ambient environment. Thermal elements shall be ambient compensating above 40 degrees C.
  - 4. Two- and three-pole circuit breakers shall have an internal common trip crossbar to provide simultaneous tripping. Circuit breaker frame sizes above 100 amperes shall have a single magnetic trip adjustment located on the front of the breaker that allows the user to simultaneously select the desired trip level of all poles.

### 2.2 ELECTRONIC TRIP CIRCUIT BREAKER WITH FULL FUNCTION TRIP SYSTEM – OVER 400 A

- A. Circuit breakers rated over 400 A shall be electronic type with full function trip system.
- B. Shall be Square D Full Function type: LE, ME, NE, or PE.

- C. Circuit breaker trip system shall be a microprocessor-based true rms sensing design with sensing accuracy through the thirteenth (13th) harmonic. Sensor ampere ratings shall be as indicated on the associated schedules and/or drawings.
- D. The integral trip system shall be self-powered and shall contain electronic components to measure ampacity, time the output from internal current sensors, and initiate automatic tripping action.
- E. The ampere rating of the circuit breaker shall be determined by the combination of an interchangeable rating plug, the sensor size and the long-time pickup adjustment on the circuit breaker. The sensor size, rating plug and switch adjustments shall be clearly marked on the face of the circuit breaker. Circuit breakers shall be UL Listed to carry 100 percent of their ampere rating continuously (except for 600 A frame LE and 2500 A frame PE).
- F. The following time/current response adjustments shall be provided. Each adjustment shall have discrete settings and shall be independent of all other adjustments.

Long Time Pickup	Instantaneous Pickup
Long Time Delay	
Short Time Pickup	Ground Fault Pickup ( $\geq 1000A$ )
Short Time Delay ( $I^2t$ IN and $I^2t$ OUT)	Ground Fault Delay ( $I^2t$ IN and $I^2t$ OUT) ( $\geq 1000A$ )

- G. Circuit breakers with adjustable short-time function shall be provided with defeatable instantaneous adjustment and 30 cycle short-time withstand ratings. Short time withstand ratings shall be specified in rms symmetrical amperes, as shown on the schedules and/or drawings.
- H. A means to seal the rating plug and trip unit adjustments in accordance with NEC Section 240-6(b) shall be provided.
- I. Local visual trip indication for overload, short circuit and ground fault trip occurrences shall be provided.
- J. An ammeter to individually display all phase currents flowing through the circuit breaker shall be provided. Indication of inherent ground fault current flowing in the system shall be provided on circuit breakers with integral ground fault protection. All current values shall be displayed in True rms with two percent accuracy.
- K. Long Time Pickup indication to signal when loading approaches or exceeds the adjusted ampere rating of the circuit breaker shall be provided.
- L. The trip system shall include a Long Time memory circuit to protect against intermittent overcurrent conditions above the long time pickup point. Means shall be provided to reset Long Time memory circuit during primary injection testing.
- M. Circuit breakers (except LE) shall be equipped with back-up thermal and magnetic trip system.
- N. Circuit breaker trip system shall be equipped with an externally accessible test port for use with a Universal Test Set. Disassembly of the circuit breaker shall not be required for testing. Test set shall be capable of verifying the operation of all trip functions with or without tripping the circuit breaker.

- O. Communications capabilities for remote monitoring of circuit breaker trip system, to include phase and ground fault currents, pre-trip alarm indication, switch settings, and trip history information shall be provided.
- P. Circuit breakers shall be provided with Zone Selective Interlocking (ZSI) communications capabilities on the short-time and ground fault functions compatible with other electronic trip circuit breakers and external ground fault sensing systems.

**2.3 INSULATED CASE CIRCUIT BREAKER WITH FULL FUNCTION TRIP SYSTEM – MAIN SERVICE DISCONNECT**

- A. Main service disconnects shall be insulated case electronic type circuit breakers with full function trip system.
- B. Shall be Square D Insulated Case type SE. Circuit breaker shall be Fixed, Individually Mounted construction.
- C. Circuit breaker trip system shall be a microprocessor-based true rms sensing design with sensing accuracy through the thirteenth (13th) harmonic. Sensor ampere ratings shall be as indicated on the associated schedules and/or drawings.
- D. The integral trip system shall be self-powered and shall contain electronic components to measure ampacity, time the output from internal current sensors, and initiate automatic tripping action.
- E. Circuit breakers shall be equipped with back-up thermal and magnetic trip system.
- F. The ampere rating of the circuit breaker shall be determined by the combination of an interchangeable rating plug, the sensor size and the long-time pickup adjustment on the circuit breaker. The sensor size, rating plug and switch adjustments shall be clearly marked on the face of the circuit breaker. Circuit breakers shall be UL Listed to carry 100 percent of their ampere rating continuously.
- G. The following time/current response adjustments shall be provided. Each adjustment shall have discrete settings and shall be independent from all other adjustments.

Long Time Pickup	Instantaneous Pickup
Long Time Delay	
Short Time Pickup	Ground Fault Pickup
Short Time Delay ( $I^2t$ IN and $I^2t$ OUT)	Ground Fault Delay ( $I^2t$ IN and $I^2t$ OUT)

- H. Circuit breakers with adjustable short-time function shall be provided with defeatable instantaneous adjustment and 30 cycle short time withstand ratings. Short time withstand ratings shall be specified in rms symmetrical amperes, as shown on the schedules and/or drawings.
- I. A means to seal the rating plug and trip unit adjustments in accordance with NEC Section 240-6(b) shall be provided.
- J. Local visual trip indication for overload, short circuit and ground fault trip occurrences shall be provided.

- K. An ammeter to individually display all phase currents flowing through the circuit breaker shall be provided. Indication of inherent ground fault current flowing in the system shall be provided on circuit breakers with integral ground fault protection. All current values shall be displayed in True rms with two percent accuracy.
- L. Long Time Pickup indication to signal when loading approaches or exceeds the adjusted ampere rating of the circuit breaker shall be provided.
- M. The trip system shall include a Long Time memory circuit to protect against intermittent overcurrent conditions above the long time pickup point. Means shall be provided to reset Long Time memory circuit during primary injection testing.
- N. Circuit breaker trip system shall be equipped with an externally accessible test port for use with a Universal Test Set. Disassembly of the circuit breaker shall not be required for testing. Test set shall be capable of verifying the operation of all trip functions with or without tripping the circuit breaker.
- O. Communications capabilities for remote monitoring of circuit breaker trip system, to include phase and ground fault currents, pre-trip alarm indication, switch settings, and trip history information shall be provided.
- P. Circuit breakers shall be provided with Zone Selective Interlocking (ZSI) communications capabilities on the short time and ground fault functions compatible with all other electronic trip circuit breakers and external ground fault sensing systems.
- Q. True two-step stored energy mechanism with five (5) cycle closing time shall be provided. All circuit breakers shall have multiple CHARGE/CLOSE provisions allowing the following sequence:
- R. CHARGE, CLOSE, RECHARGE, OPEN/CLOSE/OPEN
- S. Local control pushbuttons to OPEN and CLOSE circuit breaker shall be provided. Color-coded visual indication of contact position (OPEN or CLOSED) shall be provided on the face of the circuit breaker. Local manual charging following CLOSE operation shall be provided. Color-coded visual indication of mechanism CHARGED and DISCHARGED position shall be provided on the face of the circuit breaker. Visual indicator shall indicate CHARGED only when closing springs are completely charged.
- T. Each circuit breaker shall be electrically operated to permit remote CHARGE, CLOSE, and OPEN capabilities. Electrically operated circuit breaker shall be equipped with charge contact switch for remote indication of mechanism charge status.
- U. All circuit breakers shall be equipped with electrical accessories as noted on the schedules and/or drawings.

#### **2.4 EQUIPMENT GROUND FAULT PROTECTION (ELECTRONIC TRIP CIRCUIT BREAKERS)**

- 1. Equipment shall be Square D.
  - a. Full Function - True RMS Sensing type: LE, ME, NE, PE, SE (with ground fault option).
- 2. Circuit breakers shall be provided with integral equipment ground fault protection for grounded systems. The circuit breaker shall be suitable for use on three-phase, three-wire circuits where the system neutral is grounded but not carried through the system or on three-phase, four-wire systems.

3. A separate neutral current transformer shall be provided for three-phase four-wire systems.
4. Ground fault sensing system shall be residual sensing type.
5. The trip system shall include a ground fault memory circuit to sum the time increments of intermittent ground faults above the pickup point.
6. A means of testing the ground fault system to meet the on-site testing requirements of NEC Section 230-95(c) shall be provided.
7. Local visual trip indication for a ground fault trip occurrence shall be provided.
8. Zone Selective Interlocking (ZSI) communications capabilities on the ground fault function compatible with all other electronic trip circuit breakers and external ground fault sensing systems.
9. Circuit breakers shall be provided with communications capabilities for remote alarm indication only (no trip) per NEC Section 700-7(d) for emergency systems (Full Function circuit breakers only).

## **2.5 FUSIBLE SWITCHES**

- A. Fusible switches shall be designed for individual mounting as specified in Section 16440 - Disconnects, or for panelboard mounting.
- B. Switches designed for panelboard mounting shall have the same properties as specified for the individually mounted switches.
- C. Switches shall conform to NEMA and UL 67 standards.
- D. Switches shall be used in conjunction with fuses as specified in the following in order to constitute a complete "Overcurrent Protective Device."

## **2.6 FUSES**

- A. Manufacturer: Shall be Bussmann
- B. Fuses shall be of the sizes and types required by the application, or as recommended by manufacturer of equipment served (as applicable). Fuses shall be capable of interrupting the prospective fault current. Furnish one complete set of spare fuses of each rating installed to the Owner. Provide fuse puller(s) for fuse sizes used.
- C. Fuses through 600 Amperes: Current limiting, time delay, one-time fuse, voltage and Class as required by the application or recommended by the equipment manufacturer.
- D. Interrupting Rating: 200,000 rms amperes.

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION**

- A. Install circuit breakers in accordance with manufacturers instructions, the National Electrical Code and applicable local codes.
- B. Size devices as required by the load being served.

### **3.2 ADJUSTMENTS**

- A. Circuit breaker pick-up level and time delay settings shall be adjusted to values indicated in the coordination study, unless otherwise directed by ANC.

**END OF SECTION**