	Title: YALE OFFICE OF FACILITIES PROCEDURE MANUAL Chapter: 01 - Yale Design Standard Division: Electrical Standards	Section: 26 24.01 Enclosed Switches and Circuit Breakers
		Date: 6/15/16
		Author: Office of Facilities
CC: Project Folder		


Date	Description of Change	Pages / Sections Modified	Change Approver Initials
6/15/16	Updated division section from 16410 to 26 24 01, removed references to other section numbers	-	mgl44

## A. Summary

This section contains design criteria for individually-mounted, molded-case circuit breakers rated at 600 volts or less, low-voltage power circuit breakers, and safety disconnect switches.

## B. System Design and Performance Requirements

1. Provide load-break rated safety switches as a means of disconnecting all equipment. The design engineer must determine whether the AIC rating of the equipment supplied can withstand the phase-to-phase short-circuit rating of the electrical system. Do not solely rely on references to NEC requirements.
2. Switches must be non-fusible, except where a feeder supplies more than one piece of equipment. In such cases, the branch circuit switches must be fusible and must be specified complete with fuses of the size required for each component.
3. Provide short-circuit protection for the motor circuit at the starter location. Where the starter is not located within sight of the motor, use a non-fused type disconnect switch at the motor location.
4. Provide six-pole safety switches when located on the load side of the following types of controllers:
  - Two-speed (two windings) starters
  - Wye-delta starters
  - Part winding reduced voltage starters
5. The short-circuit interrupting ratings for circuit breakers shall be in accordance with a short-circuit analysis that accounts for all current sources and impedances between the sources and the circuit breakers. Series ratings are not acceptable.
6. Selectively coordinate all circuit breakers for all fault and overload conditions. Ensure that that breaker opens before any overcurrent device on its line side and remains closed throughout the clearing time of any device on its load side.
7. Where circuit breakers are specified with adjustable trip settings, ensure that the

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construction documents include the required settings for all trip adjustments, based on the result of short-circuit and coordination studies. The means of adjustment must be rendered inaccessible to unqualified persons by specifying locking covers or seals where commercially available. Where such covers or seals are not available, locate circuit breakers within dedicated electrical rooms equipped with locking doors.

8. Molded-case circuit breakers may be specified in switchboards, panelboards, individual enclosures, or in combination starters as described in the next paragraph.
9. Specify circuit breakers for motor branch circuits as follows:
  - a. Specify magnetic-only circuit breakers only in combination starters.
  - b. Type HACR circuit breakers may be specified only when the protected equipment is labeled for use with such breakers.

## C. Submittals

Submit the following design and construction documents.

### 1. Designer Submittals

Submit sizing calculations for switches over 100 amperes.

### 2. Construction Documents

- Shop drawings
- Operation and maintenance instructions


## D. Product Standards

Ensure that all products conform to the following standards:

- NEMA KS1, Enclosed Switches
- UL 98, Enclosed Switches
- NEMA AB1, Molded Case Circuit Breakers
- NEMA SG3, Low-Voltage Power Circuit Breakers
- UL 489, Molded-Case Circuit Breakers and Circuit-Breaker Enclosures
- UL 943, Ground-Fault Circuit Interrupters

## E. Manufacturers

Subject to compliance with the design requirements, provide products by one of the

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following manufacturers:


- Eaton
- General Electric
- Square D
- Challenger (for circuit breakers)
- ABB

## F. Equipment

1. Use NEMA 12, heavy-duty type safety switches with quick-make/quick-break switching mechanisms, dual horsepower ratings, and minimum short-circuit withstand ratings of 100,000 amperes. Switches must be fully enclosed with defeatable cover interlocks and indicating handles that accept a minimum of three padlocks.
2. Switches used in conjunction with variable frequency drives must be able to completely isolate the power and control to VFDs. Disconnect switch between VFD and motor shall have an early break auxiliary contact interlock such that it will disable the open permissive circuit of the VFD prior to opening the motor power circuit.
3. Use quick-make/quick-break, trip-free, thermal-magnetic type, molded-case circuit breakers. Automatic tripping must be clearly indicated by the operating handle assuming a mid-position between "ON" and "OFF." Two- and three-pole breakers must have an internal common trip. All circuit breakers must be bolt-on type, and must be 100-ampere frame minimum, suitable for use in 40°C ambient temperatures.
4. Specify all circuit breakers with mechanical conductor terminations rated for use with 75°C wiring.
6. All 15- and 20-ampere, single-pole circuit breakers shall be marked for switching duty.
7. All circuit breakers rated over 400 amperes must be rated 600-volts AC, with an adjustable magnetic trip and interchangeable trip units.

## G. Installation Guidelines

1. Specify a minimum 1/4-inch air gap between the switch and the wall when mounting the switch on the inside of a below-grade exterior wall.

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2. Mount groups of switches or breakers at uniform heights. Specify mounting heights as follows (measured above the finished floor to the center of the handle):
  - a. For stand-alone switches or breakers: 48 inches.
  - b. For switches or breakers installed with starters below: 60 inches.
3. Specify handle locks for all critical circuits that should not be operated by unauthorized persons (for example, circuits feeding fire alarm systems, time clocks, communications equipment, and certain computers).

## H. Quality Control

Verify proper operation of all ground-fault breakers by testing them with an external, calibrated, ground-fault simulator.

**End of Section**