

- F. Fuses are not required on the secondary of a single phase 2-wire or three phase, three wire, delta-delta transformer to provide conductor protection where all of the following are met:
1. The transformer is protected in accordance with 450.3.
 2. The overcurrent protective device on the primary of the transformer does not exceed the ampacity of the secondary conductor multiplied by the secondary to primary voltage ratio. [240.21 (C)(1)]. Selecting the next higher standard size overcurrent protective device is NOT allowed.
- G. Fuses are not required on the secondary of a transformer to provide conductor protection where all of the following are met:
1. The secondary conductors are not over 10 feet long.
 2. The secondary conductors' ampacity is not less than the combined computed loads.
 3. The secondary conductor ampacity is not less than the rating of the device they supply or the rating of the overcurrent device at their termination. Selecting the next higher standard size overcurrent protective device is NOT allowed.
 4. The secondary conductor ampacity is not less than $\frac{1}{2}$ of the rating of the overcurrent device protecting the primary of the transformer multiplied by the turns ratio.
 5. The secondary conductors do not extend beyond the enclosure(s) of the equipment they supply and they are enclosed in a raceway. [240.21(C)(2)]
- H. Transformer secondary conductors do not require fuses at the transformer terminals when all of the following conditions are met.
1. Must be an industrial location.
 2. Secondary conductors must not be more than 25 feet long.
 3. Secondary conductor ampacity must be at least equal to the secondary full-load current of transformer and sum of terminating, grouped, overcurrent devices. Selecting the next higher standard size overcurrent protective device is NOT allowed.
 4. Secondary conductors must be protected from physical damage in an approved raceway or other approved means. [240.21(C)(3)]

Note: Switchboard and panelboard protection (408.16) and transformer protection (450.3) must still be observed.

- I. Outside conductors that are tapped to a feeder or connected to the secondary terminals of a transformer do not require fuse protection when all of the following are met:
1. The conductors are protected from physical damage in an approved means.
 2. The conductors terminate in a single set of fuses, no larger than the ampacity of the conductors.
 3. The conductors are outside, except for point of load termination.
 4. The overcurrent device is near or a part of the disconnecting means.
 5. The disconnecting means is readily accessible outdoors or, if indoors, nearest the point of the entrance of the conductors or where installed inside per 230.6 nearest the point of conductor entrance. [240.21(C)(4)]

Branch Circuits—Lighting And/Or Appliance Load (No Motor Load)

The branch circuit rating shall be classified in accordance with the rating of the overcurrent protective device. Classifications for those branch circuits other than individual loads shall be: 15, 20, 30, 40, and 50A (210.3).

Branch circuit conductors must have an ampacity of the rating of the branch circuit and not less than the load to be served (210.19).

The minimum size branch circuit conductor that can be used is 14 AWG (210.19). For exceptions to minimum conductor size, see 210.19.

Branch circuit conductors and equipment must be protected by a fuse with an amp rating which conforms to 210.20. Basically, the branch circuit conductor and fuse must be sized for non-continuous load (as calculated per Article 220) plus 125% of the continuous load. The fuse size must not be greater than the conductor ampacity (for exceptions, see 210.20). Branch circuits rated 15, 20, 30, 40, and 50A with two or more outlets (other than receptacle circuits of 220.14(B) must be fused at their rating and the branch circuit conductor sized according to Table 210.24 (see 210.24).

Feeder Circuits (No Motor Load)

The feeder fuse amp rating and feeder conductor ampacity must be at least 100% of the non-continuous load plus 125% of the continuous load as calculated per Article 220. The feeder conductor must be protected by a fuse not greater than the conductor ampacity (for exceptions, see 240.3). Motor loads shall be computed in accordance with Article 430; see subsection on Motor Feeder Protection. For combination motor loads and other loads on feeders, see subsection on feeder combination motor, power, and lighting loads.

Service Equipment

Each ungrounded service entrance conductor shall have a fuse in series with a rating not higher than the ampacity of the conductor (for exceptions, see 230.90(A)). The service fuses shall be part of the service disconnecting means or be located immediately adjacent thereto (230.91).

Service disconnecting means can consist of one to six switches for each service (230.71) or for each set of service entrance conductors permitted in 230.2. When more than one switch is used, the switches must be grouped together (230.71).

Service equipment must have adequate short circuit ratings for the short-circuit currents available.

Transformer Secondary Conductors

Secondary conductors need to be protected from damage by the proper overcurrent protective device. Although 240.3(F) provides an exception for conductors supplied by a single phase transformer with a 2-wire secondary, or a three-phase delta-delta transformer with a 3-wire, single voltage secondary, it is recommended that these conductors be protected. Primary overcurrent devices cannot adequately provide protection during internal transformer faults.

Motor Circuit Conductor Protection

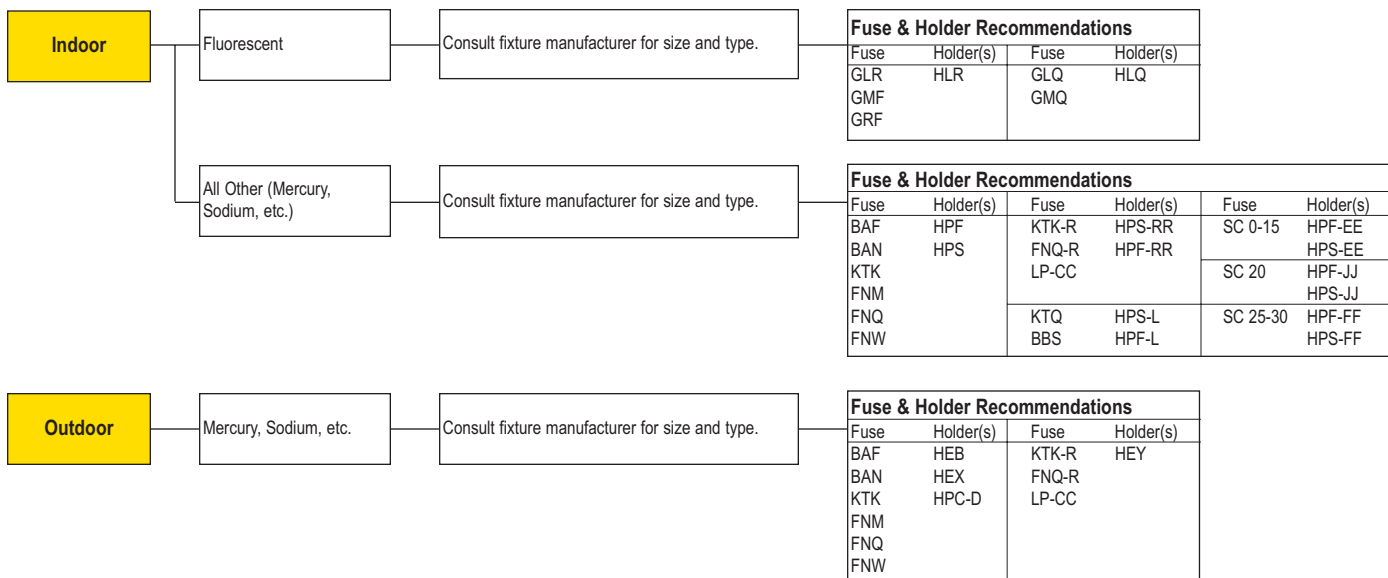
Motors and motor circuits have unique operating characteristics and circuit components and therefore must be dealt with differently than other type loads. Generally, two levels of overcurrent protection are required for motor branch circuits:

1. Overload protection—Motor running overload protection is intended to protect the system components and motor from damaging overload currents.
2. Short circuit protection (includes ground fault protection) – Short circuit protection is intended to protect the motor circuit components such as the conductors, switches, controllers, overload relays, etc. against short-circuit currents or grounds. This level of protection is commonly referred to as motor branch circuit protection.

Frequently, due to inherent limitations in various types of overcurrent devices for motor application, two or more separate protective devices are used to provide overload protection and short circuit protection. An exception is the dual-element fuse. For most motor applications, the beneficial features of dual-element fuse characteristic allow sizing of the Fusetron Class RK5 and Low-Peak Class RK1 fuses to provide both protection functions for motor circuits.

Fuse Diagnostic Sizing Charts

Ballasts



Capacitors (NEC® 460)

