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 1⁄10 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.

Electric Heat (NEC® 424)

Electric Space Heating

Size at 125% or next size larger but in no case larger than 60 amps for each subdivided load.

Electric Boilers with Resistance Type Immersion Heating Elements in an ASME Rated and Stamped Vessel

Size at 125% or next size larger but in no case larger than 150 amps for each subdivided load.

Fuse Recommendation

Volts	Fuse(s)
0-250	LPN-RK_SP FRN-R, NON
0-300	JJN
0-480	SC 25 to SC 60
0-600	LPS-RK_SP FRS-R, NOS
0-600	JJS
0-600	LPJ_SP, LP-CC FNQ-R, JKS, KTK-R, TCF, SC ½ to SC 20

Mains, Feeders, Branches

Feeder Circuits (600A & Less)

- No Motor Load: 100% of non-continuous load plus 125% of continuous load.

Fuse Recommendations

Volts	Fuse(s)
0-250	LPN-RK_SP, FRN-R
0-300	JJN
0-600	LPS-RK_SP, FRS-R
0-600	JJS
0-600	LPJ_SP, LP-CC JKS, KTK-R

- Combination Motor Loads and Other Loads: 150%* of the FLA of largest motor (if there are two or more motors of same size, one is considered to be the largest) plus the sum of all the FLA for all other motors plus 100% of non-continuous, non-motor load plus 125% of continuous, non-motor load.
- Motor Loads: 150%* of the FLA of largest motor (if there are two or more motors of same size, one is considered to be the largest) plus the sum of all the FLA for all other motors.

*A max. of 175% (or the next standard size if 175% does not correspond to a standard size) is allowed for all but wound rotor and all dc motors.

Fuse Recommendations

Volts	Fuse(s)
0-25O	LPN-RK_SP, FRN-R
0-600	LPS-RK_SP, FRS-R
0-600	LPJ- SP, LP-CC

Main, Branch & Feeder Circuits (601-6000A)

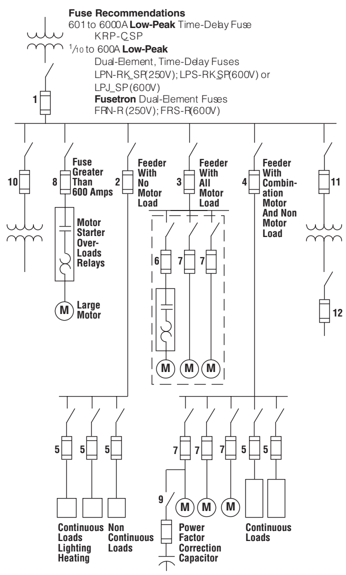
150% to 225% of full load current of largest motor plus 100% of full load current of all other motors plus 125% of continuous non-motor load plus 100% of non-continuous non-motor load.

Fuse Recommendation

Volts	Fuse(s)
0-600	KRP-C_SP

Building Electrical System

General guidelines are given for selecting fuse amp ratings for most circuits. Some specific applications may warrant other fuse sizing; in these cases the load characteristics and appropriate NEC® sections should be considered. The selections shown here are not, in all cases, the maximum or minimum amp ratings permitted by the NEC®. Demand factors as permitted per the NEC® are not included in these guidelines.



Dual-Element, Time-Delay Fuses (LPJ_SP, LPS-RK_SP, LPN-RK_SP, FRS-R, FRN-R and TCF)

1. **Main Service.** Size fuse according to method in 4.
2. **Feeder Circuit With No Motor Loads.** The fuse size must be at least 125% of the continuous load† plus **100%** of the non-continuous load. Do not size larger than ampacity of conductor*.
3. **Feeder Circuit With All Motor Loads.** Size the fuse at 150%N of the full load current of the largest motor plus the full-load current of all other motors∆.
4. **Feeder Circuit With Mixed Loads∆.** Size fuse at sum of:
   - **a. 150%**†† of the full-load current of the largest motor plus
   - **b. 100%** of the full-load current of all other motors plus
   - **c. 125%** of the continuous, non-motor load† plus
   - **d. 100%** of the non-continuous, non-motor load.
5. **Branch Circuit With No Motor Load.** The fuse size must be at least 125% of the continuous load† plus 100% of the non-continuous load. Do not size larger than ampacity of conductor*.
6. **Motor Branch Circuit With Overload Relays.** Where overload relays are sized for motor running overload protection, the following provide backup, ground fault, and short-circuit protection:
   - **a.** Size FRS-R and FRN-R, RK5, & LPS-RK_SP and LPN-RK_SP, RK1, fuses at **125% & 130%** of motor full-load current respectively or next higher size.
7. **Motor Branch Circuit With Fuse Protection Only.** Where the fuse is the only motor protection, the following FRS-R and FRN-R, Class RK5, fuses provide motor running overload protection and short-circuit protection:
   - **a. Motor 1.15 service factor or 40°C rise:** size the fuse at 110% to 125% of the motor full-load current.
   - **b. Motor less than 1.15 service factor or over 40°C rise:** size fuse at 100% to 115% of motor full-load current.
8. **Large Motor Branch Circuit. Fuse larger than 600 amps.** For large motors, size KRP-C_SP Low-Peak time-delay fuse at 175% to 300% of the motor full-load current, depending on the starting method; i.e. part-winding starting, reduced voltage starting, etc.
9. **Power Factor Correction Capacitors.** Size dual-element fuses as low as practical, typically 150% to 175% of capacitor rated current.
10. **Transformer Primary Fuse** (without secondary fuse protection). When transformer primary current is equal to or greater than 9 amps, the dual-element, time-delay fuse should be sized at 125% of transformer primary current or the next size larger. Note: Secondary conductors must be protected from overcurrent damage.
11. **Transformer Primary Fuse** (with secondary fuse protection). May be sized at **250%** of transformer primary current if,
12. **The secondary fuse is sized** at no more than **125%** of secondary full-load current. Note: Secondary conductors must be protected at their ampacities.

Non-Time-Delay and all Class CC Fuses (JKS, KTS-R, KTN-R, JJS, JJN, LP-CC, KTK-R, and FNQ-R)

1. **Main service.** Size fuse according to method in 4.
2. **Feeder Circuit With No Motor Loads.** The fuse size must be at least **125%** of the continuous load† plus **100%** of the non-continuous load. Do not size larger than the ampacity of the wire.
3. **Feeder Circuit With All Motor Loads.** Size the fuse at **300%** of the full-load current of the largest motor plus the full-load current of all other motors. Do not size fuse larger than the conductor capacity.
4. **Feeder Circuit With Mixed Loads.** Size fuse at sum of:
   - **a. 300%** of the full-load current of the largest motor plus
   - **b. 100%** of the full-load current of all other motors plus
   - **c. 125%** of the continuous, non-motor load† plus
   - **d. 100%** of the non-continuous, non-motor load.
5. **Branch Circuit With No Motor Loads.** The fuse size must be at least **125%** of the continuous load† plus **100%** of the non-continuous load. Do not size larger than the ampacity of conductor.*
6. **Motor Branch Circuit With Overload Relays.** Size the fuse as close to but not exceeding **300%** of the motor running full load current. Provides ground fault and short-circuit protection only.
7. **Motor Branch Circuit With Fuse Protection Only.** Non-time-delay fuses cannot be sized close enough to provide motor running overload protection. If sized for motor overload protection, non-time-delay fuses would open due to motor starting current. Use dual-element fuses.

Conductor Ampacity Selection

1. **Feeder Circuit And Main Circuit With Mixed Loads.** Conductor ampacity at least sum of:
   - **a. 125%** of continuous non-motor load plus
   - **b. 100%** of non-continuous non-motor load plus
   - **c. 125%** of the largest motor full-load current plus
   - **d. 100%** of all other motors' full-load current.
2. **Feeder Circuit With No Motor Load.** Conductor ampacity at least **125%** of the continuous load plus **100%** of the non-continuous load.
3. **Feeder Circuit With All Motor Loads.** Conductor ampacity at least **125%** of the largest motor full-load amps plus **100%** of all other motors' full-load amps.
4. **Feeder Circuit With Mixed Loads.** Size according to method 1 above.
5. **Branch Circuit With No Motor Load.** Conductor ampacity at least **125%** of the continuous load plus **100%** of the non-continuous load.

6, 7, & 8. Motor Branch Circuits. Conductor ampacity at least **125%** of the motor full-load current.

9. **Conductor ampacity at least 135% of capacitor rated current.** The ampacity of conductors for a capacitor connected to a motor circuit must be ⅓ the ampacity of the motor circuit conductors.

10, 11. Conductor ampacity minimum 125% of transformer full-load current.

12. Conductor ampacity per 1 above.

† 100% of the continuous load can be used rather than 125% when the switch and fuse are listed for 100% continuous operation. Most bolted pressure switches and high pressure contact switches 400A to 6000A with Class L fuses are listed for 100% continuous operation.
* Where conductor ampacity does not correspond to a standard fuse rating, next higher rating fuse is permitted when 800 amps or less [(240.3(B)].
∆ In many motor feeder applications dual-element fuses can be sized at ampacity of feeder conductors.
• Available short-circuit current and the clearing time of the overcurrent device must be considered so that the conductor's ICEA (P32.382) withstand rating is not exceeded.
†† NEC® allows a maximum of 175% or the next standard size if 175% does not correspond with a standard fuse size, for all but wound rotor and DC motors.