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Tech Spec



 A Newsletter for the Design Professional

Introduction:

One of the most fundamental and important aspects of overcurrent protection is the proper sizing and application of fuses per the NEC®. This article examines general guidelines for the sizing of fuses in the electrical distribution system. The selections shown here are not, in all cases, the maximum or minimum ampere ratings permitted by the NEC. Demand factors as permitted per the NEC are not included in these guidelines.

Time-Delay Fuse Sizing:

1. Service [NEC 230-90(a) & 230-42(a)] & Feeder Circuit (NEC 215-3, 430-62 & 430-63).

A. With No Motor Loads. The fuse size must be at least 125% of the continuous^① load plus 100% of the non-continuous load. Do not size fuse larger than the ampacity of the conductor^②.

B. With All Motor Loads. Size the fuse at 150%^③ of the full load current of the largest motor plus the full-load current of all other motors^④.

C. With Mixed Loads^④. Size fuse at sum of:

- a. 150%^③ of the full-load current of the largest motor
- b. 100% of the full-load current of all other motors
- c. 125% of the continuous, non-motor load^①
- d. 100% of the non-continuous, non-motor load

2. Branch Circuit with No Motor Load [NEC 210-20(a) & 384-16(d)]. The fuse size must be at least 125% of the continuous^① load plus 100% of the non-continuous load. Do not size larger than the ampacity of the conductor^②.

3. Motor Branch Circuit.

A. With Overload Relays (NEC 430-52 & Table 430-152). If overload relays are provided, the following provides branch-circuit, short-circuit and ground fault protection. Size Class RK5 (FRN-R/FRS-R), RK1 (LPN-RK/LPS-RK), and J (LPJ) fuses at 125%, 130%, and 150% of motor full-load current respectively or next higher standard size if these do not correspond to a standard fuse size.^③

B. Without Overload Relays (NEC 430-32).

- Where the fuse is the only motor overload protection, Class RK5 (FRN-R/FRS-R) fuses provide overload, branch-circuit, short-circuit and ground fault protection:
- a. Motor 1.15 service factor or 40°C rise: size the fuse at 110-125% of the motor nameplate full-load current.
 - b. Motor less than 1.15 service factor or over 40°C rise: size fuse at 100-115% of motor nameplate full-load current.

4. Large Motor Branch Circuit (NEC 430-52 & Table 430-152). Fuse larger than 600 amps. For large motors, size Class L (KRP-C) fuse at 175% to 300% of the motor full-load current, depending on the starting method.

5. Transformer (600V or Less) (NEC 450-3).

A. Without Secondary Protection: When transformer primary current is equal to or greater than 9 amperes, the time-delay fuse can be sized at 125% of the transformer primary current or the next standard size higher if 125% does not correspond to a standard fuse size.

B. With Secondary Protection: Primary fuse may be sized at 250% of transformer primary current if the secondary fuse is sized at no more than 125% of secondary full-load current (if secondary full-load current is 9 amperes or more).

Note: With A or B, secondary conductors must be protected at their ampacities. Compliance with 240-21 & 384-16 should also be verified.

Notes:

- ① 100% of the continuous load can be used rather than 125% when the switch and fuse are listed for 100% continuous operation. Most bolted pressure or high pressure contact switches, 400A to 6000A, with Class L fuses are listed for 100% continuous operation.
- ② Where conductor ampacity does not correspond to a standard fuse rating, next higher rating fuse, per 240-6 is permitted when 800 amperes or less [240-3(b)].
- ③ 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.
- ④ In many motor feeder applications dual-element fuses can be sized at ampacity of feeder conductors.

Conclusion:

Proper sizing of overcurrent protective devices can sometimes be a confusing topic. Hopefully, this will assist you with the proper protection of your distribution systems.

For more information, consult the Bussmann SPD, available at www.bussmann.com.

If you have any questions, contact Bussmann Application Engineering at (636) 527-1270, (636) 527-1607 (fax), or e-mail (fusetech@buss.com).