

# Proper Coordination Between Overload Relay and Branch Circuit Fuses Improves Motor Starter Protection

By Steve Hansen, Senior Field Engineer

NEC 430-51 requires short-circuit and ground-fault protection for motor branch circuits while NEC 430.31 addresses the protection of motors, motor-control apparatus, and motor branch circuit conductors against motor overloads and failure of the motor to start. Short circuit and ground-fault protection may be provided by fuses or by circuit breakers. Overload protection may be provided by overload relays, fuses, or by motor thermal protectors. The NEC includes exceptions for impedance-protected and intermittent duty motors.

This TIPS is not meant to be a dissertation on motor and motor branch protection. Its purpose is to explain how fuses and overload relays can best be coordinated to provide effective protection for across the line (full voltage) motor starting for circuits rated 600VAC and less. The recommended approach is to select and size the overload relay and fuses so that the overload relay trips before the fuses open on currents up to and including motor locked rotor current. The fuses are selected to open before the overload relay trips at currents exceeding motor locked rotor current. This approach provides a number of benefits.

Trouble shooting is expedited. If the overload relay operates an overload is indicated. If the fuses open, a fault is the likely cause. Fuse replacement related costs are minimized. The likelihood of motor single phasing is reduced. By using Class J or Class RK1 (current limiting) fuses circuit components passing fault current are less likely to experience significant damage thus safety is enhanced and downtime is reduced.

This selection approach is illustrated in the figure above. This figure shows the time current characteristics of a NEMA Class 20 overload relay and of a Class J time delay fuse. Typical starting current is shown for a 10HP motor at 460V. The rating of the Class J fuses is 20 amperes which is 143% of the motor full load current shown in NEC Table 430.250.

An alternative approach is to use the “Low Voltage Fuses for Motor Protection” tables found in the “Application Information” section of the Mersen Advisor. These tables have been proven through the years to provide coordinated short circuit and ground fault protection. If you consider using the minimum fuse sizing column, be sure to read the footnotes regarding coordination with NEMA Class 20 overload relays.

