Overload Protection

Overcurrents
An overcurrent exists when the normal load current for a circuit is exceeded. It can be in the form of an overload or short circuit. When applied to motor circuits an overload is any current, flowing within the normal circuit path, that is higher than the motor’s normal Full Load Amps (FLA). A short-circuit is an overcurrent which greatly exceeds the normal full load current of the circuit. Also, as its name infers, a short-circuit leaves the normal current carrying path of the circuit and takes a “short cut” around the load and back to the power source. Motors can be damaged by both types of currents.

Single-phasing, overworking and locked rotor conditions are just a few of the situations that can be protected against with the careful choice of protective devices. If left unprotected, motors will continue to operate even under abnormal conditions. The excessive current causes the motor to overheat, which in turn causes the motor winding insulation to deteriorate and ultimately fail. Good motor overload protection can greatly extend the useful life of a motor. Because of a motor’s characteristics, many common overcurrent devices actually offer limited or no protection.

Motor Starting Currents
When an AC motor is energized, a high inrush current occurs. Typically, during the initial half cycle, the inrush current is often higher than 20 times the normal full load current. After the first half-cycle the motor begins to rotate and the starting current subsides to 4 to 8 times the normal current for several seconds. As a motor reaches running speed, the current subsides to its normal running level. Typical motor starting characteristics are shown in Curve 1.

Fast Acting Fuses
To offer overload protection, a protective device, depending on its application and the motor’s Service Factor (SF), should be sized at 115% or less of motor FLA for 1.0 SF or 125% or less of motor FLA for 1.15 or greater SF. However, as shown in Curve 2, when fast-acting, non-time-delay fuses are sized to the recommended level the motors inrush will cause nuisance openings.

A fast-acting, non-time-delay fuse sized at 300% will allow the motor to start but sacrifices the overload protection of the motor. As shown by Curve 3 below, a sustained overload will damage the motor before the fuse can open.