CAUGHT UNPROTECTED?

A lack of high-speed fusing could undermine your plant's productivity.

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>> While many of today's industrial plants are using soft-starters and drives to reduce operating costs, there is considerable confusion about how to provide additional protection for these devices. This could leave many electronic motor controllers vulnerable to failures.

Unfortunately, not all end users recognize the benefit of using high-speed fuse protection, and no single, standard approach can properly protect every motor controller. But there are ways to properly coordinate the choice of the high-speed fuse that you want with the electronic motor controller you have.

In the past, all soft-starters and drives incorporated internal high-speed fusing. As these devices have gotten smaller, however, many manufacturers of medium- to low-power (200HP and below) motor controllers have eliminated internal fusing and only "type test" these soft-starters and drives with branch circuit protection.

For soft-starters and drives without internal fusing, the National Electrical Code requires that you establish standard branch circuit protection using a UL 248-listed fuse or UL 489-listed circuit breaker. This provides a level of protection that is intended to protect the conductors from damage or fire. If high-speed protection is not present, however—inside or outside the device—neither a standard fuse nor circuit breaker can adequately protect the electronic motor controller.

To prevent unnecessary damage, you must confirm that your component includes high-speed fusing at the time of installation. If it does not, follow the recommendation included in the manufacturer's specification sheet.

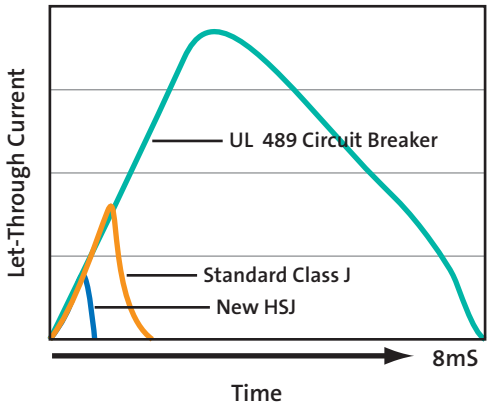
The primary switching devices in soft-starters are silicon-controlled rectifiers (SCRs) or gate turn-off thyristors (GTOs). These devices make the soft-starters susceptible to overcurrent-induced failures. If a short circuit occurs, the increase in current will exceed the energy capabilities of the SCR/GTO.

Although most soft-starters will shut down in a half cycle (approximately 8 ms), the high amounts of energy generated within that half cycle can destroy sensitive internal components. You may not be able to detect any visible damage, but the failure could propagate to feeder wires and the circuit's weakest components, causing a cascade of unwanted downtime and repairs.

To properly protect soft-starters, first determine if the component includes internal high-speed protection. If it doesn't, select a high-speed fuse according to the soft-starter's operating parameters, which include: the application's maximum inrush current and duration, the motor's full-load current (FLA) and the duty cycle (number of starts and stops) of the controller.

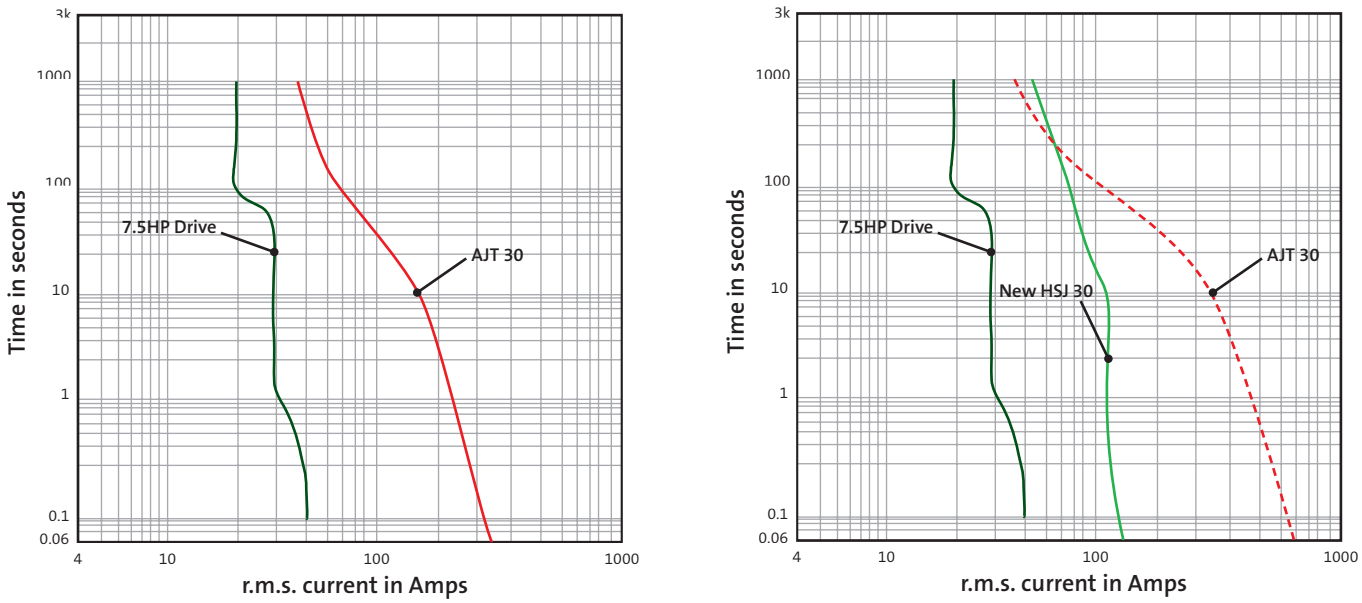
Many of today's drives use insulated gate bipolar transistor (IGBT) technology as the base switching device. IGBTs have a lower energy capacity than SCRs and GTOs, and they are particularly susceptible to overvoltage-induced failures. Due to

>> Let-Through Current During Short Circuit



Compared to fuses, circuit breakers do very little to limit the let-through energy (I2t) of a fault condition, which can lead to extensive damage.

>> 7.5HP Drive Start-Up and Standard Class J Time Delay Melt Curves



The graph on the left describes the start-up characteristics of a 7.5HP drive as it relates to the melting times of a standard time-delay Class J fuse. It illustrates that the current required to clear the fuse is far greater than the actual current needed to meet the drive's operating requirements. The graph on the right shows how the melting characteristics of the HSJ fuse are closer to the current requirements of the drive, providing short-circuit protection while lowering the possibility of nuisance openings.

the explosive consequences of IGBT case ruptures, most drives rated 200HP or above include internal high-speed fuse protection along with electronically controlled protection. But most medium- to low-power drives have only electronically controlled protection.

Internal electronics that shut down the system in the event of a fault find their effectiveness degraded over time by transient voltages. If high-speed fuse protection is not present, and the internal electronics do not operate effectively, the IGBT could have a shoot-through (fault). This could cause case rupture of the IGBT, which would expel gases and particles that could propagate failure to surrounding equipment and rack up significant costs in downtime, repairs and component replacement.

The high-speed fuse should be selected according to the performance characteristics of the drive and the motor's start-up requirements, load requirements and horsepower rating. Protection is based upon the maximum cable feed ampacity to the controller, but this cannot protect the controller itself. In the end, many of these devices are needlessly scrapped.

Ferraz Shawmut has developed the High-Speed Class J (HSJ) fuse specifically for the operating characteristics of electronic motor controllers. With a single fuse and existing blocks and holders, you can meet NEC requirements and protect soft-starters and drives from unnecessary damage. Listed to UL 248-8, the HSJ incorporates the high-speed performance and low let-through energy (I2t) of semiconductor fuses with the overload capacity and physical dimensions of a standard Class J fuse.

To really reap the benefits of electronic motor controllers, consider protecting your soft-starters and drives with a properly coordinated high-speed fuse. Without it, your potential for reduced operating costs could be undermined by unnecessary downtime. ABJ

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