sprecher+schuh

CEP7 Solid State Overload Relay
Trip Class Selection &
“Hot” Trip Curve vs. “Cold” Trip Curve




At what time is it considered a cold start? . . . or, a hot start? What is the necessary cool down time for a hot trip?

Overload Trip Class Selections

The design and UL testing of overload relays is based on motors designed for 6 x FLA. UL508 and NEC define three points of the time current curve for overload relays as follows:
Reference NEC 430-32
1) 1.25 x FLA (for 1.15 SF motors) will trip (time not specified)
or 1.15 x FLA (for 1.0 SF motors) will trip (time not specified)
Reference UL508
2) 2 x FLA trip in less than 8 minutes
3) 6 x FLA (LRA) less than 20 seconds

T-frame motor applications typically have acceleration times of less than 5 seconds and are best protected by Class 10 overload relays (see Figure 2). Class 10 is defined as tripping in less than 10 seconds under locked rotor conditions (6 x FLA). A motor with long acceleration times (greater than 7 seconds) requires Class 15 or 20 and in rare cases Class 30 trip response curves (see Figure 3-5). Applications that involve long acceleration times include, but are not limited to centrifuges, punch presses, turbines, and large fans powered by small motors.

High efficiency motors with less FLA and greater inrush (LRA) will cause an overload relay to trip faster under locked rotor based on the time current curve but typical applications should not cause a problem. Long acceleration times added to increased inrush values of premium efficiency motors will accelerate early tripping due to the nature of the overload relay time current curve (see Figure 1).

CEP7-EE__ overload relays have dip switches which are field adjustable to determine the trip class which best suits the application.

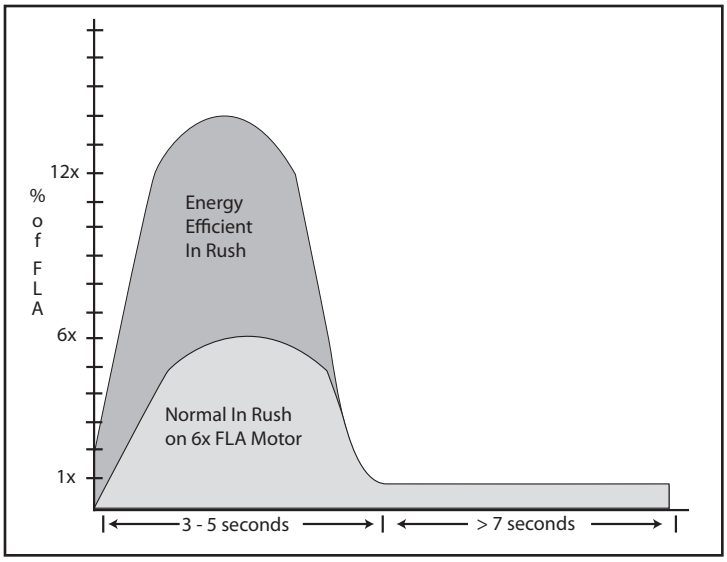

Figure 1: Typical Motor Inrush

Time Current Curves

Testing of overload relays is based on tripping times from cold (room ambient) start conditions and hot start conditions as this relates directly to the time/current curves issued by Sprecher + Schuh. In the following, you will find representation of the four trip class ranges –

- Trip Class 10
- Trip Class 15
- Trip Class 20
- Trip Class 30

Trip Curve Legend
Cold trip ———
Hot trip - - - - - - -

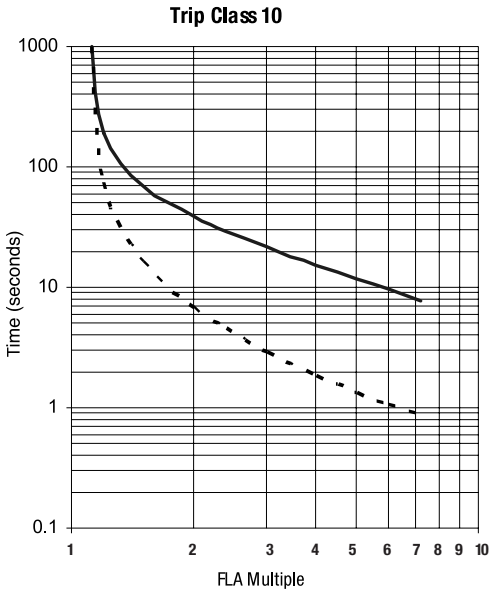

Figure 2: Trip Class 10

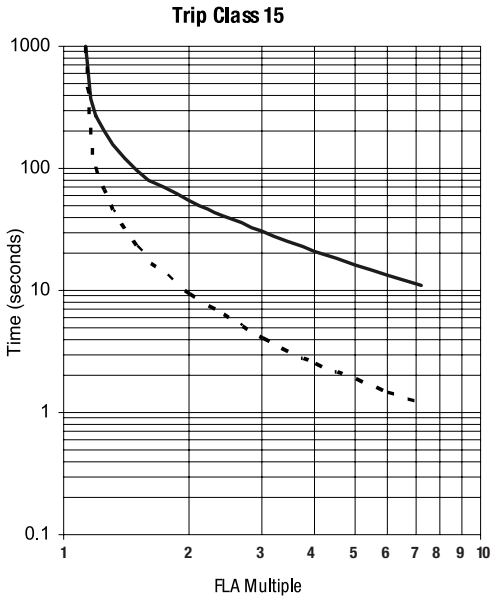

Figure 3: Trip Class 15

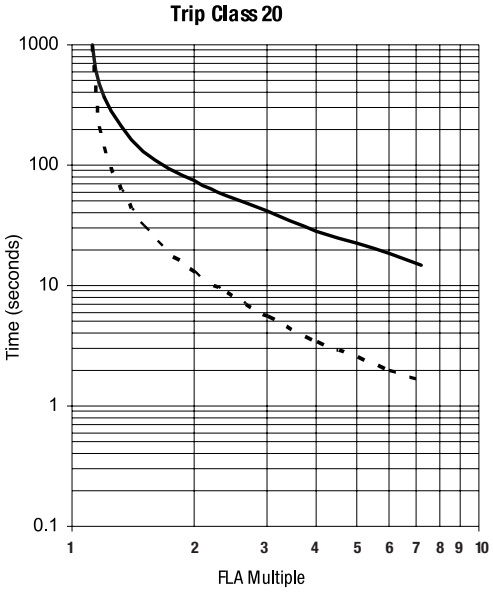

Figure 4: Trip Class 20

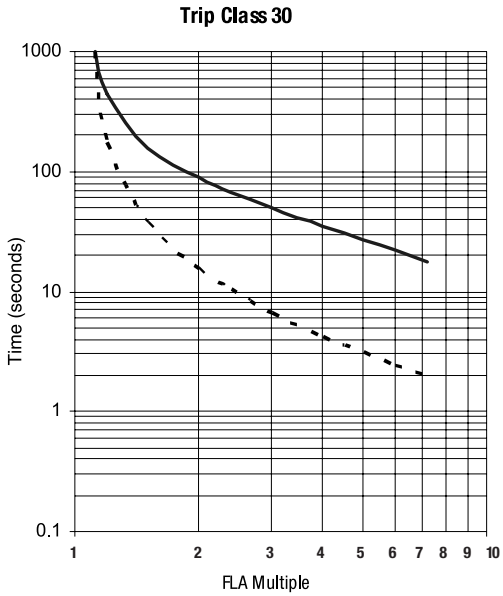

Figure 5: Trip Class 30

Hot Start vs. Cold Start

The dotted line curves shown in Figures 2-5 are the Hot Trip Curve. In a 3-phase induction motor, particularly the larger units, hot start and cold start refer to the temperature of the motor when starting. A hot start is considered a time that a motor has been restarted in less than 30 minutes from the previous start or after an overload condition has been experienced.

The CEP7 has a resistor/capacitor (R-C) circuit which charges the amount of current that it sees being drawn compared to the current setting on the dial. This is “modeling” the heating of the motor windings. If the overload trips on an overload condition, you will not be able to perform a Manual Reset until the motor has “cooled” for approximately 120 seconds. This is the time that the RC circuit is slowly bleeding off the accumulated current. At approximately 120 seconds it is the equivalent of the motor being at 75% of its TCU (Thermal Current Usage), which is a safe level to do a restart. The longer you wait before restarting, the closer you get to the cold start curve. If the overload is set for Auto Reset, it will reset automatically after approximately 120 seconds. Note – the 120 seconds is an approximate time depending on the level of current the overload was seeing when it was tripped.

A cold start is an initial start or when a motor has not been ran for at least 30 minutes. At that point the RC circuit has totally bled off all of its charge. This is the time it takes to account for the temperature in the motor windings.

Understanding the aspects of a hot start is important because there is usually a limit on the number of hot starts that are allowed in a certain period of time. This is due to the fact that motors pull more current starting (inrush = 6 x FLA) than when they run (FLA), and if you start them too often they can overheat.

CEP7 Cool-Down Time

It has previously been stated that after 120 seconds, it is safe to perform a restart after resetting the overload. From the motor’s viewpoint, it takes at least 30 minutes for the motor windings to return to the state of a cold start. However – from the perspective of the CEP7 overload and the below cool-down curve, it takes approximately 600 seconds (or 10 minutes) that the parameters return to the cold trip curve (Figure 6).

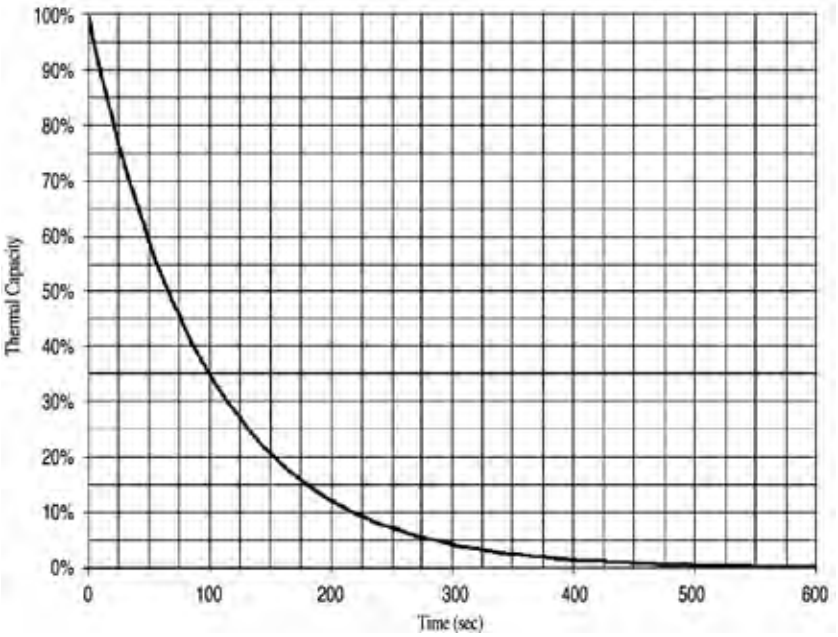

Figure 6: CEP7 Cool-down curve

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Technical Paper

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Sprecher + Schuh has provided reliable control and protection solutions for its customers since 1903.

Today, Sprecher + Schuh offers a wide range of low-voltage industrial control products, including contactors, a variety of relays, starters, push buttons, switches, terminals and controllers, to name a few. All of our products are crafted with precision and tested rigorously for performance — far exceeding industry standards. Moving forward, we continue along the path of constantly seeking innovative ways to provide solutions for our customers. It is by this philosophy that Sprecher + Schuh has come to be the industrial control manufacturer of choice for many customers around the globe seeking quality, reliability, and a name they can trust.

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