



## *Cyclic Motor Load Case Study With SEL-749M*

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### **INTRODUCTION**

U.S. Steel, Minntac, in northern Minnesota has used microprocessor based motor protection relays since the early 1990s. In spring 2006, Pro-Tech Power Sales, Inc., met with the U.S. Steel Electrical Coordinator about the performance of the existing motor protection relays.

The Electrical Coordinator reported that in the heavy rock-crushing area, the relays “were tripping four or five times per shift, up to once per hour in some cases.” These trips caused disruption to the flow of material to other parts of the plant. There are over forty crushers at the facility all powered by 350-horsepower motors.

### **PROBLEM**

Pro-Tech Power Sales, Inc. offered to install a demo SEL-749M Motor Relay with an SEL-2600A RTD Module as a trial unit, which U.S. Steel accepted. The motor data supplied by U.S. Steel were sent to SEL engineers for a recommendation on settings. In addition to the protection settings recommended, a 64-cycle event report length setting was selected due to the cyclic loading known to occur on the motors.

### **SEL SOLUTION(S)**

SEL motor relays utilize a thermal model based on first order differential equations for heat rise in a conductor that calculates temperature rise in real time. The thermal model assures that the relay will not trip for steady or cyclic overloads until the motor’s thermal limit is exceeded.

The SEL-749M was installed at U.S. Steel on April 10 and has operated since installation “without any false operations,” per the U.S. Steel Electrical Coordinator. They have had multiple starts and significant variations in motor loading. The unloaded current level is around 30 A, sometimes jumping up to 60 A when a large rock is being crushed. The SEL-749M Thermal Model properly tracks heating in the motor and has saved significant down time for this crusher motor application.

In Figure 1, a 64-cycle event report was manually triggered just as a rock was being delivered to the crusher. The event was retrieved from the SEL-749M and the current oscillography was plotted using ACCELERATOR<sup>®</sup> Analytic Assistant SEL-5601 Software. In this event, it can be seen that the unloaded motor load is just below 30 A, and there were three oscillations in just a 60-cycle window.

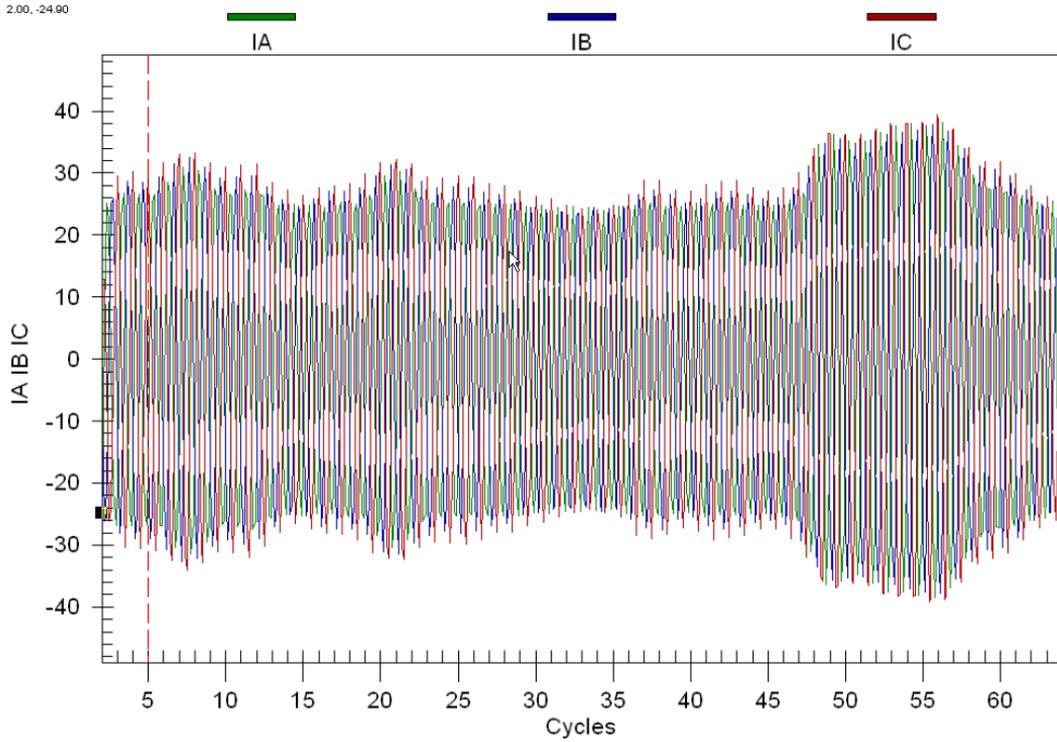


Figure 1 Current Oscillations on Crusher Motor

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