Technical Notes TN0003-01

POWER FACTOR CAPACITORS ON SOFT STARTERS

When using power factor correction capacitors with a soft starter the capacitors must be connected into the circuit before the starter. It is recommended that the UTS (Up-To-Speed) contact on the soft starter be used with a contactor so the capacitors are switched into the circuit whenever the motor is running at full speed.

The capacitors can not be connected to the starter at any point after the SCRs. If this is done it will result in damage to the SCRs. This is a result of the incompatibility of the voltage waveform that the starter produces on the motor terminals while starting and the inherent characteristics of power factor capacitors.

Figure 1 is a drawing of the waveform that would be seen on the motor terminals during one point in the ramp cycle. The voltage waveform looks like this because the SCRs are controlled in such a way as to only allow a portion of the input voltage to reach the motor. The sharp rising voltage transitions are produced when the SCRs are turned on. A capacitor acts like a short circuit to any sharp voltage transition so every time one of the SCRs turns on it has to do so while providing current to what is essentially a short circuit. The device may fail because the rate of change of current (di/dt) in the device while turning on may be greater than the device's rated di/dt.

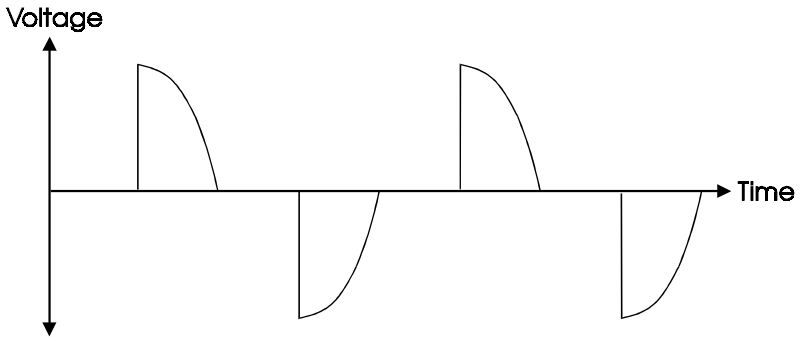

Figure 1: Voltage Waveform During Starting

When using power factor correction capacitors on soft starters, the connection of the power factor capacitor (contactor) must be on the line side of the CTs (Current Transformers). The standard Benshaw procedure is to install the CTs on the load side of the soft starter. If the CTs are installed ahead of the power factor capacitor connection, the soft starter will be monitoring the corrected line current, which will be lower than the actual motor current. Because of this lower current measurement, the built-in overload will not be able to protect the motor properly. This could result in motor damage.