



BEWARE OF PHASE CONTROL INTO RESISTIVE LOADS

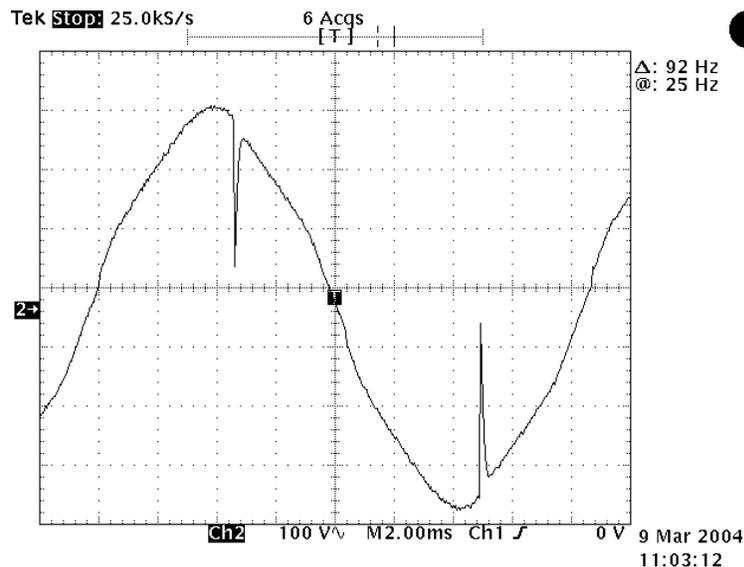
Nichrome type heaters should be controlled with a zero cross type of power control to reduce the electrical noise generated, and to insure that the power factor is high.

Tungsten and other heaters with a high resistance change, (cold to hot), need to be controlled by phase angle control so that they can be powered slowly (soft start) to allow a gradual resistance change.

Phase control into resistive loads can cause several problems.

- **Electrical noise.** The fast turn on of phase control produces harmonics that can cause problems with sensitive equipment, and reduce heater life.
- **Power Factor Concerns.** The delayed turn on causes the current to be behind the voltage, which results in a reduced power factor. This can cause reduced voltage levels in the plant, and causes increased electricity cost.
- **DI/DT.** The rapid turn, on inside the sine wave, causes very high DV/DT (delta voltage/delta time) ratios. Without any circuit inductance wired after the power control, the amperes per microsecond rating of the SCRs could be exceeded, causing premature failure. This can also put voltage notches in the sine wave that can confuse the zero cross detector.

The normal failure mode is nuisance power shut downs. The control will soft start to approximately 30% power, detect an extra zero cross pulse, shut down, then restart.



Scope picture



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These problems are usually worse in a small plant where the heating load is a large percentage of the power available to the building. Operating from a generator may also be a problem.

There are several ways to correct or eliminate this problem.

- Add inductors between the power control and the heater. This will reduce the DI/DT , and reduce the voltage notches in the sine wave. Adding inductors also increases heater life.
- Use “Power Factor correction capacitors” ahead of the power control to stiffen the line, fill the voltage notches in the sine wave and improve the power factor.
- Reconnect the system to a stiffer (lower impedance) power source.
- Make sure that all connections are tight and the wire size is adequate.