



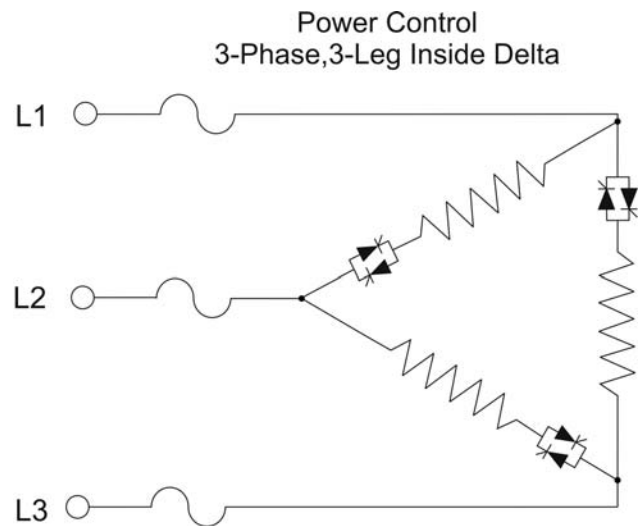
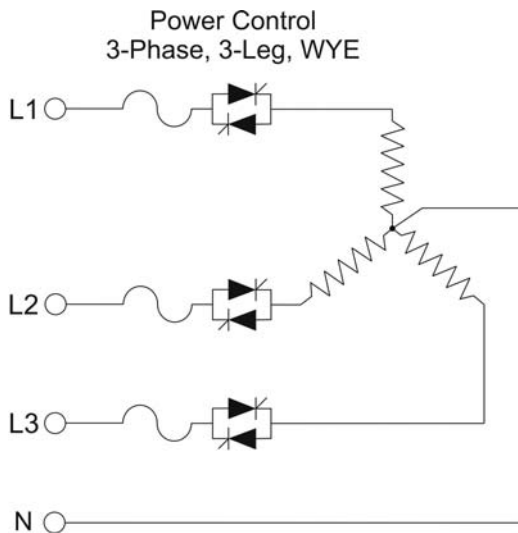
## Choosing Two-LEG vs Three-LEG Control for 3-phase applications

### THE ANSWER IS IN THE HEATER

Customers who wish to control three phase heaters require power controllers. How do you decide which method of control to select? 'Two-leg versus three-leg control' and 'zero cross versus phase-angle control need to be considered.' The following will help you decide when each method is appropriate.

Switching all three legs of a heater load is only necessary for the following:

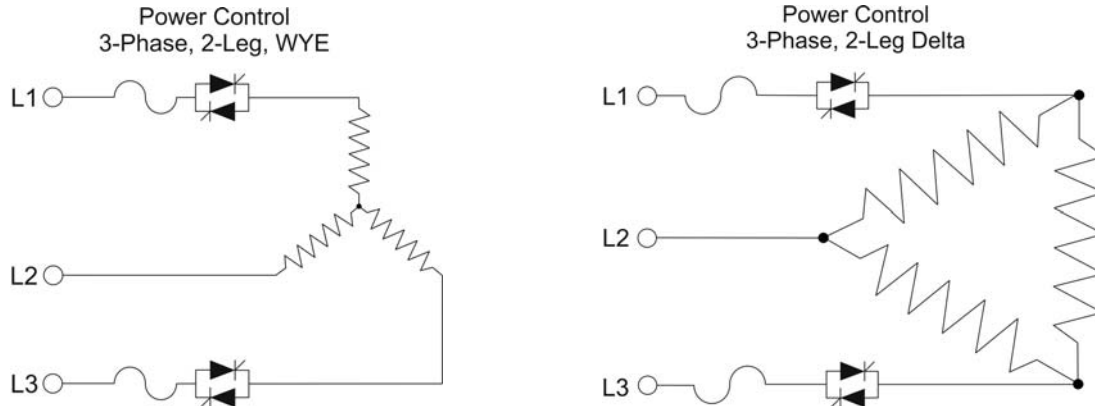
- Grounded 'Y' heater: Each phase controls to neutral. Grounded heaters have 4 wires attached. The center of the 'Y' heater is connected to the neutral of the power distribution system.
- Inside Delta: A pair of SCR's controls each heater in the delta. Open delta heaters have six wires attached or are three single-phase heaters wired in an open delta arrangement.
- Three phase, phase angle-controlled loads: Phase angle control requires that all three legs be switched. Phase-control should be selected for non-linear load devices such as tungsten heaters, moly heaters, primary of transformers or other inductive loads. Also, if any current limiting feature is required, phase angle control must be selected.
- Heater Bake Out feature: Requires phase control to limit current through a heater. Heater bakeout is a function of the Watlow Power Series where the current is limited through a heater to drive the moisture from the insulation of the heater. Once the moisture is removed, the heater may be operated in phase-angle or zero cross control.





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When zero cross control is selected for an ungrounded heater, it is better to switch only two legs.



Several reasons are:

- **ELECTRICAL NOISE** - The load turns on when the AC is at zero cross without clipping of the first AC waveform. Since no two phases of three phase systems ever cross zero volts at the same time, the load cannot turn on at the zero voltage crossing without a return path which results in a clipping of the sine wave at turn-on resulting in generated harmonics. Consequently, a two-leg unit produces less electrical noise.
- **HEAT** - A three phase two-leg unit, will produce 1/3 less heat in the enclosure than a three-leg power control. An SCR dissipates approximately 1.2 watts per ampere passing through the device. A three-leg device controlling 30 amperes dissipates 108 watts versus a two-leg device controlling the same load dissipates 72 watts.
- **COST** - A three phase two-leg unit costs less to buy than a three-leg unit. In addition, semiconductor fuses are used only in controlled legs. Two semiconductor fuses with holders cost 1/3 less than three semiconductor fuses with holders.
- **SAFETY** - A three leg (6 SCR) power control is an illusion of safety. A three pole mechanical contactor meets the definition of a disconnect. Disconnects provides for a positive mechanical break on all hot legs simultaneously). An SCR is not a mechanical break device. The National Electrical Code requires a disconnect ahead of any SCR power control.