

# Spang Power Electronics

## PROJECT PROFILE



**Spang Power Electronics** designed and manufactured seven 50 KVA silicon carbide power supplies for Lindberg/MPH in Riverside, MI. Each system consists of six (6) phase-angle fired SCR power controllers and a three phase transformer with six (6) secondary taps for precise load matching. These systems precisely control power to silicon carbide elements and maximize its useful life.

The silicon carbide elements are used in holding furnaces for an aluminum die casting application to produce cast aluminum wheels for the automotive industry.

### System Operation

In each system, two SCRs are located back to back on each phase of the transformer primary and provide stepless control over the coarse tap ranges of the transformer. The phase angle firing of the SCRs precisely modulates power by varying the conduction period of each

half cycle of a full AC sine wave, resulting in a smooth, almost continuous output. This eliminates thermal shock by minimizing temperature fluctuations in the load and preventing element damage. SPANG Silicon Carbide Power Centers continually monitor the actual RMS heating current in order to automatically limit high draw as the element heats-up and the resistance drops. This prevents the build-up of stress to the elements that can reduce their life.

The number of secondary taps is chosen to optimize efficiency, power factor and equipment utilization. In these systems, there are six (6) taps on the transformer secondary. These taps range from a nominal voltage, for a new element, to twice the nominal voltage for older elements. The SCRs reduce the transformer secondary voltage to the value of the next lower tap while delivering full power. This is done by reducing the transformer primary by the same percentage that the taps are apart. As the number of secondary taps increases, the power factor approaches unity.

### Silicon Carbide Elements

The resistance of silicon carbide elements changes with both temperature and age. As the temperature of the elements increases from room to operating temperature, its resistance decreases by as much as 20%, causing

## 50 KVA Silicon Carbide Power Supplies for Lindberg/MPH

high current draw. During this heat-up period, the electrical loading produced can exceed the wattage capacity of the elements, resulting in a build-up that can damage and reduce the life of the elements.

When the operating temperature reaches about 1200°F, the resistance of the elements begins to increase. Its resistance also increases as the elements age. Over the life of the element, the resistance may increase by as much as four times. In order to maintain a constant temperature, the elements require higher voltages.