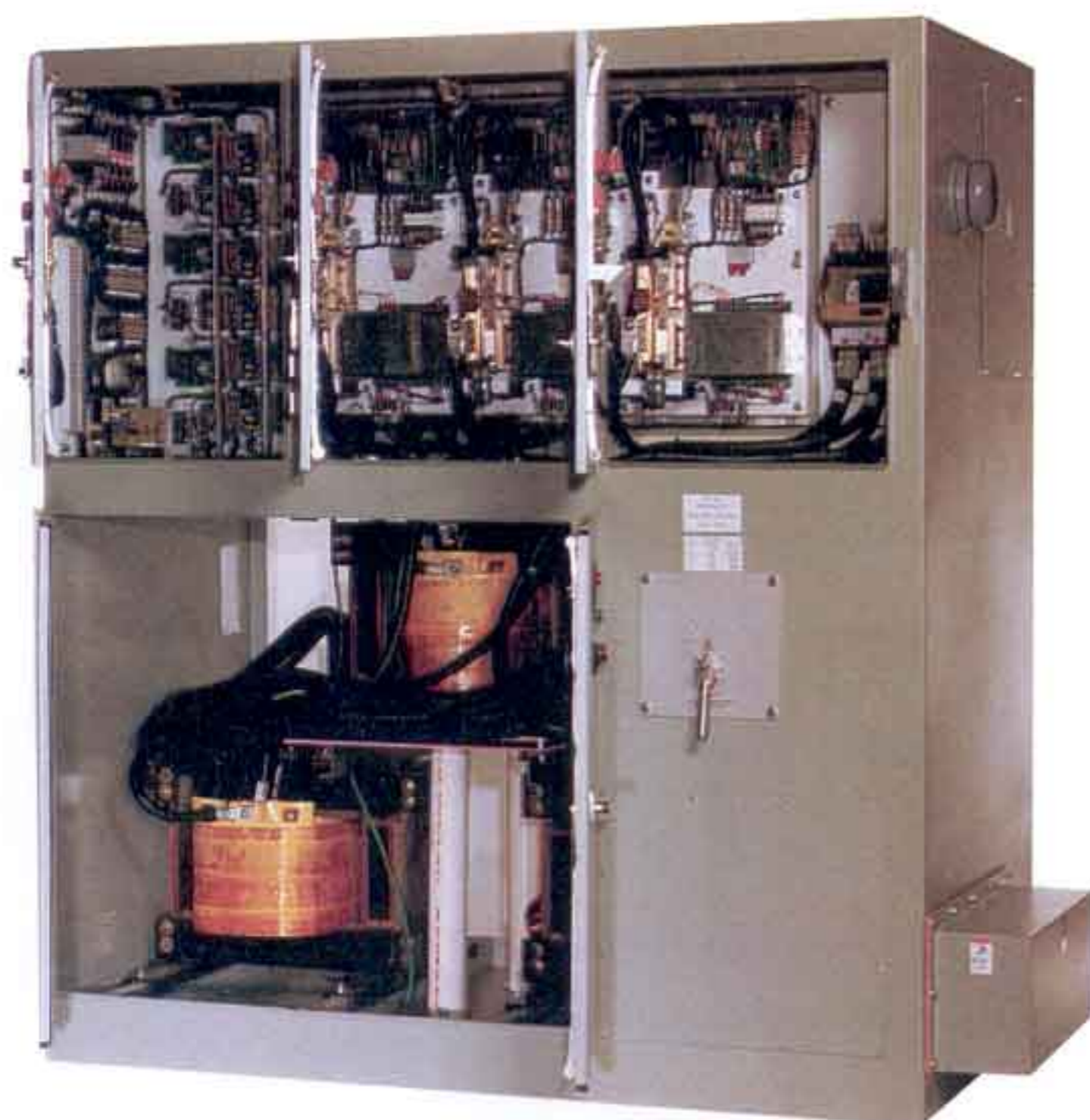


PROJECT PROFILE



Spang Power Electronics designed and manufactured a three zone, "phase controllable" power center for the Ferro Corporation's Electronic and Specialty Glass Group in Cleveland, OH. This power center is being used in a direct glass melting application for the manufacture of high lead and zinc content specialty glass.

This system contains an input circuit breaker; three (3) single phase, phase angle fired SCR power controllers; three (3) single phase isolation transformers with six position, no load, secondary tap switches; an air-to-water heat exchanger; and various meters and controls. Each zone is capable of delivering 150 kw. The entire system is housed in a NEMA 12 enclosure.

System Operation

The input circuit breaker serves as the main disconnect. The power control units regulate the incoming power to the transformer. The transformer isolates the line from the load and steps down the 480 volt input. Full power secondary taps are provided from 75 to 550 volts. The secondary of the transformers are connected in a wye formation to create a "phase controllable" three-phase, four wire output to the glass

melter. Each phase of the wye is capable of delivering zero to full power independent of the status of the other phases. The air-to-water heat exchanger provides cooling to the NEMA 12 unit by blowing the hot internal air through the water cooled heat exchanger and then over the system components.

The Direct Melt Process

The raw materials are poured into a water-cooled copper pan. Three electrodes and one neutral are located on the bottom of the pan. These electrodes are connected directly to the output of the power supply. In a direct glass melt application, the resistance of the glass is used as the heating element. The melting process is initiated by applying heat, with a torch, between an individual electrode and the neutral. Once the raw materials begin to melt and become more conductive, one phase of the system begins delivering power to the electrode. Current flows from the electrode to the neutral and continues the melting process. This initial melting process is then repeated for the other two electrodes. Once all three electrodes are operating, they are simultaneously brought up to the optimum power level to complete the melting

Three Zone Glass Melt Power Supply for Ferro Corporation

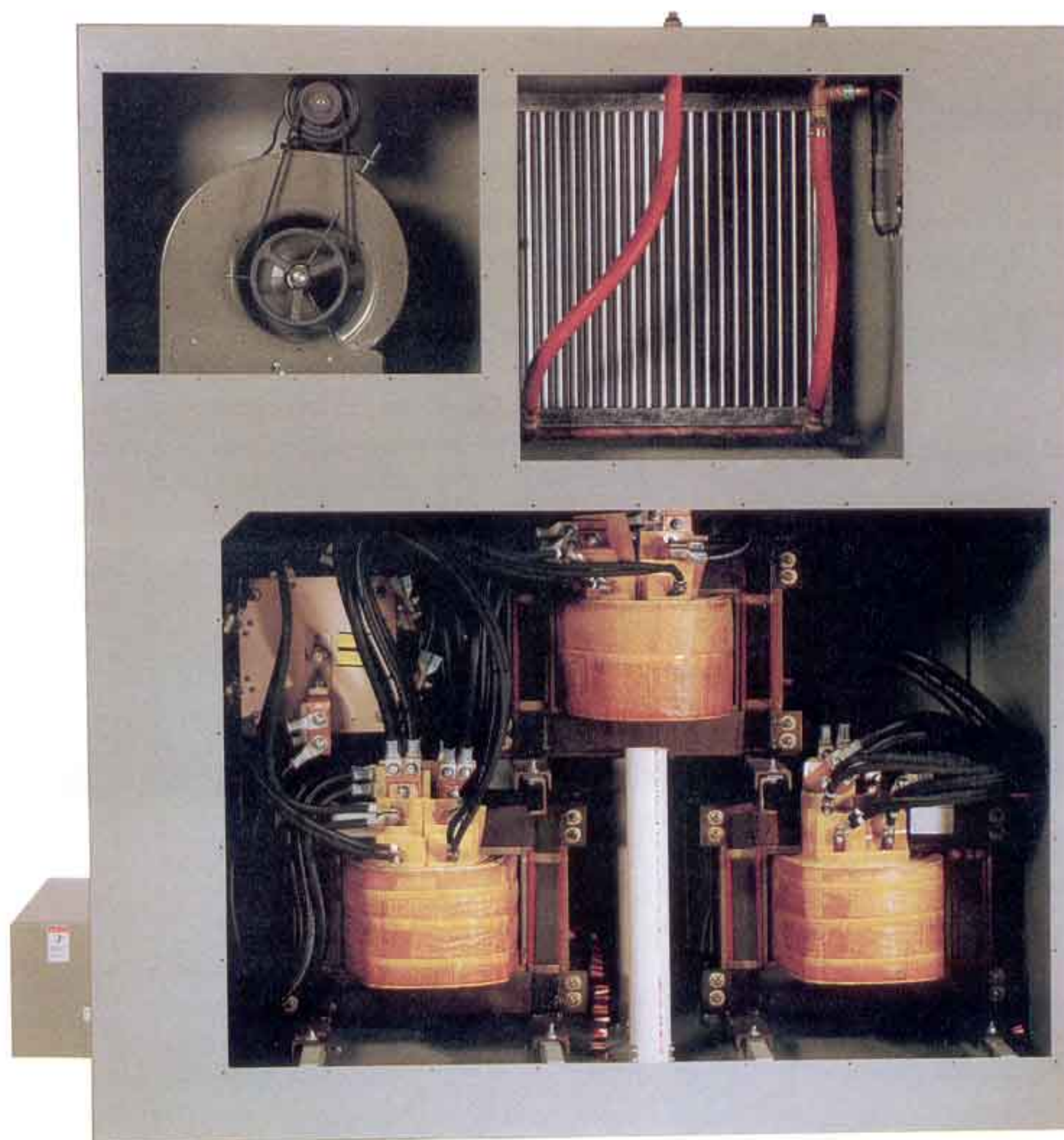
process. When the raw materials are completely converted into molten glass, they are released through small holes located on the bottom of the pan.

The power center provides isolation from the power source and steps the source down to the required process voltage. This level is determined by the electrode spacing and glass resistivity. Maintaining the proper voltage level prevents degradation of the glass quality. Because of the multi-tapped transformer secondary and tap switch, the power supply can easily be set to melt many different varieties of glass.

Prevents Downtime and Eliminates Product Waste

A unique feature of this system is single phase overcurrent shutdown (OCS). Occasionally, when the power is turned on, the current will arc from the electrode, through the torch head and then to the neutral. This results in an overcurrent condition. When this occurs, the OCS feature shuts down the individual phase and then ramps back on. In most cases, the condition clears and the phase operates

as if nothing happened. However, if the condition does not clear, the individual phase will shutdown and require manual reset. During this entire procedure, the other two phases continue the melting process, thereby decreasing the chances of delaying production and wasting product due to premature solidification. This protection is present on all three phases of the system at all times.



Rear View – Transformers and Air-to-Water Heat Exchanger