**Eclipse Product:** ThermJet Burners

**Submitted by:** Jim Whitted, Eclipse Great Lakes Regional Office

**Application:** Pulse Fired Roller Hearth Furnace

**Description:**

H-A Industries, located in Hammond, Indiana, was founded in 1993. It is a state-of-the-art, value-added processing division for Castle Metals. Since their inception, they have spent millions of dollars on leading-edge processing equipment to insure the highest quality of carbon and alloy bar products and offer cost savings solutions for their customers. H-A Industries currently has two single bar quench and temper lines that will handle bars from 3/4” diameter through 12” diameter, two roller hearth furnaces to anneal, normalize, normalize and temper or stress relieve in bar sizes 1/2” diameter through 16” diameter. In addition to their world class thermal processing capabilities, H-A Industries also has three high speed turn and polishing lines for bar sizes 9/16” diameter through 6-1/4” diameter and four grinders to provide their customers with exacting size requirements.

One of the roller hearth furnaces was designed for indirect firing, a type of operation no longer in high demand. Frequent maintenance and down time coupled with the high cost of radiant tube replacement and high fuel consumption, forced H-A Industries to review the furnace operation and to reevaluate the combustion system. To assist in this evaluation, H-A contracted Armil/CFS, Inc. Armil/CFS, Inc. located in South Holland, Illinois, is an OEM for high temperature process equipment. Their in house capabilities include combustion and control engineering, refractory design and field installation. The decision to retrofit the combustion and controls to a direct fired design with pulse firing offered the efficiency and paybacks to meet H-A’s goals and budget. The existing radiant tube burners were replaced with Eclipse ThermJet high velocity burners. The overall result was increased furnace efficiency, reduced fuel consumption, and a dramatic decrease in maintenance and down time.
Due to the plant layout and existing cat walks and traffic patterns, the low mounted burners were located on the drive side of the furnace.

The new furnace configuration has ten zones with a total of 34 Eclipse ThermJet model TJ040 burners. The first four zones contain a total of 22 burners positioned over and under the load. The burners are fired with a high/low pulse firing system. Thermal input is adjusted by the cycling of multiple burners within each zone from high to low fire for controlled periods of time. Zone 4, the first cooling zone, has two burners positioned over and under the load. Operation is high/off pulse firing. In cooling mode, full air (no fuel) passes through the burners. Four additional cooling air ports were provided. Zones 5, 6, 7, 8 and 9 make up the balance of the cooling zones. Each zone has two ThermJets positioned over and under. Operation is high/off pulse fired and in cooling mode full air (no fuel) passes through the burners.

Temperature, logic and safeguard circuits were designed to provide personnel and equipment protection as outlined in NFPA 86 (Standard for Ovens and Furnaces) and NFPA 70 (NEC). The existing PLC, PanelMate operator interface and control panels were modified to incorporate the new combustion system. A freestanding NEMA 12 enclosure was provided for flame supervision and pulse firing controls. An Allen-Bradley programmable logic controller is used to take the temperature PID loop signal from the existing PLC and sequence the pulsing of the burners.

A flame supervision network for the 34 burners provided pre-ignition purge and ignition trial timers. It features a fully modular design for ease of maintenance and self checking circuitry for optimum safety. Ultra-violet scanners monitor each burner. Relays, timers, pushbuttons and indicating lights completed the control system. Remote of the panel are (34) ignition transformers and (34) UV flame detectors.

With the removal of the (28) radiant tube burners, (26) cooling tubes and (12) recirculating fans, a total of (66) cover/patch plates were fabricated and installed. Furnace flues were incorporated in the recirculating fan cover/patch plates. Tube support hardware was removed from the drive side of the furnace and counterweighted barometric type dampers were provided on all flues. In addition, all (66) cover/patch plates were insulated with a ceramic fiber lining of a thickness equal to the surrounding areas. Locations where the (54) tube supports were removed also required patching.

The rebuild went smoothly and the furnace was back on line three days prior to the estimated date. All of the expectations were met. Operational versatility was improved because of better control and flexibility in the heating and cooling zones. Heat up time was decreased from three or four hours to one hour and fuel consumption has been decreased by 30% to 35%. Electrical costs were greatly reduced with the removal of recirculating fans and cooling air blowers. In addition, maintenance costs have dropped substantially.