



# Valmet Acoustic Pyrometer Technology

## reheat furnace temperature applications Improvements to improve steel making

1. The reheat thermocouples are located on the roof of the furnace (2 preheat / 2 heat zone / 3 soak zone). The thermocouples do burn out. Estimate 6 thermocouples per year are replaced each year. (\$2k per thermocouple) \$12k. This produces added expendable waste. There is no waste with AP system. No expendables.
2. Safety issue. A number of thermocouples are located in very difficult areas on the roof. Technicians are required to replace the units with the furnace on-line when they fail. The replacement of these difficult locations poses an additional safety risk to the technician. Additional resources and time (lost opportunity cost - \$'s). Total time from point of notification to replacement time of thermocouple is a one hour. Ten (10) units x \$150 hour. \$1500 cost. Plus any safety issue and costs associated with the replacement.
3. The thermocouples located in the roof have different depths of immersion due to roof space constraints (duct work). The different lengths will inherently have different temperature readings. Known and documented studies have indicated this contributes to significant inaccuracy of measurements.
4. The measure of the temperatures (paths) is closer to the billet area providing a more accurate temperature measurement near the material. Thermocouples are nearly 8 ft. away and not representative of critical temperature near the billet. Heat transfer rate.
5. By incorporating the thermocouple methodology for temperature measurement, the main driver is for the measurement is more susceptible to radiant heat conditions (near the roof) and not thermal.
6. Thermocouples are influenced by thermal cycling, cold junction compensation, and calibrations of the thermocouple, calibration of the TC wiring and connectors, and calibration of the instrumentation. None of these influences are present with AP system.
7. Maintenance on AP system. Generators and Receivers are located on side walls of the furnace. Access to any maintenance cycle of components requires less time and safer than access to roof access. Generators and ASR can be mounted at safer distances from furnace walls. Hence less exposure to potential safety issue to the technician with this set-up.
8. At start-up, a decision is (by Level 2) made to begin adding billets based on the current preheat zone thermocouples. The AP system is providing an instantaneous measurement in this zone. However, at start-up there is a 'ramping effect' with the preheat zone thermocouples. The temperature difference and the time lag between these two measurements is 5–8 minutes. Hence, more energy is being used based on the thermocouple reading rather than the real temperature reading near the billet. If the real temperature has no "ramping effect" than overall furnace operation is more efficient and hence less energy cost consumed.
9. Thermocouples provide a 'single point' measurement reading. The AP technology (by using the Universal Gas Equation) is deriving the average temperature across the path length directly from the proportionally to the speed of the transmitted

The AP system measurement is completely thermal and not influenced by radiant conditions.

sound wave. Therefore, the temperature measurement is a 'true' average temperature measurement across the path. No calibration, no special algorithms, no drift. In the end, accuracy is greatly enhanced over a single point measurement.

10. The AP system can be configured to accommodate multiple temperature paths from one generator. Adding paths to the system can provide zonal measurements that near the different key reference areas of the reheat furnace. This is not achievable with a single point thermocouple measurement. Adding such information to the Level 2 decision making process can only be a more effective means in achieving further cost savings in the process.
11. Any step to enhance the accuracy of temperature measurement enables for a more uniform thermal dispersion in the reheat furnace. This will lead to an improved process, better management of the input costs to the operation and enhanced quality of material in the rolling operations.