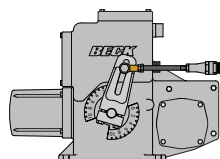


Actuator Resolution's Impact on Steel Mill Furnace Combustion Valves



ArcelorMittal - Galati Mill, ROMANIA

The ArcelorMittal – Galati mill was having trouble maintaining a reducing atmosphere in their continuous galvanizing preheat furnace. An oxygen starved environment within the furnace is created by maintaining slightly fuel rich combustion at the burners. This limits oxidation of the steel sheet, improving quality as it's heated prior to coating. Combustion air flow is monitored and, in a cascade control scheme, the gas valve is adjusted to control CO to a level of 4 to 6%.

The continuous process often allows for relatively constant combustion rates, with very small valve changes required to maintain the 4 to 6% CO level. Periodically, the line speed must be slowed to allow for upstream sheet welding. This can require opening the furnace flue to quickly remove heat from the furnace, and cool the strip to avoid breakage. This temporarily disrupts the reducing atmosphere, so the combustion valves must be modulated to rapidly restore the correct CO level. The coarse resolution of the existing combustion valve actuators at the Galati mill caused them to hunt around the set point. The actuators would often oscillate for more than 5 minutes, and would have to be manually overridden.



Figure 1 - Old Actuators

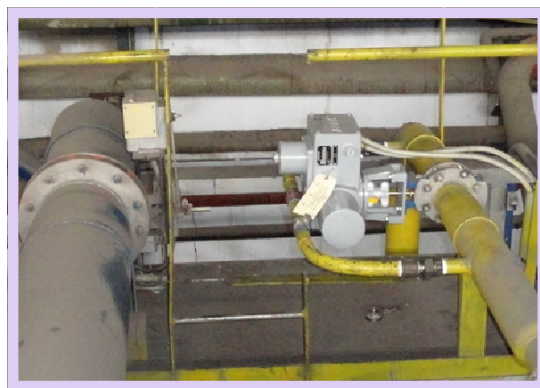


Figure 2 - New Beck 11-168

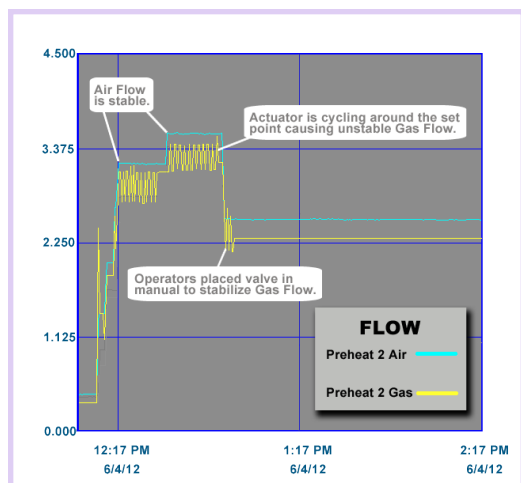


Figure 3 - Response curve with the old actuator cycling. Poor resolution causes the actuator to cycle around set point.

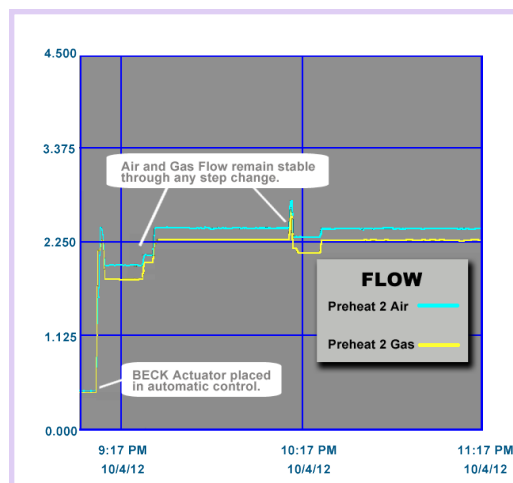
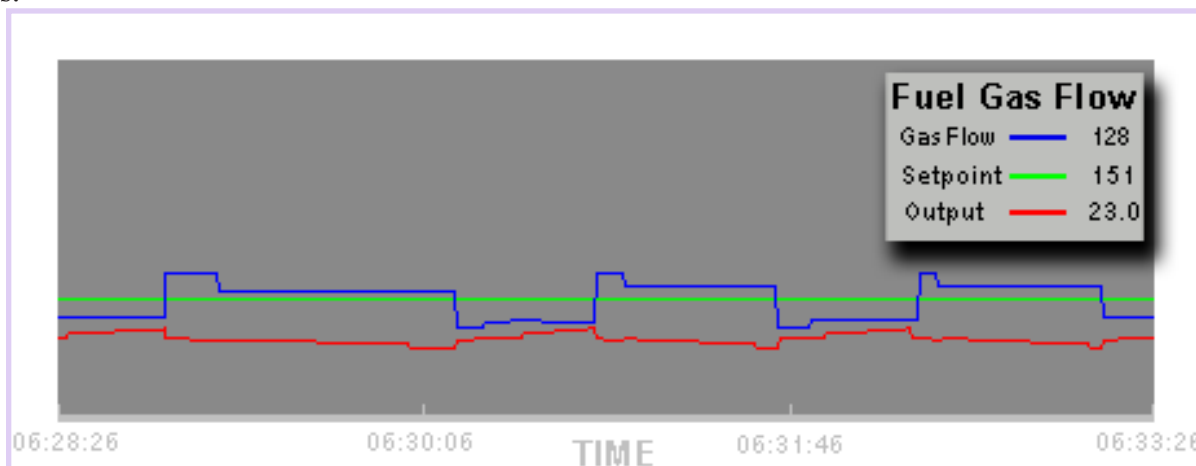


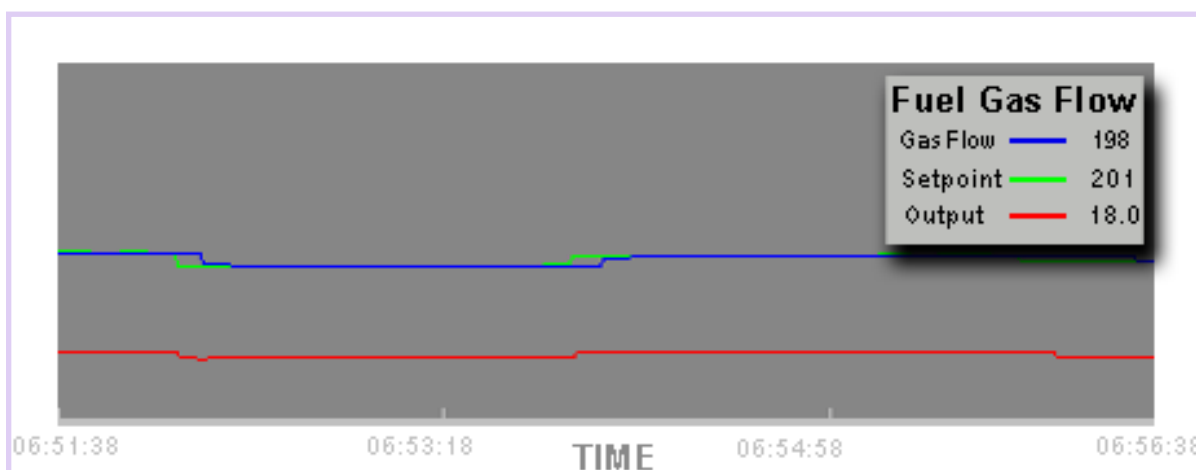
Figure 4 - Response curve with the new Beck actuator. The gas flow closely tracks the air flow as expected.

The hot strip galvanizing line electrical foreman, Anghel Marius, performed step tests with the existing actuators. He found that at the smallest deadband setting, a 0.2 mA signal change was required to initiate movement. The existing actuators could only provide about 80 discrete steps over the valve's full range. As can be seen in the following chart, gas flow from the actuated valve (blue curve) would overshoot the set point in both directions.



In contrast to the old actuator's 80 step resolution, the Beck is capable of up to 900 steps – typical. Beck actuators had been used successfully on the furnace's flue gas pressure control dampers for 14 years, so Anghel was familiar with the Beck's consistent performance and reliability. He purchased two Beck 11-168 actuators to upgrade the gas valves in both furnace zones. With the same process conditions, the new Beck actuators track the setpoint closely. The 4 to 6% CO level is quickly reached and maintained.

The setpoint (green curve) and gas flow (blue curve) in the "After" chart are so close they're almost indistinguishable:



"Now I have very good gas flow regulation in both zones of the Preheating Furnace."
-Anghel Marius-



Harold Beck & Sons Inc.
11 Terry Drive
Newtown, PA 18940
(215) 968-4600

Actuator Solutions since 1936
www.haroldbeck.com