TIP SHEET:
January 2011

Controlling the Burner's Fuel/Air Ratio

In last month's tip sheet, "When does O2 Trim Make Cents," we discussed controlling the fuel/air ratio from the perspective of atmospheric changes and their impact on air constituents and density, and how an O2 Trim system can compensate for these variances.

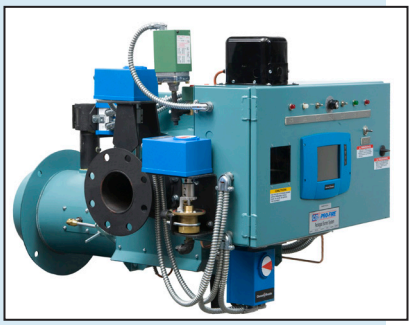
This month, we will explore the mechanical devices that can be applied to the burner to control the fuel/air ratio, and how a higher degree of sophistication can result in better overall performance.

Single Point Positioning system with single drive actuating fuel and air through single jackshaft and linkage

SINGLE POINT POSITIONING

The simplest and most commonly found positioning system on boilers ranging in size from 10 - 800 HP is a Single Point one, which uses a single drive to control both the fuel and air. This is accomplished through a common motor driven jackshaft that has cams, arms and linkages connected to it. Through individual adjustments to these components, the fuel and air is adjusted and a ratio is set.

The problem with this arrangement is the more frequently the system moves due to modulation, the more the various joints and arms wear and stretch resulting in slip and hysteresis, which in turn results in poor fuel/air ratio control. This can be costly and possibly dangerous depending where the fuel/air ratio is relative to stoichiometric combustion.



Parallel Positioning system with independent fuel/air actuators and central controller

PARALLEL POSITIONING

To counter this possibility of poor fuel/air control due to slip and hysteresis, the burner can be equipped with individual motorized actuators that independently control the fuel and air, electronically sending their relative positions back to a feedback controller.

The actuators offer a wide span of control throughout the entire firing range while at the same time affording excellent repeatability as the boiler modulates from low to high fire and back. Slip and hysteresis is thereby eliminated as a concern.

FULL METERING/CROSS LIMITED

When parallel positioning actuators are employed for fuel and air control, often times the control scheme includes full metering and cross limiting.

Full metering is an anticipatory control logic wherein the rate of change is reacted to as the change is occurring, allowing the fuel and air to either increase or decrease in relation to the process and/or heating demand.

The cross limiting feature is an additional safety measure whereby the control logic assures the air always stays within acceptable limits, not allowing the burner to go fuel rich. This condition, besides being energy wasteful, can be very dangerous as well.

In the final analysis, proper fuel/air control is essential when considering best practices for assuring optimum efficiency and safety. Which control scheme is ultimately employed is a choice whereby economics and boiler size often are the major deciding factors.