



**Waterloo
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Company Limited

Boiler News

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The following articles "When does O₂ Trim make Cents" and "Controlling the Burner's Fuel/Air Ratio" were provided as tip sheets for December 2010 and January 2011 from Cleaver-Brooks. They do an excellent job of explaining the factors that affect your burner/boiler and the amount of fuel used in your process or in heating your location. A variety of possible control solutions are outlined in the articles. As well, we would add that Waterloo Manufacturing offers service contracts whereby our service technicians go to your site on a regular basis checking operation and setting up the burners to run at peak efficiency utilizing an O₂ analyzer.

At this time we are sending out our Annual Service Request forms and we ask that you complete and send them in to ensure your spot in our calendar.

If you would like more information on anything in this newsletter or to discuss how your boiler room equipment could run more efficiently, please contact us and we can accommodate your request. We would also be able to ascertain if any rebate programs with the local gas companies would be available to you as well.

When does O₂ Trim make Cents?

To combust a fuel, it takes fuel, heat and air. An excessive amount of air in the combustion mix is wasteful as it robs the burner's energy, taking Btu's away from the heat exchange process, applying it to exiting stack gases. In short, this results in dollars being blown up the stack.

Normally, when setting up the fuel/air ratio on a modulating burner, the technician will attempt to hold the excess air at between 3-7% O₂ throughout the firing range with the low side (3%) being at the higher firing rate and the 7% being at the low end.

Unfortunately, the technician or operator is not at the boiler every operating hour with an analyzer and wrench making adjustments as variations occur due to uncontrollable conditions. What are these varying conditions ?

They are:

- Relative humidity
- Barometric pressure
- Varying Btu valve in the fuel
- Ambient temperature
- NOx control through Flue Gas Recirculation (FGR)

Of these, varying ambient temperature is probably the most common, and it's problematic because as the air temperature varies, the fire can go rich (too little air, sooting the boiler) or lean (too much air heating the

excess nitrogen) depending on the density changes of the air due to the increase or decrease in temperature.

FRG is another common causal factor, especially when it is excessive (15-25% hot gas recirculation as it often precipitates fuel/air ratio imbalance requiring a vigilant monitor to make the ongoing adjustments to compensate for the varying conditions.

Therefore, if you have a boiler room that can experience any of these uncontrollable changes, a quality oxygen trip system should be a serious consideration. It won't tune your burner, but once the burner is properly tuned, it will compensate for the uncontrollable variables. As a result, it will return wealth to the business by constantly monitoring the scarcity or excess oxygen, adjusting the fuel/air ratio accordingly.



O₂ Trim helps regulate the balance of fuel and air for greatest efficiency on these CBL Firetube boilers at a hospital in North Carolina.

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 Trip 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



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

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

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 send-



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

ing 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.

Lunch & Learns for Engineers, Contractors and End Users

We are offering Product Lunch and Learns and we can do it 2 ways

1. We come to you and bring the product information and lunch; you provide the meeting room and the people.

or

2. We can host the Lunch & Learn here at our location and with interest we can arrange a factory tour, allowing you to view the product in the plant.

Either way we can provide you with a broad overview or design a very specific presentation to meet your needs.

For information on products and services please contact us at:

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