

# Improved LOI through Fuel Pipe Balance

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## Summary

It is generally understood that the primary function of a coal pulverizer is to dry, grind, and convey coal to a boiler. Pulverizer performance is typically measured in terms of fineness or capacities. Most power plants, however, often overlook the lesser known effects of the pulverizer on Combustion Performance. It is entirely possible to have a properly performing pulverizer, as measured by fineness and capacity, and still have poor Combustion. The following case study illustrates how one plant, operating with acceptable coal fineness, suffered from high LOI, and the unique solution to fixing the problem.

A Wall Fired Unit in Southeastern United States, operating with three pressurized pulverizers (6 coal pipes each) with dynamic classifiers, had recently undertaken a Low NO<sub>x</sub> Burner retrofit. After the Low NO<sub>x</sub> conversion, the LOI climbed to over 16%. At that time, the plant was running with fineness levels about 99% through 50-mesh and 68% through 200-mesh firing western fuel. Plant personnel correctly deduced that they had a large imbalance in their coal pipes. Subsequent testing and mapping of O<sub>2</sub> and CO levels in the boiler confirmed the effects of the imbalance. In an attempt to correct the problem, the plant replaced all fixed orifices with adjustable orifices. After numerous attempts they were unable to make any substantial gains in coal pipe balance. The plant then installed Multi-Outlet Diffuser Systems (A patented product manufactured by Sure Alloy Steel Corp) in all three pulverizers. The result was a 78% improvement in coal-pipe balance and a 56% reduction in LOI; down to 7%.

Boilers operate more efficiently if the coal (and air) delivered to them is properly balanced and ground to the correct fineness. In the above case, the fineness level of the coal was acceptable, yet the coal pipe balance was poor-resulting in slagging and high LOI. Until recently, the most common method used to balance individual coal pipe flows has been fixed or adjustable orifices. Many power plants have tried this approach with very limited success. The fact remains - if orificing is the solution, why do power plants still have poor coal pipe balance?

Sure Alloy Steel Corporation has developed a practical solution to the coal pipe balance problem by addressing it at its source – within the pulverizer itself. Sure Alloy's Multi-Outlet Diffuser System (Patented and Patents Pending) promotes proper coal distribution from pressurized pulverizers. The usage of orifices to match individual pipe resistance is much more effective with the coal evenly distributed exiting the pulverizer. Improvement in coal *and* air to fuel ratio balance across all of each mills' coal pipes are the end results of the SAS Multi-Outlet Diffuser System. SAS has successfully used this technology to balance pulverizers with 3 to 8 coal pipes.

Many plants fine tune their boilers with secondary and tertiary airflows to compensate for imbalanced coal and primary airflows. A balanced fuel delivery system would allow engineers to make more subtle adjustments, have fewer side effects and allow more precise boiler tuning. Other applications of SAS Patented Diffusion Technology include pre-riffle distributor and/or riffle elimination, one-to-x splitters and pre-burner (SAS Patented In-Line Diffuser) applications.

The SAS In-Line Diffuser would be a separate and final step in a Fuel Delivery System Upgrade after mill performance and balance are achieved. The In-Line Diffuser is used just upstream of the burner nozzles, typically oriented in a horizontal position inside of the barrel. Stratified fuel and primary air (roping) are 'diffused' just as they enter the nozzle tip and exit into the boiler creating an ideal mixture for combustion. This diffused mixture helps many problems associated with burner performance including: flame instability/detachment, eyebrows, increased LOI, fuel impingement on boiler walls, imbalance in CO and O<sub>2</sub>, excessive slagging, and problems adjusting low NO<sub>x</sub> burners.

The first step in boiler optimization initiatives such as Low NO<sub>x</sub> Burners, Over Fire Air, Reburn Fuels or SCR projects, etc. should be a complete evaluation of the pulverizer fuel delivery system. Many large scale projects end up in litigation which could be easily avoided by spending money upfront verifying and correcting pulverizer performance and balance first. Some projects may not even be needed with a properly performing and balanced fuel delivery system!