APPLICATION BULLETIN
ICA-09

Pf-FLO with MILL INLET DIVERTER

The Challenge

The objectives in the power industry today are twofold; to lower emissions, and increase plant performance. Precise measurement of combustion airflow and fuel rates positively contributes to achieving those objectives by providing the information needed to optimize stoichiometric ratios and facilitate more complete, stable combustion.

Traditional designs of coal fired power plants lack any means to measure and control airflow into individual burners. This practice changed when NO_x attainment levels mandated by the Clean Air Act prompted installation of low NO_x burners which, unfortunately, were frequently accompanied by extensive and often non-repeatable tuning of burner settings solely targeted at meeting the manufacturer's NO_x and CO emissions guarantees at a single load condition. Such burner tuning did nothing to address significant variances in fuel distribution to each burner, while multiple burners served by a common or partitioned wind box continued to have substantial burner-to-burner imbalances in secondary airflow (SA). The result was little sustainable improvement in overall boiler operation over a range of load conditions.

A Southeast Utility wanted to implement a comprehensive and sustainable combustion optimization management strategy for one of their wall-fired boilers, recently upgraded with low NO_x burners that were not equipped with any means to measure burner SA. The scope of the project involved upgrading mill primary air measurement, installing individual burner SA measurement, and adding instrumentation to measure the amount of pulverized coal being delivered to each burner.

The boiler was equipped with Atrita double ended mills, each fed by a single duct providing both fuel and primary air to the mill. See Figure 1 below. Each mill end fed an exhauster, which in turn delivered fuel to a pair of burners after passing through a primary riffle box. Based upon their many years of experience operating the Atrita mills the Utility's combustion engineering group was convinced the shared coal / PA duct configuration produced variable end-to-end coal imbalance, which in turn resulted in two of each Mill's four pipes getting more pulverized coal than the other two pipes. See Figure 2.

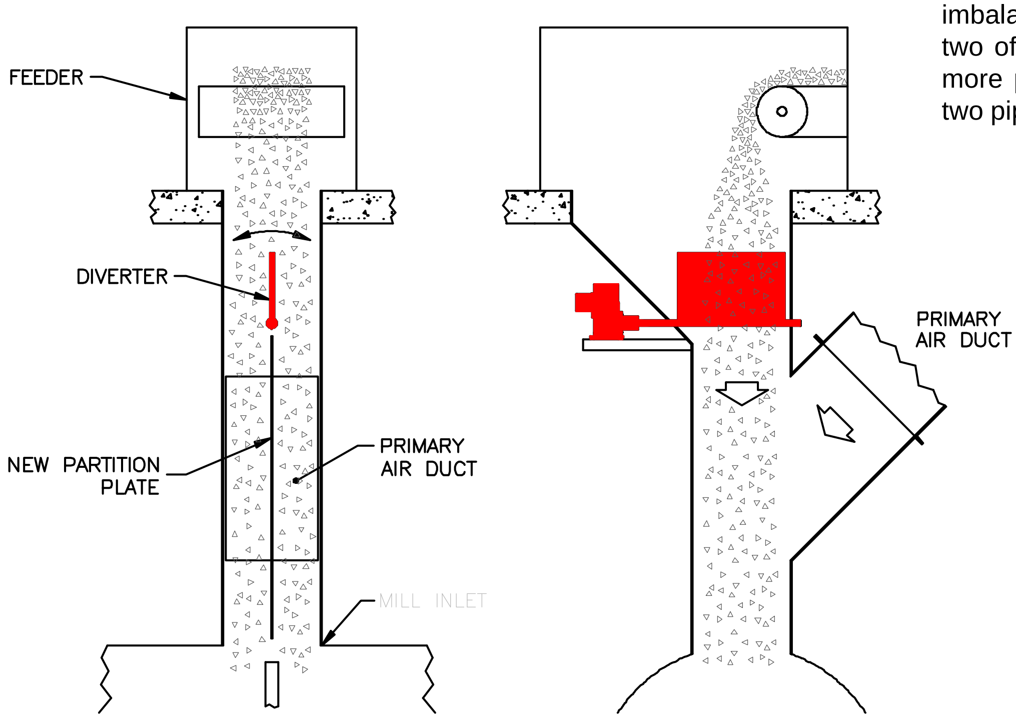

Figure 1

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The Solution

To address the end-to-end fuel imbalance Air Monitor Power's Application Engineering department engineered a coal diverter with actuator that was installed into the top section of the existing coal / PA duct. Diverter components directly exposed to coal were constructed of wear resistant alloys, with an overall design that permitted ease of periodic inspection for long term removal and replacement. The diverter was engineered to permit as much as ±25% end-to end bias via a control signal from the DCS. A divider plate was also installed to maintain the coal distribution from the diverter into the mill entrance. See Figure 1.

In conjunction with the coal diverter a Pf-FLO Coal Flow Measurement System was installed on all 20 pipes, initially to gather baseline coal distribution data over the Unit's full range of load conditions. By summing the mass flow of pipes 1 & 2 served by the mill's left end and comparing it to the summed mass flow of pipes 3 & 4 served by the mill's right end, the baseline data collected in Pf-VU confirmed the existence of 20% end-to-end imbalance at different load conditions, and as much as 35% fuel variance between the lightest and heaviest loaded pipes. By means of manually biasing the diverter blade position the ability to achieve mill end-to-end balance was demonstrated.

Result

Air Monitor Power assisted the Utility's contractor in the development of new control logic using the coal mass flow measurements from each of the four pipes served by a single mill; by summing the two coal flow measurements corresponding to each mill end a control output was generated to reposition the diverter damper, automatically maintaining end-to-end mill balance within ±5%. Data from the Pf-FLO system was also used to guide the process of statically adjusting each primary riffle box to balance the fuel being delivered to both burners. The combined effect of manual riffle adjustment and implementation of automatic diverter damper control was successful in achieving the primary objective of ±10% coal delivery balance to all burners over the normal range of boiler operation.

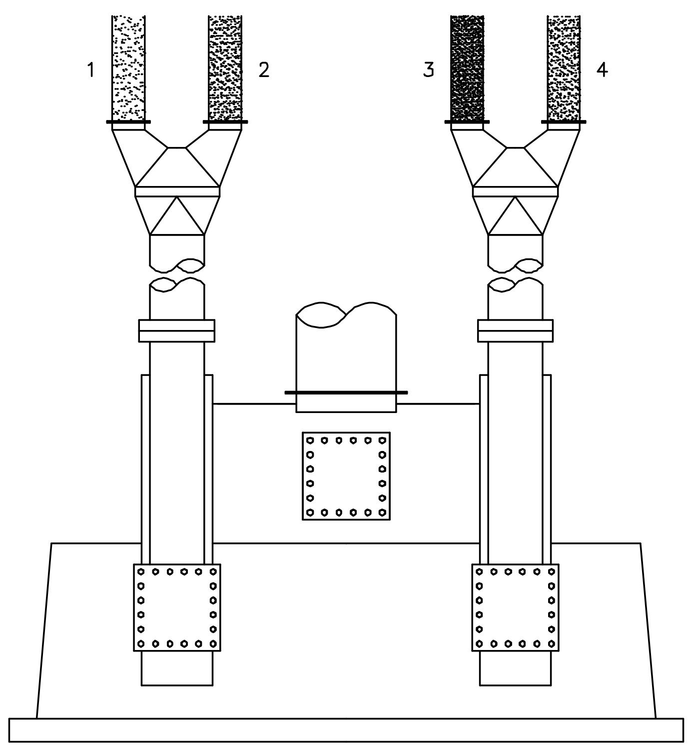

Figure 2