Pulverizers 101: Part 3

Why Precise Measurement and Control of Primary Air is Important

Some of the largest opportunities for improving performance and reliability come from optimizing primary airflows such as reducing NO_x, slagging and other furnace issues. But before you can correct those issues, you must first understand the role of primary air and its use in the coal pulverizing process.

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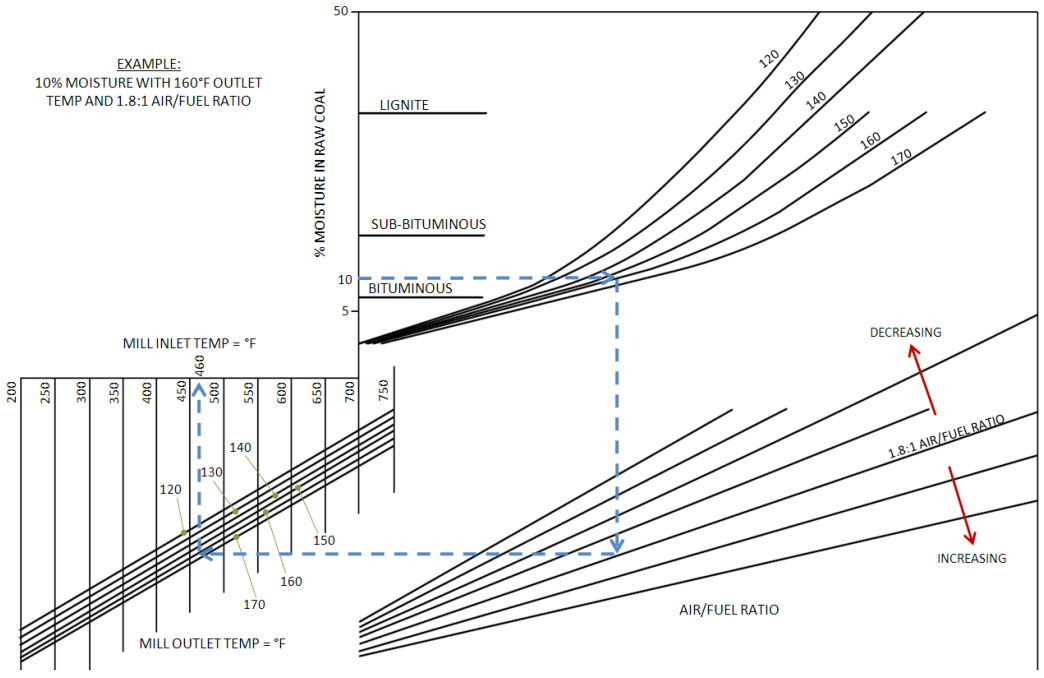
Primary airflow through a pulverizer is generally thought of simply as transport air - the air that moves the pulverized coal from the mill to the furnace. For bituminous coals, the primary airflow, at optimum, may be as little as 15% of the total air for combustion. This is based on 13,000 Btu/lb fuel that requires 12 lbs of air per lb of fuel for complete combustion. PRB fuel with a HHV of 8,500 Btu/lb will require about 7.2 lbs of air per lb of fuel for complete combustion (including primary, secondary and overfire airflows). Therefore, with PRB, the primary airflow will be about 25% of the total air for combustion. Primary airflow is transport air, but it is much more important to be precisely controlled than conventional wisdom would suggest. Why? Because the burner tuning and furnace burner belt performance has a lot to do with the trajectory of coal particles and the interaction of the secondary air flow streams. Also, primary airflow supplies the needed heat energy to evaporate the moisture contained in the fuel. The chart below shows the relationship of primary air temperature, air/fuel ratio and coal moisture content.



Let's think about the coal pulverizing process. Raw coal with a preferred maximum size of about ¾" enters the mill. Let's use bituminous coal with 10% total moisture as an example. The coal is dry to the touch and the 10% moisture is inherent moisture - moisture that will not be removed by air-drying or by being stored on a sunny summer day on the coal pile. Inherent moisture is basically liquid phase water that is bound within the coal. It will not be released until the coal is pulverized and/or exposed to high temperatures in a low humidity environment, which is essentially what is done in a coal pulverizer. The raw coal is ground and exposed to a very low relative humidity. The coal enters the mill at about 80°F and then hot primary air flows over the

ground particles causing the liquid phase moisture to evaporate. The amount of heat energy required to change the state of water to vapor is enormous. The bottom line is this: changing the state of 10% liquid phase water at an air/fuel ratio of 1.8 lbs of air per lb of fuel will require the primary air entering the mill to be 460°F to produce a mill outlet temperature of 160°F.

If primary air removes moisture from the coal, then why is primary airflow measurement and control important? High primary airflow may appear to be a good method to improve drying of coal and reducing overall moisture. It will reduce overall moisture, but at a cost. When the boiler furnace burner belt, superheater, airheater and the entire boiler island are looked at comprehensively, we find at least seven consequences of high primary airflow.

These consequences show the importance of measuring and controlling primary airflow accurately and with a well-defined and repeatable primary airflow ramp (relationship of coal flow and primary airflow). Our experience favors an air/fuel ratio of 1.8 lbs of air to lb of fuel whether lignitic (high moisture western fuels) or bituminous (eastern fuels).

If you are experiencing any of these issues or your airflow isn't being precisely measured and controlled, Storm Technologies, Inc. can help. Please contact us about our testing programs and airflow measurement devices.

Yours truly,

Dick Storm
CEO/Senior Consultant

Seven Common Consequences of High Primary Airflow

- Fuel Fineness - High primary air causes poor fuel fineness.
- NO_x - High primary airflow contributes to higher furnace production of NO_x.
- Slagging - Upper furnace secondary combustion is often the result of high primary airflow.
- Heat Rate - If tempering air is used, such as with bituminous fuels, then high primary airflow causes significant primary air to bypass the airheater, thus elevating the exit gas temperature slightly.
- Fuel Distribution - High primary airflow can negatively affect fuel distribution. Fuel distribution is usually best at a repeatable and "tuned" primary airflow for a given fuel flow.
- Wear of Fuel Lines and Burners - High primary airflow causes excessive wear of burners and fuel lines.
- Flame Stability - Flame stability is affected by high primary airflow. Detached flames, flame scanning issues and flame safety are concerns.

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Registration:

Online: www.stormeng.com or email storm@stormeng.com

Phone: Contact Storm Technologies, Inc. at (704) 983-2040

Continuing Education Credits: Up to 18

Pricing Includes: (registration, learning materials, meals)

Standard rate: $1,200 per person
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