IDENTIFYING AND CAPITALIZING ON OPPORTUNITIES COMING OUT OF AN OUTAGE

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- The Importance of Balanced Fuel to the Boiler

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When coming out of outages it is not uncommon to realize that issues have developed or are still present and have gotten worse from before the outage. The direct cause of these issues can sometimes be challenging to identify. Some examples are:

- High superheat and reheat temperatures; leading to higher de-superheating spray flows or limitations due to temperature
- Fan limitations
- Increased emission levels
- High carbon in ash levels
- Flame stability issues
- Mill rumble
- High SCR inlet temperatures that limit load to prevent catalyst damage
- Slagging and burner eyebrows
- Coal rejects from a mill
- Plugging of fuel lines

The immediate cause of these issues is often not clear from just the control room indications. However, testing the system inputs can help reveal the issues. This testing includes airflow testing of the primary, secondary, and overfire air to ensure accurate flow measurement and control, as well as correct flow rates and proportions of air to each location. Mill performance testing involves assessing fineness, distribution, and air-to-fuel ratio. Flue gas testing is also conducted to review the temperature distribution and flue gas constituents, which can help identify problem burners, air-in leakage, or incorrect O_2 indications that the unit is controlling from.

Mill Checkups Coming out of Outages

Storm recommends conducting comprehensive testing of all mills following an outage. Prior to mill testing, potential issues can often be detected by monitoring control room indicators such as mill inlet temperatures, mill amps, and damper positions. The establishment of a baseline for these values or comparison among mills enables the identification of underperforming mills. A lower mill inlet temperature compared to the benchmark or to other mills is indicative of high air-to-fuel ratios. Similarly, low mill amps suggest reduced work or lower fineness levels. However, further testing is imperative to accurately identify and rectify these issues.

Clean Air Balancing

Clean air balancing is completed by running airflow only through a pulverizer at normal operating temperature and minimum flow rate and testing the flow through each fuel line. The purpose of this testing is to balance the system resistance to each fuel line. This testing can also identify issues such as swing valves/isolation valves not opening fully and other restrictions in the system such as pluggage or burner damage. In outages in which burner work has been completed, it is very important to perform clean air testing, as it is the first step in air and fuel balancing.

Figure 1: Storm team performing Clean Air Testing

Figure 2: Storm team performing Primary Air Testing & Calibration

Primary Air Checks and Calibration

One common cause of mill issues following an outage is inaccurate airflow measurement. To address this, Storm advises conducting primary airflow testing at the mill inlet, in close proximity to the airflow measurement device. This method ensures a more precise calibration of the flow element. Prior to mill start-up, it is recommended to perform a Cold 'K' calibration check, often carried out in conjunction with clean air testing. Cold 'K' tests involve airflow passing through the mill at normal outlet temperature. These tests are essential to verify reasonably accurate airflow before initiating mill operations, thereby ensuring safe operating conditions. Subsequently, upon mill start-up, it is advised to conduct Hot 'K' calibration tests under typical operating conditions, across the load range, at three flow rates. These tests are pivotal in ensuring accurate airflow measurement across the mill's operating range.

Mill Performance Testing

To more accurately assess mill performance, Storm conducts mill testing by measuring the dirty airflow (primary air + coal) through each fuel line and then collecting an isokinetic coal sample from each fuel line. This testing provides both air and coal flow balance to each burner, flow rate, air-to-fuel ratio, and a sample to determine weighted fuel fineness. During the testing, mill amps are also monitored to calculate an HP/ton value for each mill.

Some common causes of poor mill performance identified through this testing include:

- Improper primary airflow
- Coal feeder calibration issues
- Excessive grinding element clearances
- Classifier settings need adjustment
- Restriction of coarse particles being returned to the grinding zone from the classifier
- Low or inadequate grinding pressure

Figure 3: Storm team performing Dirty Air Testing & collection of coal sample

Air In Leakage/ O_2 Probe Accuracy and Representativeness

Air-in leakage often increases over time with unit cycling. Therefore, issues that were not present going into an outage can appear at startup. Large amounts of thermal expansion take place throughout the boiler and this constant expansion and contraction can lead to an opening in which air infiltrates the system. A common area that causes issues coming out of an outage is the economizer outlet area. Leakage in this area is very troublesome due to the close proximity to the O_2 probes used to control the boiler. When leakage occurs in this area the probes are deceived into showing high O_2; which then trims airflow from the secondary air, often resulting in a furnace that is sub-stoichiometric. The reason this area is challenging is that for most boilers the ductwork turns horizontal at this location. With most boilers being top-hung, when the unit ramps up to load and heats up, the boiler expands downward. To handle this large movement, expansion joints or toggle sections with two expansion joints are commonly used in this area, increasing areas of possible leakage.

In addition to expansion joints being tasked with handling cycling, an additional challenge is the handling of the ash-laden environment. Expansion joints are typically equipped with flow liners to protect the joint from ash buildup and are even equipped with pillow blocks to prevent buildup in the void. However, over time and many cycles, ash can accumulate in the joint behind the flow liner. This has a higher tendency to occur in horizontal ducts like at the economizer outlet. Both due to settling ash as well as water washes accumulating water that then traps ash. When ash accumulates in the joint, it is then limited in movement and can crack. This can then result in an area for air-in leakage.

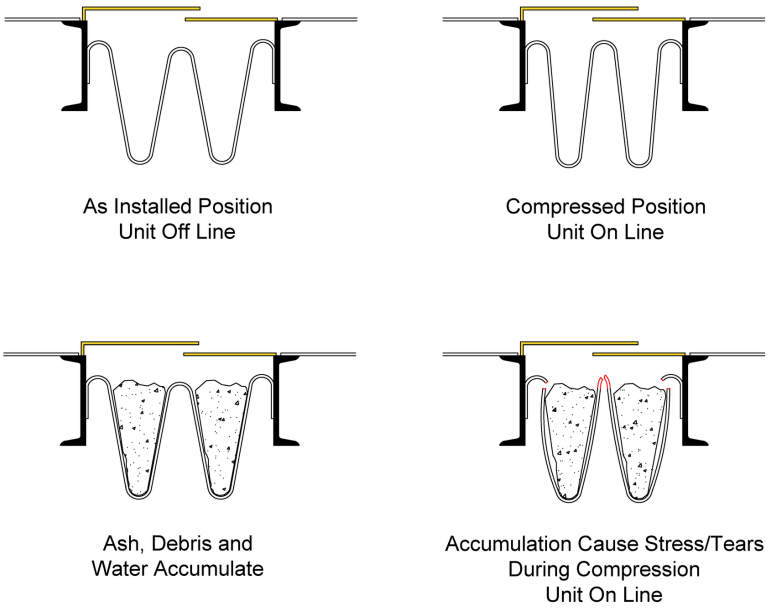

Figure 4: Expansion Joint Accumulation & Failure

If you are experiencing issues that need to be further identified, Storm can help. We offer test equipment and services to conduct thorough boiler performance tests, as well as technical outage services for inspecting the boiler, mills, ductwork, fans, etc. Please contact us if you would like more information or if we can assist with your plant's needs.

Respectfully,

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