SERVICE QUALITY RESULTS
STORM

Part 1 - Airflow Management on Corner Fired Boilers

Storm Technologies has been solving difficult combustion problems for many years. We thought that sharing some of our experiences and case studies would be helpful to those of you working in the utility industry. Some of these same issues that we have identified and made corrections to are certain to still be challenges today. This is the first newsletter of a series that uses data and experiences from the last three decades. Most of the figures used are slides from our "Large Utility Boiler Combustion and Performance Improvements" seminar. We hope that you appreciate it and find it useful..

Case Study

- 750 MW C-E Boiler, 8 Corners
- Fuel Eastern Bituminous Coal
- Typical Eight Corner Secondary Air Distribution

Two problems with Secondary Airflow

- Poor distribution to each corner
- Pre-outage was found to have insufficient combustion airflow to the furnace

Figure 1: Wind-box airflow distributions determined from flow traverses at full load

STORM's 13 Essentials

1. Furnace exit must be oxidizing, preferably an average of 3.0% with no single point below 2.0%.
2. Individual fuel lines balanced by "Clean Air" test to within ±2% deviation from the mean or better.
3. Fuel lines balanced by "Dirty Air" test, using a Dirty Air Velocity Probe, to ±5% deviation from the mean or better.
4. Fuel line flows balanced to ±10% deviation from the mean or better.
5. Fuel line fineness shall be 75% or more passing a 200 mesh screen. Particles remaining on 50 mesh shall be less than 0.1%.
6. Primary airflow shall be accurately measured & controlled to ±3% accuracy.
7. Overfire air shall be accurately measured & controlled to ±3% accuracy.
8. Primary air/fuel ratio shall be accurately controlled when above minimum line velocity.
9. Fuel line minimum velocities shall be 3,300 fpm or higher.(3,300 fpm allows for ± 10% imbalance, 3,000 fpm absolute minimum)
10. Mechanical tolerances of burners and dampers shall be ±1/4" or better.
11. Secondary air distribution to burners should be within ±5% to ±10% deviation from the mean.
12. Fuel feed to the pulverizers should be smooth during load changes and measured and controlled as accurately as possible. Load cell equipped gravimetric feeders are preferred.
13. Fuel feed quality and size should be consistent. Consistent raw coal sizing of feed to pulverizers is a good start.

The data shown is the result of about 3,000 velocity points that were converted to mass flow rates for each corner. The red line in the data plot above shows the combustion airflow to each of the eight corners. These flow measurements were obtained using a Storm Technologies' Forward/Reverse Pitot Tube through hundreds of points, traversing each of the auxiliary air and fuel-air compartments (shown in Figure 2). Note the black dots showing the test ports that were installed. Yes, this was a rigorous test and over 250 test ports were installed to provide the velocity probe access. This process however, was repeated on several large C-E eight corner boilers ranging from 450 to 900 MW size. The poor air distributions were typical, not always the same corners were low, but low flow corners deviated more than 300% from the flows from the high flow corners.

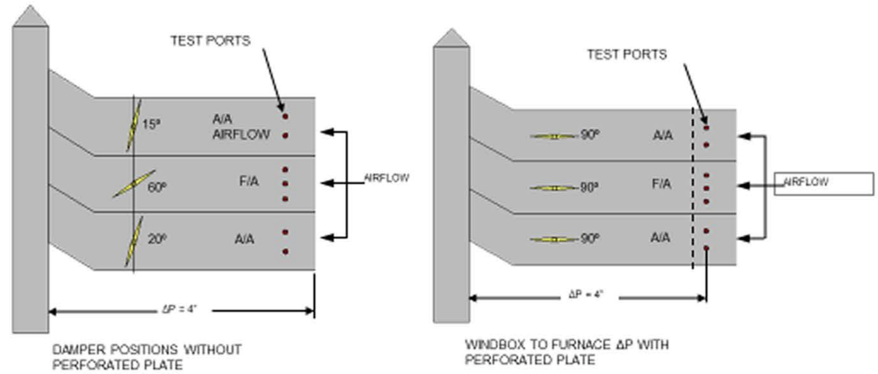
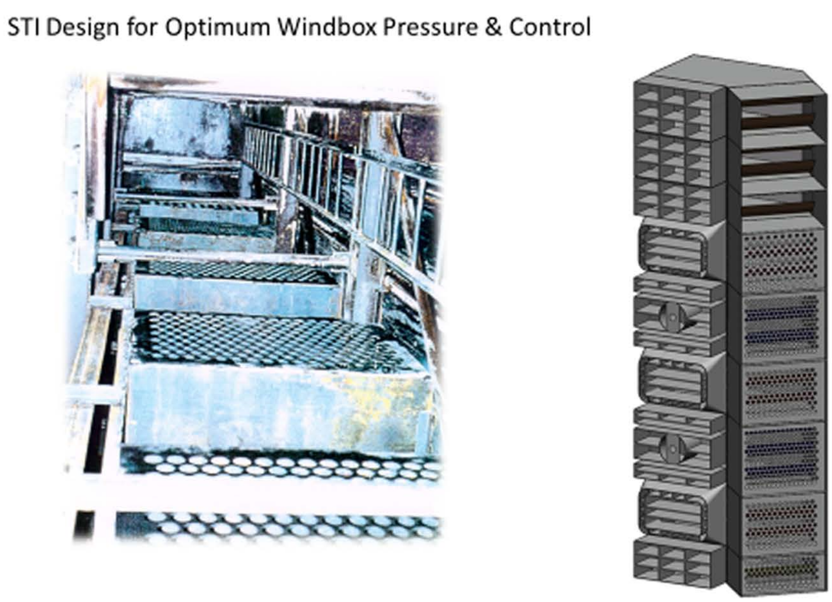


Figure 2: Pre/Post Wind-Box Test Port and Perforate Plate Locations

The solution in the case in point, was to make ductwork changes in splitter dampers and the installation of perforated plate in the wind-box. Please see Figure 3 below.



The blue data plot (Figure 1) shows the flows after the outage corrections to the wind-box and ductwork. Still not perfect but far better than before. Also, note the increased flow to the wind-box post outage. This was due to corrections to expansion joints, convection pass and roof tramp air in-leakages. This can also assist with low load, NOx tuning and combustion optimization. At the end of the improvement process, which included pulverizer fineness, fuel line balancing and the application of the "Essentials for Optimum Combustion", there was an improved heat rate, less water wall slagging and reduced temperature stratifications on the superheat and reheat tube metals.

Figure 3: Application of Perforated Plate to help balance secondary air to the individual corners

For the next edition of this series, we will show a case study of pulverizer and fuel line improvements.

Yours Truly,

Richard F. (Dick) Storm, P.E.
Founder / Senior Consultant
Storm Technologies, Inc.

Disclaimer: These suggestions are offered in the spirit of sharing our favorable experiences over many years. Storm Technologies, Inc. does not accept responsibility for actions of others who may attempt to apply our suggestions without Storm Technologies' involvement.