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SYNERGISTIC AND ESSENTIAL COMPONENTS FOR GETTING RESULTS:

A. A Comprehensive Approach to Combustion Optimization

B. Teamwork, Follow through and continued Performance Preservation EFFORTS

Introduction

Large coal fueled utility power plants are Storm Technologies, Inc.'s "Bread and Butter" business. About 80% of what we do is related to large pulverized coal plant combustion optimization. We have a lot of experience at this, and have been successful when the components of success, as mentioned above, and expanded below are present. Specifically the following:

1. Apply the fundamentals, including the 13 Essentials.
2. Work in Partnership, as a team member with the Owner.
3. It takes follow-through and a comprehensive approach.
4. **Performance Preservation** and **Condition Based Maintenance** must be applied ***after*** opportunities for improvement are identified and corrected.

I would like to use this month's newsletter to share some experiences of "How Good" RESULTS can be achieved. As well as, "How Good" RESULTS can be elusive because of incompleteness of the Storm approach.

Pulverizer performance optimization is an absolute must for any pulverized coal fueled power plant. In the past, Storm has provided case studies of Bowl Mills, MPS Mill, Ball Tube Mills, EL's and MBF mill changes. I would like to relate how the devil is in the details. Also, how some plants have missed achieving "Best Results", by not implementing all of the recommendations on a Bowl Mill performance improvement project.

First let's take a look at a Bowl Mill, and the typical "Opportunities" for improvement:

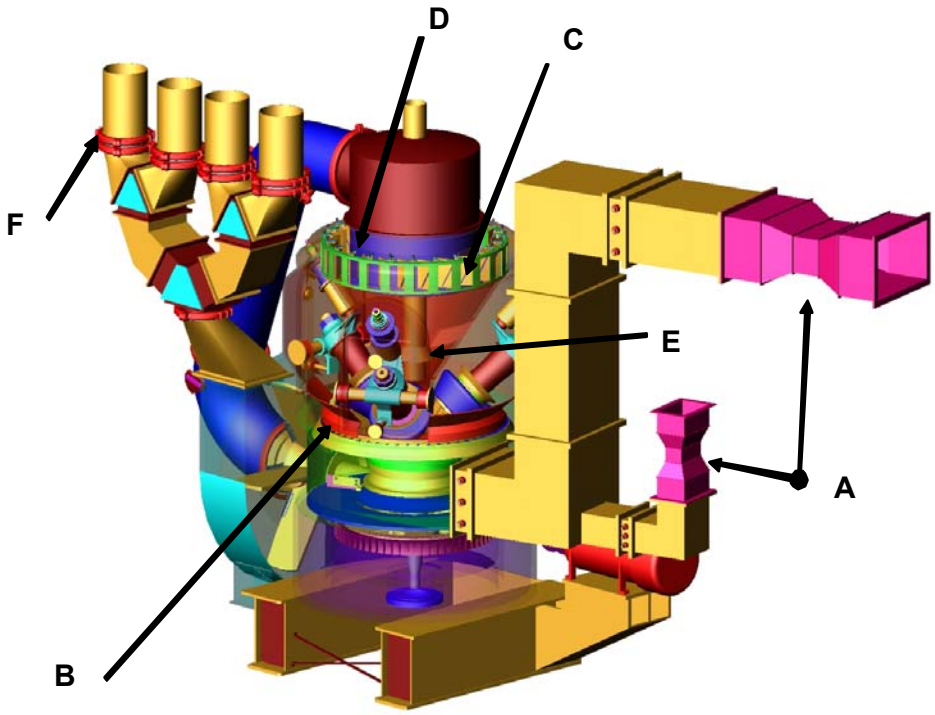


Figure No. 1

A. Airflow Measuring Venturi for improved measurement accuracy - Primary (HOT) & Tempering (COLD) airflow venturis
B. Improved Throat & Deflector modification and design for reduced coal rejects, optimum primary classification, vectoring and reduced mill rumbling
C. High Spin Classifier Vanes for improved circulation and air/fuel distribution
D. Modified outlet cylinder for improved homogenization & 50 mesh particle rejection
E. Inverted cone for coarse particle rejection
F. Orifices and housings for achieving optimum clean air system resistance

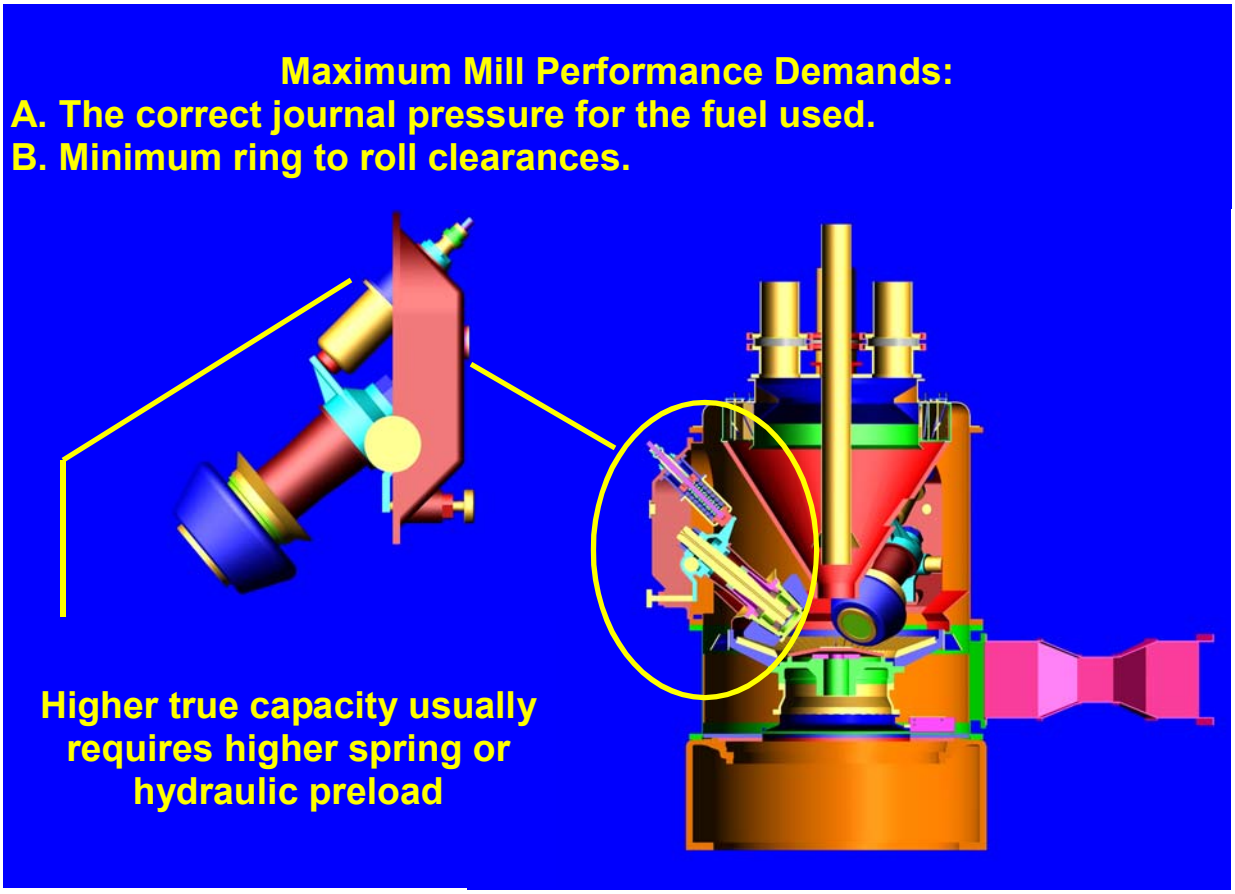
The improvements as outlined above are proven and known to be successful. There are a few recurring details that some owners/users have neglected to implement. Omission of a few details can completely nullify an otherwise successful mill performance/reliability and capacity improvement program.

These follow:

1. **<u>Roll pressure</u> must be high.** Yes, probably higher than the original settings. Why? Because now, most plants are operating their mills at either higher throughput than original design, (as with changing to lower BTU western fuels for mills designed for eastern bituminous) or mills designed and sized for 50 HGI in the 60's and 70's are now supplied with coal of an HGI more like 40-45 HGI. Compounding the problem is environmental, No_x tuning that requires increased fuel fineness. Pulverizer "capacity" is not simply coal through-put! True pulverizer capacity is the Resultant of three factors, which are:

    a. Throughput
    b. Fineness
    c. Coal HGI

Of course there are other factors of less impact, such as moisture and raw coal sizing. Electric utility sized bowl mills always have 3 rolls, or journals. The only place that coal grinding takes place is between the rotating bowl and the rolls. Simple you say, no kidding. Everyone knows that! Well, yes, but we are continually surprised by the number of mills that we are involved in. Either roll to ring clearances are way too wide or the roll initial pressure is inadequately set at a value too low.



What are the consequences of roll pressure that is too low?

The classifier has two purposes:

A. Return coarse particles for regrinding. The name sake of what this is.
B. For pressurized mills. The classifier contributes to fuel and primary air mixing to distribute coal uniformly to each burner line.

Getting back to if the roll to ring clearances are too wide, or the initial spring loading too low. Then, the classifier will return excessive quantities of coarse coal particles back to the grinding zone.

Higher mill differential then RESULTS because of the excessive quantities of recirculated coarse product. Therefore, one of the most common problems of "High mill differential" is insufficient grinding pressure, worn grinding surfaces, or clearances between rings and rolls set too wide.

2. **Pulverizer throats that are too wide** is an extremely common problem. So, to minimize coal rejects, it appears simple to correct. Just increase the primary airflow right? NO not right, or at least not optimum. The Best "heat rate" operation and Best low No_x in furnace performance is produced by careful and precise measurement and control of the primary airflow. The primary airflow needs to be measured and controlled for the optimum airflow ramp. The Storm standard for pulverizer throat area has been established and proven. Complimenting the proper throat area are the other recommendations as shown in Figure No. 1. Getting favorable and good RESULTS takes the "**Synergy**" of all the Storm recommendations (The Comprehensive Approach).

3. **Primary airflow measurement** and control at an optimum "ramp" with load is absolutely mandatory for "Best Heat Rate" and best furnace performance. Of course, the pulverizer throats, roll pressures, classifier settings and clearances and controls must all be tuned and coordinated to function together.

Summary "Getting it Together"

Back to that Synergy word. All factors, many of which seem to be small details, need to be addressed and handled as importantly as a symphony orchestra coordinates "strings", "horns", and "percussion". Together, when properly coordinated, fine music is produced. Uncoordinated RESULTS end in nothing but noise. We know how to coordinate the inputs to a furnace for best furnace performance.

It has been our experience that the teamwork of operations, instrumentation, maintenance and Storm working together can, and has achieved excellent RESULTS. The key to success, has been the continued attention to the details. The 13 Essentials seem simple enough. However, as one gets into applying them, sometimes it takes a "culture change" of plant practices to really achieve "Best performance".

For those of you we presently work for and with, let us say, **Thank You** for the opportunity! For those of you that we are not working with yet, let me caution you, that great RESULTS are achievable as we have implied. But that there are many little details that we can help you with, that may not seem to be related to "Best" heat rate combustion", capacity, reliability, and lowest No_x. Nine of the 13 Essentials are pulverizer, primary airflow, and fuel line balance related. RESULTS ARE FOUND IN THE DETAILS!, and we know how to optimize those details.

Wishing you the best for high load factor and low heat rate operations.

Sincerely,

Dick Storm
Senior Consultant
Storm Technologies, Inc.

FEATURED EQUIPMENT

A complete HVT probe kit typically includes the following items:

- Standard HVT probe
- Stainless steel armored lead wire for the type “K” thermocouple
- Portable digital thermometer to accurately measure the temperature
- Clear tubing to go from the HVT probe to the gas sample conditioner
- STORM custom gas sample conditioner
- ECOM-AC Gas Analyzer that measures O_2, CO, NO_x

Isokinetic Coal Sampling Kit
Includes:

Stainless steel coal sampler w/filter canister, cyclone separator, Orifice Aspirator Assembly, H.D.P. Sample Container with O ring, Extra Filter Paper, 10ft. section of reinforced tubing w/clamps, 1) coal sampling probe, 10 calibrated dirty air probe, 1) temperature and static probe w/ type “K” thermocouple, 2) dustless connectors, digital manometer, 10” vertical incline manometer w/18” pitot tube and steel carrying case, 1 lot of required heavy wall 3/16” tubing, 1) 8 ft type “K” thermocouple lead wire with connections, labels and spare seals.

Call for pricing.

How can you determine the carbon content (L.O.I.) of the flyash? A flyash sampler provides the means to draw ash samples from the flue gas.

Insitu Flyash Sampler includes:
Sample canister, nozzle tip, perforated cylinder, 100 Reg. filter paper, aspirator assembly, optional pipe length, required air connection fitting and procedures.

Call for pricing.

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