



Are You Ready for Your Spring Outage?

Storm Technologies, Inc. is an experienced group of engineers and technicians that specializes in combustion improvement programs, assisting plants with performance related issues, boiler MACT and/or emission control. Our focus has always been and remains Service/Quality/Results. We look forward to the opportunity to support your plant with providing engineered solutions. Storm has the capabilities and experience to address any issues that your plant may have, such as slagging, pulverizer performance, high LOI, NO_x or CO levels, unit de-rates or fuel flexibilities. Please give Storm a call to support your plant needs.

Sincerely,

Danny Storm
 Danny Storm
 President

Spring outages are upon us and we would appreciate the opportunity to help.

IN THIS ISSUE:

- Expedited Outage and Replacement Parts
- Scroll Burner Inserts
- Heavy Duty Fine-Cut Riffles
- Chordal Thermocouples

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Expedited Outage and Replacement Parts

Are you aware of Storm's Capabilities to Provide Expedited Outage Repairs and Replacement Parts?

Storm Technologies, Inc. is known for our comprehensive combustion improvement testing programs, training courses, engineering and consulting services. Not only can we provide these services, but we would like to tell you about the additional resource that you have in Storm Technologies' fabrication shop for engineered solutions. We are able to provide our products in an immediate time frame (most projects can start the SAME DAY, depending on material, complexity, etc.). This includes in-kind replacement, duct work, some dampers and many other engineered solutions for improved performance, unit reliability and heat rate.

What Storm can provide:

- Replacement Parts for:
 - Worn riffles (replaced with more durable riffles and improved material)
 - Damaged burners (coal nozzles, spinners, buckets, etc.)
 - Superheater alignment bars (stainless straps, etc.)
- Scroll burner inserts for scroll inlets (see review on the next page)
- Duct work and some smaller metal expansion joints and dampers
- We can provide a technician to come to your plant and review components
- Parts can be picked up, repaired and delivered as needed to meet plant schedule

Storm Technologies, Inc. is ready to provide for your fabrication needs.

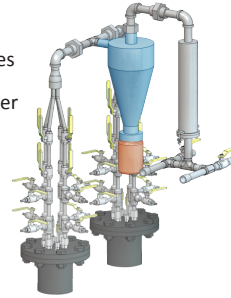


Boiler Tubes:

- Chordal/tube metal thermocouples
- Soot blower and door opening seal boxes
- Serpentine straps

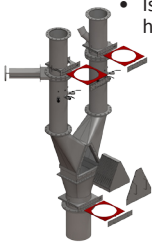
Ductwork Equipment:

- Multipoint probes
- Multipoint emissions sampler



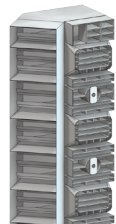
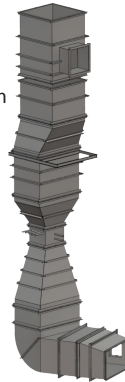
Fuel Lines:

- Riffles and housings
- Orifice housings
- Isolation housings



Ductwork:

- Custom duct work
- Metal expansion joints
- Airflow measurement products

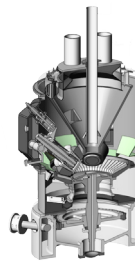


Burners:

- Burner components for corner fired boilers
- Coal nozzles and/or spinner spreaders for wall-fired units
- Oil tips
- Scroll burner inserts

Pulverizers:

- Classifier blades
- Outlet cylinders
- Rotating throats
- Deflectors
- Inverted cones
- Reject doors



Storm E-newsletters

Storm has an e-newsletter. Do you want to be on our mailing list? Send us an email at storm@stormeng.com and we'll make sure you are ready to receive this publication. Topics vary weekly between optimization opportunities, customer case studies, testing techniques and more.

Storm Newsletters

Do you know someone who would like to be on our mailing list? Send us an email at storm@stormeng.com and we'll make sure they are ready to receive this publication. All of our past newsletters can be viewed online at www.stormeng.com.

Does your boiler have burner scroll inlets with any of the following?

- Burner "coking" or plugging
- Fuel line and coal nozzle wear
- High air/fuel ratio
- Boiler NO_x/CO/LOI/slag issues
- High de-superheating spray flows or SH/RH temperatures

Here is one solution in conjunction with performance testing and tuning.

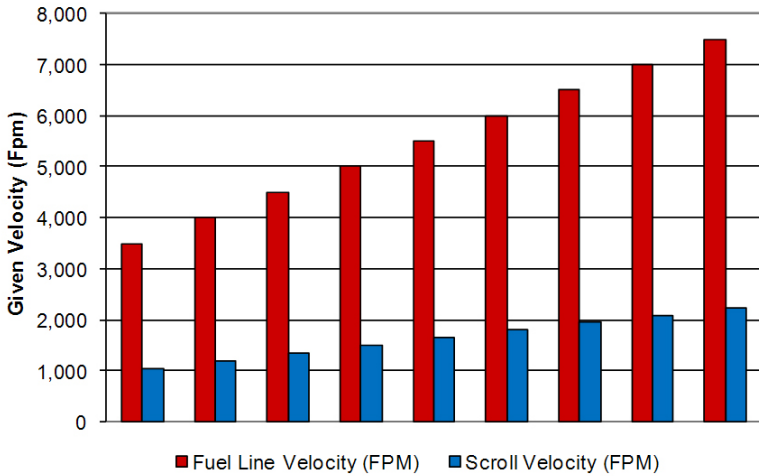


Scroll Burner Inserts

We were requested to provide a solution to address fuel line velocities while operating with a reasonable air fuel ratio on "scroll" inlet type burners. These burners are prone to have coal lay out in the inlet causing plugging and/or possibly burner fires. The situation was reviewed and the customer provided the necessary information and components so that we could provide an expedited solution. We were able to identify their problem through testing efforts and were able to provide an engineered solution to meet the plant outage schedule. On the next page is an overview of the problem and why Storm scroll burner inserts are beneficial.

The problem with scroll burners is that they generally have low velocities at the inlet, but high velocities at the outlet and the fuel lines. Because of this, it creates a larger area at the rear of the burner which results in the lowest velocities within the scroll inlet of the burners and the following graph shows this.

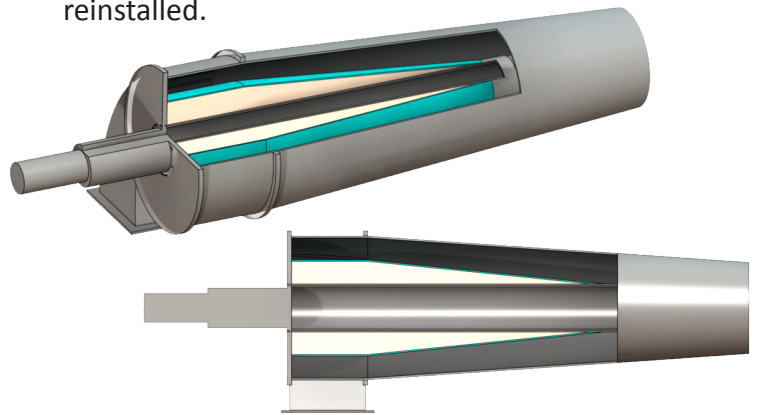
Typical Fuel Line Vs. Scroll Velocities



Inserts are designed to set the velocities within the burners to maintain coal in suspension throughout the fuel conveying system (fuel lines to furnace). The stainless steel insert shown (in teal) is welded to the existing inner pipe and back plate. The void between the new insert and inner pipe is filled with a high density/erosion resistant refractory so there are no "dead air" spaces.

Due to the highly abrasive area in which the inserts are to be installed, the high density/erosion resistant material will be in place when the stainless steel erodes.

If you send the burner inner pipes along with igniter back plates and outer section to our shop, we will return them as a finished assembly ready to be reinstalled.



Summary of benefits - Scroll inserts:

- Allow for a more optimum air-fuel ratio to be maintained and controlled
- Maintain burner line and adequate scroll velocities
- Minimize coking of the nozzle at the scroll inlet
- Prevent coal layout in the scroll inlet
- Reduce velocities and wear on the fuel lines
- Improve mixing with the burners and secondary air for improved combustion and emission control

Heavy Duty Fine Cut Riffles

Some vertical spindle type pulverizers (suction and pressurized) are equipped with riffles that are prone to wear and should be inspected and replaced as needed. Riffles that are manufactured from thin materials will wear out quickly. In addition, many of them have poor distribution performance as well. Storm Technologies manufactures heavy-duty fine cut riffles that are nearly 50% thicker than typically designed and have solid dividers. For a case example, the table illustrates where "coarse cut" riffles (Figure 1) were installed on all mills with the exception of "fine cut" riffles (Figure 2) installed on Mill D. The data shows that the distribution is better for Mill D.

Fuel Balance Summary

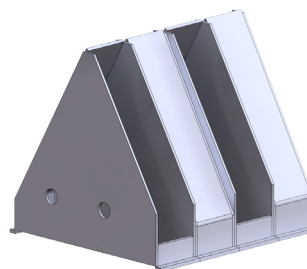
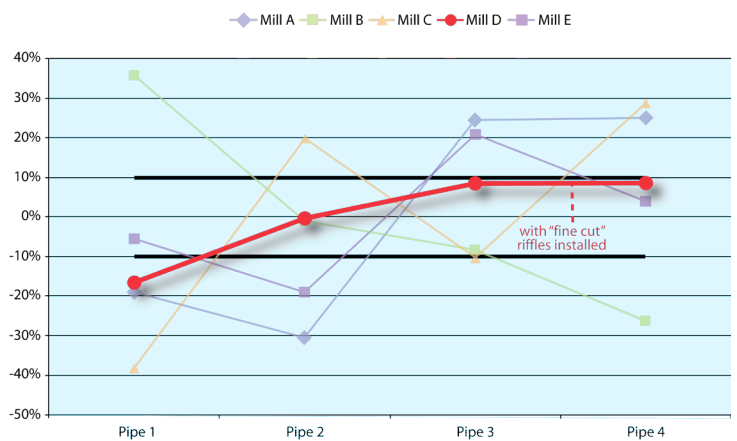


Figure 1
(Original "Coarse Cut" Riffles)

Figure 2
(New "Fine Cut" Riffles)



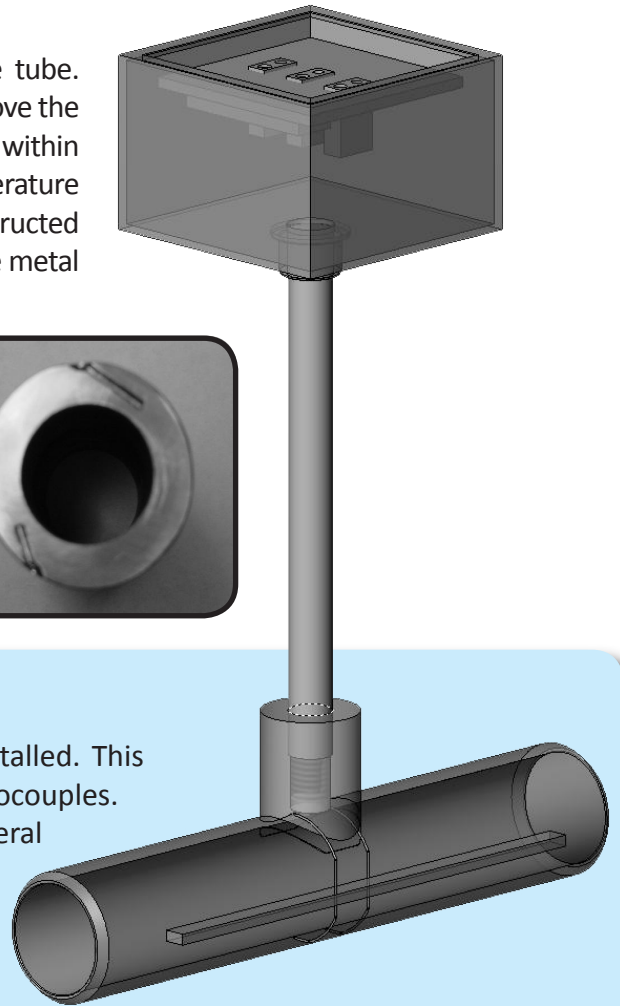
Chordal Thermocouples

Waterwall tube metal temperatures are highest on the fire side of the tube. Usually on a clean tube, the mean wall temperature is less than 50-75°F above the saturation temperature. Supercritical boiler furnace wall tubes are usually within similar temperature differences of about 50-75°F between the fluid temperature and the “crown” of the tube on the fire side. However, if circulation is obstructed or more commonly, if the water side of the tubes accumulate deposits, the metal temperatures can climb to the point of metal overheating.



The Purpose of the Chordal Thermocouple is Twofold:

1. To determine the approximate heat flux in the zone the tube is installed. This is roughly determined by the ΔT of the surface and depth thermocouples.
2. To ascertain the harmful deposition of water side deposits of mineral salts, iron oxide or other metallic oxides that impede the heat transfer through the water side deposit. This ΔT is additive to the temperature drop across the water tube inside surface interface. Therefore, the temperature of the tube metal can be increased above the allowable limits.



Chordal thermocouples are a useful tool for predicting waterwall metal temperature distress. The readings from the mean wall temperature of a chordal thermocouple should be recorded weekly after installation. If a previous problem of water side deposits caused overheating to the extent that acid cleaning of the boiler was required, then use of chordal thermocouples are useful tools to record temperatures on a weekly basis. The chordal thermocouple readings are directly related to heat flow through the tube wall. Therefore, the recording of temperatures should always be at the same high load, with the same burners in operation. Recording the mean wall temperature will provide a trend of water side deposits. It only takes a thin coating of water side deposits to increase the temperature of the tube metal. Iron oxide deposits have a heat transfer coefficient of about 1/70th of steel. Mineral deposits have even lower heat transfer coefficients.

If the tube metal temperature of a chordal thermocouple continues to gradually climb, then an adjacent tube sample should be removed for internal deposit analysis. This is one way to maximize boiler reliability and prevent surprise waterwall failures. Storm can design and manufacture these chordal thermocouple tube sections to monitor the mean wall temperature of waterwalls as well as heat flux chordals which monitor a surface and depth temperature within the waterwall tube.

Storm chordal thermocouples are custom fabricated for each application and can be provided in tubing of any length desired. Some applications require that a heavier walled tubing be used to provide adequate wall thickness once the thermocouples are installed for reliable indication and tube life. If a heavier walled tubing is used, the ID of the tubing is beveled on each end to match the ID of the existing tubing. Typical chordals are provided with a NEMA IV junction box connected to each chordal assembly for reading locally or connecting to the DCS. However, as stated above, each are custom designed and fabricated to meet each application's individual needs.