Biomass, Chemical Recovery & Energy-from-Waste

JANSEN Combustion and Boiler Technologies, Inc.

BOILER NEWS

Number 47, Spring 2020

OUR MISSION

Our Company provides combustion, boiler, and energy technologies, products, and services.

We are dedicated to working with our clients to help define and achieve their productivity, reliability, efficiency, safety, and environmental goals.

We accomplish this by:

- *Listening and understanding.*
- *Providing a flexible approach to problem solving.*
- *Developing creative and innovative solutions.*
- *Partnering with clients to implement these solutions.*

We commit ourselves to creating a challenging and supportive work environment that fosters opportunity for professional growth and fulfillment.

Our team is dedicated to the highest standards of professional ethics and integrity.

INSIDE THIS ISSUE

Recently Completed BFB and CFB Boiler Evaluations

In Jansen's fall 2019 newsletter (No. 46) we reported on a study of erosion/corrosion in a bubbling fluidized bed (BFB) boiler in Brazil. Since then, Jansen has completed three additional evaluations on BFB and circulating fluidized bed (CFB) boilers.

Lower Primary Air Port and Grid Nozzles in Fluidized Bed Boiler

Jansen evaluated two Pyropower CFB boilers in New England that were unable to maintain the same ratio of biomass to coal firing between winter and summer operations. The study identified several shortcomings, including insufficient bed inventory, excessive biomass overflow conveyor flow, and fuel bin screws tripping due to ice chunks in the biomass.

Bed inventory control was complicated by bed pressure tap plugging, which forced use of the primary air (PA) windbox pressure to track bed height. However, the type of PA grid nozzles used in the boiler are prone to plugging. Over time, the result of increased pressure drop across the grid nozzles was less bed inventory for the same PA windbox pressure. Jansen recommended replacing the bed pressure taps and grid nozzles with improved designs. For the biomass supply system, Jansen recommended higher torque screws, and a weightometer on the return conveyor to allow better overflow control.

Continued on page 2

Focus on: Pressure Part Engineering

Jansen has gained a reputation for designing and supplying combustion system upgrades for recovery boilers and power boilers. Along with all those air ducts and nozzles, fuel distributors, burners and liquor nozzles are necessary pressure part modifications to wall tubes and downcomers, all of which is included in Jansen upgrades. In addition to these pressure part modifications to support combustion system upgrades, Jansen has designed and supplied large pressure part replacements, including water wall panels, floors, superheaters and economizers.

Jansen is authorized by the American Society of Mechanical Engineers (ASME) ("S" stamp) and the National Board of Boiler and Pressure Vessel Inspectors ("R" stamp) to design boiler pressure part components. As part of our design, we perform the engineering calculations necessary to ensure the pressure parts are sized correctly with regards to heat transfer, steam side pressure drop, tube wall temperatures, and tube wall thickness. Project deliverables and services typically include installation and fabrication drawing packages, shop inspections of equipment, construction support during installation, and, if appropriate, start-up and tuning assistance following installation.

Continued on page 2

Recently Completed BFB and CFB Boiler Evaluations

Continued from page 1

A BFB boiler in Brazil was evaluated to find ways to reach the design steam flow and to reduce maintenance. Problems included fuel bin screws frequently breaking, fuel chutes warping, generating bank tube thinning, and an inability to reach the design load because of excessive steam flow swings. Jansen recommended operating with lower fuel bin levels to reduce screw breakage and allow more flow through the chutes that warp. The wide fluctuations in steam flow are believed to be caused by poor fuel modulation with steam demand.

Removal of thinned generating bank tubes is planned for 2020, but the evaluation indicates that this will cause issues with controlling the final steam temperature unless the feedwater routing is changed to allow a gain in capacity of the sweetwater condenser supplying desuperheater water.

JANSEN evaluated another BFB boiler in the Eastern USA to solve bed temperature control difficulties at times of either unusually dry or wet fuel. Findings indicate that issues with wetter fuel were caused primarily by bed agglomeration and potentially faulty bed temperature measurements by some of the bed thermocouples. Contributing factors for bed temperature problems with dryer fuel included limiting the PA from dropping below a set minimum and insufficient flue gas recirculation (FGR) fan capacity due to high flue gas oxygen caused by air heater leaks and high excess air operation. Jansen recommended modifying the bed temperature calculation to avoid skewed values, modifying the PA fan controls to allow lower bed flow, and fixing air leaks to reduce the oxygen content of the FGR.

Focus on: Pressure Part Engineering

Continued from page 1

Jansen-Designed Wall Tube Panel for Fuel Distributor Opening

Project scopes for pressure part design range from as small as a single bend tube opening for inserting a furnace camera to as large as complete lower furnace replacements for power boilers and recovery boilers, including downcomer and waterwall header modifications.

Jansen has also executed complex pressure part projects such as new superheater pendants and headers with inter-stage piping, sweetwater condensers, steam drum modifications, economizer additions and modifications, and attemperator stations. Our superheater designs have incorporated tube material changes and weld overlay for improved corrosion and erosion resistance, additional heat transfer surface area, improved pendant support systems, and steam cooled spacer tubes for improved lateral support.

Jansen focuses on listening to and understanding our clients' needs, whether it is addressing a fundamental design issue with existing equip ment, or modifying equipment in order to support future operational goals. As with our combustion system upgrades, we sell nothing "off the shelf." Jansen is committed to providing Customized Engineered Solutions for all the industries we serve.

Jansen Welcomes

Trevor Seidel. Trevor recently graduated from the University of North Dakota in Grand Forks, North Dakota, where he earned his master's degree in Chemical Engineering. While in school, Trevor focused on topics related to chemical process engineering and computational fluid dynamics. During his graduate studies, he modeled problems associated with oxy-coal combustion processes. Recently, an article was published as a result of this effort which details a new methodology to model coal combustion. Trevor also has previous experience researching bacterial fermentation of syngas and nanoparticle dispersions for solar energy utilization.

Outside of work Trevor spends time with his wife, Olivia. Having recently relocated to Redmond from North Dakota, he and his wife spend a great deal of time exploring the area.

Trevor is working as a CFD Engineer in Jansen's Process Engineering Department.

Successful Tuning in Biomass Boilers

Biomass boiler performance can decline over time due to maintenance issues, fuel quality changes, drift in setpoints and targets, or other issues. Given the cost of equipment upgrades or replacement, boiler tuning is often a good first response to diminished performance. The approach to tuning is an important factor in whether tuning will be successful.

Stoker Fired Biomass Boiler

First, the boiler and its problems must be understood. Are the key instruments functioning and well calibrated? What limits the air and fuel systems (fan capacities, grate or bed conditions, fuel feed limitations, etc.)? Are all field control devices (dampers, air ports, fuel distributors, etc.) functional? Answers to these and other questions can help set the tuning parameters and potential for performance improvement.

The next step is to optimize fuel distribution to the grate or fluidized bed. Grate or bed conditions should be visually assessed if possible, either using a furnace camera or through lower furnace view ports. Distributor air pressure and feed screw speeds should be adjusted to achieve as uniform of fuel delivery as possible. For stoker boilers with continuous ash removal grates, the grate speed or vibrating schedule should be modified to achieve a desired fuel and ash bed depth and to achieve complete burnout before discharge from the grate. This cycle of observation and adjustment may have to be repeated many times during tuning.

Adjustment to the combustion air system will follow. Here, the oxygen trim setpoint, the split between undergrate (primary) air and overfire (secondary) air, and pressures at both air levels should be manipulated to minimize fuel being blown into the upper furnace to burn in suspension or fuel piling due to poor combustion in the lower furnace. This step is often performed with the air system in cascade mode, but may require switching to local automatic or manual mode. Flue gas carbon monoxide (CO) emissions should be monitored, either via a boiler instrument or portable flue gas analyzer, as an indicator of combustion improvements.

Finally, the air and fuel control systems should be reprogrammed based on the tuning results, if possible. Tuning across a range of loads can yield new curves for flue gas oxygen and combustion air flows. Modifying the control system to reproduce these settings can ensure improved boiler performance in future operations.

Two recent tuning efforts by Jansen engineers stand out for excellent results. Boiler A had issues with high and widely fluctuating CO emissions. By reducing the fuel distributor pressure, increasing overfire air flow, and decreasing undergrate air flow, CO was stabilized and cut by about 35%, even with a simultaneous reduction in natural gas co-firing. For Boiler B, char carryover from the furnace was the problem. Fuel screw speed adjustments coupled with primary air/secondary air optimization resulted in near elimination of char in the dust collector hopper, along with a 50% reduction in CO.

Jansen's methodical approach to tuning and years of experience can yield significant improvements in boiler performance and stack emissions. Contact Jansen for your boiler tuning needs!

RECEIVE OUR
Newsletter by E-mail

This newsletter (No. 47, Spring 2020) is again being sent by e-mail to our contacts for whom we have an e-mail address. We are continually expanding the electronic distribution list for our newsletter.

To receive this and upcoming newsletters electronically, send your e-mail address to jansen@jansenboiler.com to be added to the list.

Additional information and specific project references can be found on our website at www.jansenboiler.com.

JANSEN Combustion and Boiler Technologies, Inc.

Boiler News is published regularly by Jansen Combustion and Boiler Technologies, Inc. to provide information to Owners and Operators of boilers.

Inquiries should be directed to:

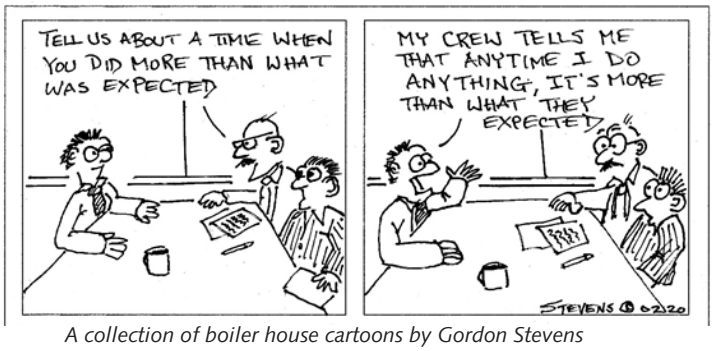
Editor, Boiler News
Jansen Combustion and Boiler Technologies, Inc.
11335 NE 122nd Way, Suite 275
Kirkland, WA 98034

Phone: (425) 825-0500 Fax: (425) 825-1131
E-mail: jansen@jansenboiler.com

NEWS Briefs

Jansen's experience in the pulp & paper, forest products, agricultural, and waste-to-energy industries and with independent power producers is extensive. Services recently provided to our customers include the following, many of which are in progress:

- Engineering evaluations of biomass, chemical recovery, waste-to-energy, and coal-fired boilers.
- Chemical recovery boiler capacity and condition assessments.
- Combustion air system upgrades.
- Economizer and superheater upgrades.
- Boiler steam/water-side circulation studies.
- CFD modeling of biomass, chemical recovery, and waste-to-energy boilers.
- Emissions control evaluations (CO, NO_X, TRS, and PM).
- Boiler operational tuning and optimization support.
- Boiler MACT compliance review and operational tuning.



A collection of boiler house cartoons by Gordon Stevens shown in our previous newsletters can be viewed on our website: www.jansenboiler.com.

For further information on these types of projects, contact John La Fond at 425.952.2832 or by e-mail at john.lafond@jansenboiler.com, or Marcel Berz at 425.952.2836 or by e-mail at marcel.berz@jansenboiler.com. Specific project references can be found on our website at www.jansenboiler.com

Attend Our Spring 2020 Biomass Boiler Workshop

Nashville, Tennessee | May 14 and 15, 2020

Due to travel restrictions related to the COVID-19 outbreak, and with the health and safety of our clients in mind, the spring 2020 Biomass Boiler Workshop has been postponed. The workshop will be rescheduled for fall 2020 in Nashville, Tennessee. Please watch for future announcements or check at www.jansenboiler.com for updates. Thank you for your understanding.

POSTPONED

Since Jansen's workshops began in 2000, they have been attended by over 1,000 engineers, operators, and managers from numerous plants in the pulp & paper, forest produc[illegible] independent power, and food processing industries.

The workshops consist of presentations abo[illegible] hnol[illegible] dev[illegible]nts and results of upgrades to improve the operating performance, burning capacit[illegible] thermal e[illegible]ency, [illegible] fuel economy of biomass- and waste fuel-fired boilers. In addition, the program will in[illegible]p[illegible]es fo[illegible]oubleshooting and problem solving discussions of challenges that attendees bring to th[illegible]. Pa[illegible]ipants [illegible] be[illegible]it by: 1) learning from experts in the industry about current retrofit technology for biom[illegible]b[illegible]rs[illegible]d a[illegible]ci[illegible]d equipment; 2) seeing how other mill operations solve their biomass boiler area problems; and 3) disc[illegible]ing pot[illegible]ial solutions for their specific problems. Attendance to the workshop is free of charge, but space is limited.

Stay tuned at www.jansenboiler.com/biomass-boiler-workshops for information on future workshops!

For sign-up and to receive a detailed program of the technical presentations, workshop location, and hotel information, please contact Cathy Thomas by phone at 425.952.2835 or by e-mail at cathy.thomas@jansenboiler.com.

The workshops are presented and co-sponsored by:

JANSEN Combustion and Boiler Technologies, Inc. · processbarron · EMERSON Process Management · LDX SOLUTIONS · PSA WWW.PSAENGINEERING.COM · KENNAMETAL