

BOILER NEWS

Number 45, Winter 2019

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.

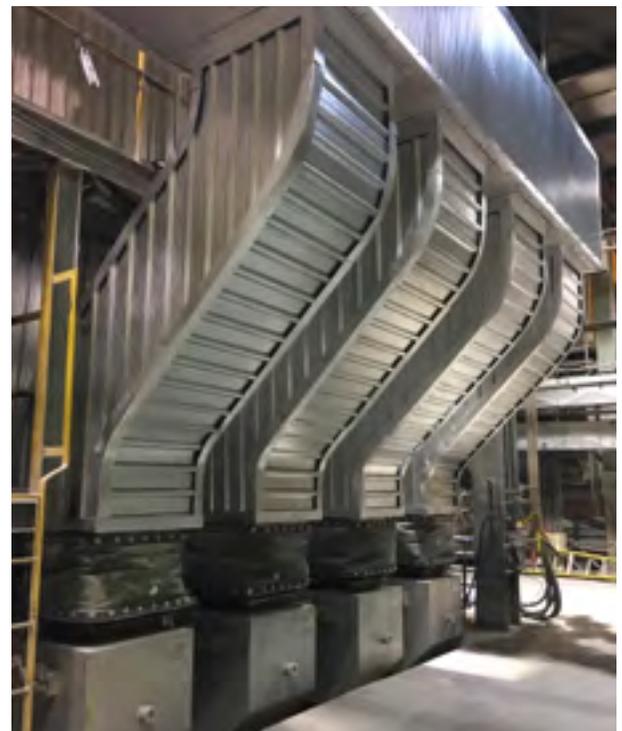
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Power Boiler Upgrade Leads to Increased Biomass Firing and Elimination of Oil Co-Firing

In our previous issue (No. 44, Winter 2018), we highlighted an upcoming boiler upgrade that would include a Jansen overfire air (OFA) system, new fuel feed bin, new grate and ash removal system, and new fuel distributors. The boiler is a biomass-fired unit at the Canadian Kraft Paper Industries (CKPI) pulp mill in The Pas, Manitoba. The upgrades were installed during summer 2018, and the boiler has shown greatly improved performance since the start-up in September. Biomass firing has increased by 70% (from 380 tonnes/day to 640 tonnes/day) and recycle fuel oil co-firing has been eliminated.

This particular upgrade has a fairly long history. Jansen had presented the mill with an upgrade proposal in 2015, but after initial development the project was shelved because of funding restrictions.



New Jansen OFA nozzles and ducting.

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Recovery Boiler Upgrade Lifts Liquor Limits

Another major project for Jansen in 2018 was the design and supply of air system upgrades for a kraft recovery boiler in western Canada. The B&W boiler was supplied in the early 1960s with an original virgin dry liquor solids firing rate of 2.4 million lb/day. Following a low-odor conversion and later pressure part modifications to increase steam/water-side circulation, the boiler's reported design liquor firing capacity increased to 3.96 million lb/day with a maximum steaming rate of 520,400 lb/hr. However, the boiler was never able to achieve such high liquor firing rates.

In recent years, the boiler was limited to firing rates of about 2.9 million lb/day due primarily to excessive total reduced sulfur (TRS) emissions. The mill contracted Jansen to conduct a boiler capacity upgrade evaluation. Jansen's study concluded that the boiler's induced draft (ID) fan was limiting the boiler load and excess air levels, and that the secondary air (SA) and tertiary air

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Power Boiler Upgrade

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Ultimately, however, the mill came under new ownership and the project was revived.

The boiler is a 1974 Foster Wheeler unit originally equipped with a stationary pinhole grate. The grate sloped steeply down from the rear wall to a flat section near the front. As a result of this design, biomass piled at the bottom of the grate's slope section, greatly limiting its biomass burning capacity. Jansen had installed an OFA system on the boiler in 1999, but the grate design, coupled with limitations in the boiler's fuel feed system, led to unsteady combustion, high ash and char carryover, and difficulty in achieving high steam loads on biomass firing.

The 2018 upgrade included a new Jansen OFA system that was sized for increased biomass burning and featured a multi-range design that allows greater system flexibility over a wide range of steam loads. The boiler also received a new Detroit Stoker air-cooled horizontal vibrating grate and pneumatic fuel distributors, along with a new ProcessBarron live bottom fuel bin and ash handling equipment. These upgrades required extensive pressure part modifications to the lower furnace water walls, downcomers, and headers, as well as an undergrate air delivery system, all of which Jansen designed and supplied.

With these improvements, not only has fuel delivery and grate combustion greatly improved, but the operators are no longer faced with difficult and dangerous manual grate cleaning. The Jansen OFA system is keeping CO emissions below pre-



Lower furnace water walls, downcomers and headers being installed for grate replacement.

upgrade levels and reducing carryover from the furnace even though biomass firing is greatly increased. CKPI staff has estimated that the mill will save over CDN\$3.5 million a year by eliminating oil firing in the boiler. In their words, "The end results are second to none."

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Recovery Boiler Upgrade

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(TA) systems lacked sufficient capacity and mixing effectiveness to support operation at higher liquor firing rates. Subsequent Computational Fluid Dynamics (CFD) modeling performed by Jansen showed that upgrades to the combustion air delivery systems could allow increased liquor firing while reducing TRS to less than pre-upgrade levels.

To improve combustion conditions in the furnace and increase the firing capacity up to an interim level of 3.3 million lb/day, Jansen was contracted to install modern SA and TA systems. New automatic port rodders were supplied with each new air nozzle.

The installation was completed in April 2018. Since start-up, the boiler has been able to fire at rates above the interim target level. With additional recommended work on the TA fan, ID fan, and primary air ports, it is expected that further increases in firing rates will be achieved.

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New Jansen TA nozzles during recovery boiler start-up.

Recent Erosion Evaluations on Biomass Boilers

Erosion of furnace pressure parts, air heater tubes, and other boiler equipment is a costly and ongoing maintenance issue for many biomass-fired boilers. Root causes can include: 1) excessive quantities of inert material in the fuel, 2) pressure part design deficiencies, 3) over firing, leading to excessively high flue gas velocities, 4) high ash carryover, often due to insufficient use of overfire air, and 5) poor performance of a mechanical dust collector (MDC).

Jansen engineers have recently completed erosion evaluations on the following three biomass-fired boilers:

- **Circulating fluidized bed boiler:** This unit experienced numerous tube failures in the superheater and wall tubes in the proximity of the superheater. Jansen engineers conducted an inspection and parametric study to find operational factors that could reduce erosion. Although using more primary air and less flue gas recirculation flow, and improving side-to-side fuel distribution uniformity were identified to be beneficial, the main cause for the recent failures was attributed to the use of inappropriate replacement materials and poor repair techniques.
- **Stoker-fired biomass boiler:** This boiler has experienced excessive erosion damage, particularly in the ID fan. Jansen's evaluation included on-site data collection for flue gas flow rates, oxygen, pressure, particulate loadings, particulate size distribution, and loss on ignition at both the MDC inlet and outlet. The results indicated low MDC collection efficiency, primarily due to air in-leakage through the rotary valves at the MDC ash hopper outlets.

- **Stoker-fired multi-fuel boiler:** This boiler experienced erosion in the economizer after a recent ID fan upgrade that allowed significantly more biomass burning. The Jansen evaluation indicated that the economizer design, particularly exposed tube bends in the flue gas stream, was the main culprit, considering that flue gas bulk velocities in the economizer were in the normal range. A contributing factor was the high fraction of combustion air supply through the grate and the underutilization of the OFA system, which caused excessive char and ash carryover. marcel.berz@jansenboiler.com 



Photo of a severely eroded boiler tube.



Rainbow Road - Charleston, South Carolina

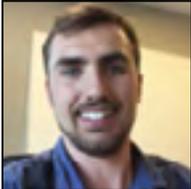
ATTEND OUR WINTER 2019 BIOMASS BOILER WORKSHOP

Charleston, South Carolina
February 21 and 22, 2019

(See page 5 for details)

WELCOME TO OUR NEW EMPLOYEES

In this issue we welcome three new employees, one each in our Process Engineering, Design Engineering, and Administrative departments. Please join us in welcoming...



CORY LUKER
Process Engineer

Cory recently graduated from the University of Washington in Seattle, WA where he earned his master's degree in Mechanical Engineering. While in school, Cory focused on topics related to energy systems and worked for the Northwest National Marine Renewable Energy Center (NNMREC). His work at NNMREC included managing the final design and construction of a hydrokinetic turbine testing facility and designing a thermal management system for a wave energy converter. In addition, Cory has previous experience designing fuel systems for biodiesel powered cars and researching biomass heating systems used in remote Alaskan villages.

Cory lives in Seattle and is a passionate fly fisherman and photographer.

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

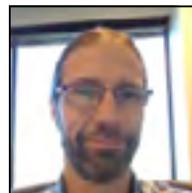


JEFF JAY
Mechanical Designer

Jeff has been a mechanical designer for over 30 years, most recently as a piping designer. His previous experience was in various industries including marine, oil and gas, pulp and paper, aircraft, and power. Jeff has led project discipline teams, laid out piping

systems, created general arrangements, checked drawings, and participated in construction field support and surveys. Jeff lives in Bothell with his faithful Yorkshire Terrier sidekick Dude and when away from the office he enjoys working out, playing golf, and hanging out with his faithful sidekick.

Jeff is working as a Mechanical Designer in Jansen's Design Engineering Department.



PATRICK VERBOUT
Manager of Finance & Administration

Patrick grew up in the Portland area, then moved with his family to a farm in eastern Oregon. He earned a degree from Oregon State University in Agricultural Business Management and a degree from Eastern

Oregon College in Business/Accounting. His professional experience includes work in the accounting field for a number of engineering, environmental remediation, and construction companies. Patrick managed the finance portion of the construction of a desalination facility in Trinidad & Tobago, which is now supplying water to much of south Trinidad island. He has been working in the accounting field as a Controller for several years.

Outside of work he spends time with his daughter, whose love for ice skating has led to Patrick playing hockey. He lives in Kirkland and spends a lot of time in the gym and in the outdoors.

Patrick is serving as Jansen's Manager of Finance and Administration.

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 and upgrades of biomass, chemical recovery, waste-to-energy, and coal-fired boilers.
- Chemical recovery boiler capacity and condition assessments.
- Boiler steam/water-side circulation studies.
- CFD modeling of biomass, chemical recovery, and waste-to-energy boilers.
- Boiler operational tuning and optimization support.
- Boiler MACT compliance review and operational tuning.



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

ATTEND OUR WINTER 2019 BIOMASS BOILER WORKSHOP

Charleston, South Carolina, February 21 and 22, 2019

Since 2000, these workshops have been attended by over 1,000 representatives of numerous plants in the pulp & paper, forest products, and food industries, independent power producers, and energy-from-waste industry.

The workshops consist of presentations about new technological developments and results to improve the operating performance, waste fuel burning capacity, efficiency, and fuel economy of biomass-fired boilers (mostly stoker-fired). In addition, the program will include troubleshooting and problem solving discussions of challenges that attendees bring to the workshop. Participants will benefit by: 1) learning about current retrofit technology for biomass boilers and associated equipment; 2) seeing how other mill operations solve their biomass boiler area problems; and 3) discussing potential solutions for their specific issues. Attendance to the workshop is free of charge, but space is limited.

Stay tuned at 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. 



Rainbow Road - Charleston, South Carolina

The workshops are presented and co-sponsored by:



RECEIVE OUR Newsletter by E-mail

This newsletter (No. 45, Winter 2019) 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, you may directly sign-up through the link on our website (<http://jansenboiler.com/publications/newsletters/>) or alternatively, send your e-mail address to editor@jansenboiler.com to be added to the list. 

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



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

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