Successful Startups Reflect Effective Upgrades

In our last issue (No. 42, Spring 2016), we reported on the many startups for boiler upgrades that Jansen would be doing in 2016. While each of these startups was successful in its own right, three are especially noteworthy for their stellar results.

Boiler A, located in the Southeastern US, was designed for a maximum steam load of 250,000 lb/hr on natural gas or oil or 232,000 lb/hr on biomass plus natural gas co-firing. Due to an inadequate combustion air system, plus issues with the grate and fuel feed equipment, the boiler was typically able to generate only around 150,000 lb/hr on hog fuel, often with natural gas co-firing, and CO emissions were extremely high. Jansen provided a new overfire air (OFA) system while the mill also installed a new grate and fuel distributors.

Jansen’s guarantees for the project were a steaming rate of 173,000 lb/hr on hog fuel only and CO emissions not exceeding 1,400 ppm at the guarantee steam load. Performance tests in July brought clear results: despite extremely high volumetric heat loadings, not to mention occasional fuel feed issues and grate temperature excursions, the boiler averaged 172,000 lb/hr of steam with CO emissions at 1,020 ppm.

Boiler B is located in western Canada. It was originally designed for steam generation rates of up to 450,000 lb/hr on fuel oil or 250,000 lb/hr burning hog fuel on the grate. During the region’s damp winters, hog fuel moisture is typically high, often above 60%, which led to sharp reductions in steam generation from hog fuel, high CO emissions, and large amounts of char carryover. Jansen supplied a new OFA

Jansen Tackles Four-Boiler Evaluations in Colombia

Jansen has had a significant presence in Colombia over the years, performing studies on recovery boilers and power boilers in various pulp mills and sugar plants, and installing combustion system upgrades on two recovery boilers. The city of Cali, in particular, has been host to Jansen for several projects. That trend continued in late 2016 when four Jansen engineers traveled to Cali to begin evaluations of four power boilers located in three different plants. Although the boilers all fired some combination of coal, pith, and/or bagasse, each had unique challenges.

A general goal for all four boilers was to increase steam generation from pith firing. Pith and bagasse are the fibrous materials that result when sugar cane is crushed and the juice extracted for sugar production. The longer bagasse fibers are used in making pulp, although bagasse can be used as a fuel alongside the shorter pith fibers. Considering the amount of cane processed in the plants Jansen visited, there is an economic incentive to using pith as a fuel rather than disposing of it.

Boiler A was supplied by Fives Cail Babcock with a maximum design steaming rate of 243,000 lb/hr on coal, and currently fires a mixture of coal and pith in suspension. The boiler has a unique “igni-fluid” design, which is an early iteration of a modern circulating fluidized bed boiler. There are reportedly only four boilers in the world of this kind, two of which Jansen has now studied. Boiler B also fires coal and pith, but on a conventional grate, with a design steaming rate of 250,000 lb/hr. Factory Sales & Engineering supplied Boiler B in 2007.
Recent Boiler Efficiency Evaluations and Plant Energy Assessments

Jansen engineers have recently completed the following process evaluations with the goals to improve the boiler and/or overall plant energy efficiency:

• Thermal efficiency improvements in several biomass boilers, finding options to reduce fuel usage by installing economizer surface, reducing excess air, and considering condensing economizers.

• Natural gas fired boiler energy efficiency evaluation in New England. The client is considering switching to continuous use of its high pressure backup boiler and an idle steam turbine generator. Study aspects included the use of a condensing economizer, installing more economizer surface, operating at lower excess air, replacing an ID fan outlet damper with a VFD, and a turbine drive for the feedwater pump.

• Evaluation of two natural gas package boilers that showed strongly different thermal efficiencies based on fuel flow rates. The results indicated fuel metering issues as the root cause. Also studied options to reduce NOx emissions by replacing the laminar air heater with an economizer and/or installing low NOx burners.

• Two Boiler MACT energy assessments were completed for a West Coast biomass power plant and for a large pulp mill in the South. In addition to boiler performance reviews, these assessments included evaluating steam turbines, feedwater heaters, and energy performance of mill equipment such as multiple-effect evaporators, digesters, and paper machine hoods.

• Plant energy efficiency evaluation to assist a University power plant with making future equipment operation strategies. This included five natural gas fired boilers, a feedwater heater, and a back pressure steam turbine generator.

For further information and specific inquiries, please contact Marcel Berz at 425.952.2836 or John La Fond at 425.952.2832, or by e-mail at marcel.berz@jansenboiler.com.

Jansen Tackles Four-Boiler Evaluations in Colombia

The owner of Boilers A and B would like to increase pith firing in both units while reducing coal usage, but increases in pith firing are hampered by insufficient capacity in the ID fans. Other issues include generating bank tube erosion in Boiler A and an underperforming economizer in Boiler B. Jansen’s evaluations of these boilers focused on increasing pith firing rates, understanding the effects of changing pith moisture, and employing CFD modeling to examine different firing scenarios. Installing smaller generating bank tubes to reduce erosion rates and upgrading the ID fan were identified as the primary solutions to meet the client’s goals for Boiler A. For Boiler B, an ID fan upgrade is also in store, as well as a possible FD fan upgrade.

Boilers C and D were manufactured by Distral, a Combustion Engineering licensee. The two units fire a mixture of coal, bagasse, and pith, with design steaming rates of 300,000 lb/hr and 200,000 lb/hr, respectively. Both experience extremely high CO emissions and, for Boiler D, high stack opacity. The owner wants to increase pith firing and decrease coal firing for both units, and is considering increasing the steam flow and final steam temperature for Boiler C.

Jansen’s evaluation of Boiler C consisted of boiler performance calculations, a boiler circulation analysis to determine maximum steam generation capacity, and a detailed superheater evaluation. For Boiler D, Jansen employed boiler performance calculations and CFD modeling to find ways to improve the effectiveness of the combustion air system. Jansen’s evaluation showed that both boilers are in need of upgrades to the fuel feed equipment and air system controls, as well as new air system instrumentation. Boiler C will also require a new superheater to achieve higher steam temperatures, plus possible fan upgrades.

For all four boilers, Jansen issued detailed cost estimates for the various recommended boiler upgrades. The clients are evaluating Jansen’s studies and recommendations to decide on a path forward. Jansen looks forward to continued work in Colombia and throughout Central and South America in 2017!

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Jansen has made extensive use of Computational Fluid Dynamics (CFD) modeling over the years in evaluating combustion conditions inside boiler furnaces. These evaluations are a key element in predicting how changes in fuel and air delivery impact the combustion process and the flue gas conditions leaving the furnace. But downstream of the furnace, there is often a need to better understand flue gas and particulate matter flow patterns and their effect on boiler equipment and performance. Here again, Jansen’s CFD modeling has been a powerful evaluation tool in a variety of projects.

The figures below show just a few examples of Jansen’s non-furnace CFD modeling. In each case, the model’s calculated velocity profiles were useful in identifying problem areas or “hot spots,” whether inside a multiclone dust collector (Figure 1) or CFB combustor cyclone (Figure 2), entering a precipitator (Figure 3), or through heat transfer surfaces (Figure 4). The information from the model can then be used in addressing questions related to equipment sizing or the need for redesign.

Jansen CFD modeling is performed entirely in-house by Jansen engineers. Contact Jansen for more information on how our capabilities can help improve your plant’s performance.

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system in order to allow steaming at 275,000 lb/hr on hog fuel only. Jansen tuned the boiler during startup in June 2016 and again in December. Fuel moisture was slightly below 50% in June, but was around 62% in December. The upgraded boiler showed improved performance under both fuel conditions, with increased steam generation from hog fuel and drastically reduced char carryover. Mill data in fact showed that char carryover was cut by more than half in the first month following the startup compared to a seven-month period in 2014.

Boiler C, located in central Canada, has a maximum steaming rate on biomass of 287,000 lb/hr and up to 397,000 lb/hr on natural gas or oil. Furnace combustion issues limited the unit’s typical steam generation to less than 231,000 lb/hr and forced natural gas co-firing most of the time. Jansen designed and supplied an OFA system to increase steam generation from hog fuel and decrease char carryover from the furnace.

The OFA system performed well during startup and tuning in June, providing significantly more OFA flow capacity than with the old air system. The benefits of the new OFA system were immediate. Before the upgrade, deficiencies in the OFA system forced higher air flow through the grate, which led to the virtual absence of an ash bed. With the upgrade, the increased OFA flow allowed a reduction in grate air flow. This in turn helped create and sustain an ash bed on the grate, and substantially reduced the amount of ash and char blown off the grate and out of the furnace. Achievable steam generation from hog fuel was also greatly increased compared to the pre-upgrade boiler.

For general information or specific inquiries, please contact John La Fond at 425.952.2832 or by e-mail at john.lafond@jansenboiler.com.

This work was completed, or is currently in progress for the following companies:

- Alabama River Cellulose LLC
- Appvion
- Atlantic Power Corporation
- AV Terrace Bay
- Boise Wood Products LLC
- Capital Power Corporation
- Cargill Agricola
- Caribo Pulp and Paper
- Carvajal Pulpa y Papel
- Cascade Pacific Pulp LLC
- Catalyst Paper
- Clearwater Paper
- Cosmo Specialty Papers
- Covanta Energy
- Daishowa Marubeni International
- Dominion Virginia Power
- Domtar Inc.
- Doyon Utilities
- DTE Stoneman
- Finch Paper LLC
- Georgia-Pacific LLC
- Glafelter
- Greenleaf Power
- Howe Sound Pulp & Paper Corporation
- International Paper Company
- International Paper do Brasil Ltda
- Kapstone Paper and Packaging
- Louisiana-Pacific
- Mackenzie Pulp Mill Corporation
- MeadWestvaco Corporation
- Minnesota Power
- NewPage Corporation
- Nippon Industries
- Northern Pulp Nova Scotia Corporation
- Paper Excellence
- Port Townsend Pulp Company
- Resolute Forest Products
- RockTenn
- Roseburg Forest Products
- Sappi North America
- Skookumchuck Pulp Mill
- SP Fiber Technologies
- Suzano Papel e Celulose
- Tolko Industries
- University of Washington
- West Fraser - Hinton Pulp
- Weyerhaeuser Company
- Wheelabrator Technologies, Inc.
- Woodland Pulp LLC

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. Additional information and specific project references can be found on our website at www.jansenboiler.com.
ATTEND OUR SECOND 2017 Biomass Boiler Workshop
Montreal, Quebec, September 14-15, 2017

Since 2000, these workshops have been attended by over 1,000 representatives of numerous plants in the pulp/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 problems. Attendance to the workshop is free of charge, but space is limited.

Stay tuned at jansenboiler.com/biomass-boiler-workshops for information on 2018 workshops!

The workshops are presented and co-sponsored by:

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

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This Newsletter, No. 43, Spring 2017, 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.

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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: editor@jansenboiler.com