JANSEN
Combustion and Boiler Technologies, Inc.

Recovery & Power BOILER NEWS

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Biomass Boiler Overfire Air System Upgrades... from Atlantic to Gulf to Pacific

In the first half of this year, Jansen was awarded contracts to design/supply biomass boiler overfire air (OFA) system upgrades on eight (8) units in the forest products industries. In two of these projects Jansen carried out engineering, procurement, and construction (EPC) responsibilities.

From the States of Maine to Louisiana to Washington, power boilers of different vintage, design, and size were upgraded by Jansen with efficient OFA delivery systems to improve operational performance, waste fuel burning capacity, emission performance, and last but not least: fuel economy. These upgrades were installed during outages between May and October. Following is a brief synopsis of these projects.

Mill in Virginia. At this mill the No. 6 Power Boiler is a 1957 Babcock & Wilcox (B&W) unit with design steaming capacity of 325,000 lb/hr at 750°F and 600 psig. The purpose of the OFA system upgrade was to minimize emissions of CO and NO_x from

Four Jansen OFA nozzles with dampers and pressure gauges are shown on the left side wall of the No. 6 Power Boiler, together with expansion joints and air supply ducting

burning wood waste and stoker coal, while following mill steam demand fluctuations. The customer had defined specific performance requirements pertaining to steam generation rates, types and quantities of fuels burned, as well as emissions limitations for CO and NO_x.

The upgrade was installed in July of 2003. The work included necessary improvements to the combustion air system, namely installation of a new OFA fan and upgraded OFA delivery from the side walls through eight Jansen High Energy Combustion Air Nozzles™. The supply also included other associated air system components, such as dampers and actuators, expansions joints, bent tube openings, flow meters, and pressure transmitters. Because of their location, selected boiler downcomer sections were relocated to accommodate the installation of the air nozzles.

The upgraded OFA system has maximized wood waste combustion, minimized ash carryover, and reduced excess air usage in the lower furnace, while meeting the predicted emission limits.

Mill in Louisiana. OFA delivery was upgraded on two identical boilers originally supplied by B&W in the early 1980s. The units, each rated at 500,000 lb/hr steaming capacity (at 925°F and 1,275 psig), burn a combination of wood waste, sludge, and tire-derived fuel (TDF), along with fuel oil, pulverized coal, or natural gas.

The objectives of the upgrades were to:

- Increase combustion efficiency,
- Reduce carryover of ash and unburned carbon,
- Reduce maintenance caused by excessive erosion,
- Provide for more stable combustion conditions over the full range of wood waste fuel qualities and quantities, and,
- Maintain emissions of SO_2, NO_x, and particulate below permit levels.

The OFA upgrades were installed during two phases; pressure part modifications were made during the boilers' back-to-back outages in March. The balance of the OFA upgrades were installed in the spring, while the boilers were in operation. The final tie-ins were made on one unit in late July and in August on the other.

With this upgrade, the mill has increased the TDF burning rate by over 50%, while maintaining good combustion conditions and controlled emissions. The carbon content in the fly ash has been reduced by approximately 20%.

Mill in Washington State. Jansen supplied upgraded OFA and wood distribution systems on the mill's No. 8 Power Boiler, a Combustion Engineering (CE) VU-40S unit built in 1958. The design steaming rate of the unit is up to 120,000 lb/hr from firing wood and oil, at 550°F and 225 psig.

Prior to the upgrade, the unit burned a combination of waste wood, mill primary and secondary sludge, and recycle plant sludge on the grate with No. 6 fuel oil co-

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firing, mainly in the winter months. The performance was characterized by relatively low grate heat release rate, high excess air usage, elevated CO emissions, and high unburned carbon content in the fly ash. These shortcoming were caused by undergrate air (UGA) channeling, virtually no OFA delivery, FD fan limitations, wood/sludge mixing inconsistencies and seasonal high moisture content (up to 60%), as well as poor combustion controls.

With the upgrade, the mill wants to increase the steaming rate up to 130,000 lb/hr from wood waste and sludge firing without burning fuel oil, as well as to improve the boiler's efficiency and minimize emissions. The supply of the Jansen OFA upgrade consisted of a new booster OFA fan, eight Jansen OFA nozzles (four nozzles placed on each side wall in an interlaced pattern), associated air system components, as well as new air swept spouts to replace the existing mechanical fuel distributors.

The installation of the upgraded OFA delivery system took place during the annual outage in June. Because of other issues with the boiler/mill, the new OFA system will not be placed in service until October of this year.

Mill in Maine. Jansen supplied the OFA system upgrade on another B&W hog fuel boiler in Maine. At this mill, the No. 1 Hog Fuel Boiler was built in the mid 1970s and burns hog fuel, sludge, wood pellets, both concentrated and dilute non-condensable gases (CNCG and DNCG), and fuel oil. The typical steaming rate was in the 450,000 to 550,000 lb/hr range at around 800°F and 900 psig. The mill's goals with the upgrade were to maximize steam generation from grate fuels and minimize the need for more costly purchased fuels such as oil and pellets. In addition, the mill wanted to improve the boiler's efficiency and minimize emissions. In particular, the upgrade was carried out to achieve the following objectives:

Internal view of the boiler in Maine prior to start-up, showing four new OFA openings on the right side wall. Jansen's design of few but large OFA nozzles facilitates deep air jet penetration and excellent OFA cross-sectional coverage, therefore greatly enhancing boiler performance.

- Increase the hog fuel burning rate by at least 6 ton/hour,
- Keep CO emissions below 0.4 lb/MM Btu,
- Maintain NO_x emissions from hog fuel below 0.3 lb/MM Btu, and
- Reduce unburned fraction of fuel in the fly ash.

The upgrade was installed during the annual outage in June and consisted of the placement of eight new Jansen High Energy Combustion Air Nozzles™, four on each of the side walls. Associated ductwork modifications were made and new OFA system components were supplied, such as control dampers, pressure transmitters, expansion joints, and access platforms.

The performance of the upgraded boiler has been better than predicted. A side benefit of the upgrade was a reduction in fan horsepower requirement by 160 HP. Because of these good results, the mill is now planning on proceeding with a similar OFA system upgrade on their No. 2 Hog Fuel Boiler, a CE VU-40 unit.

Mill in Virgina. Jansen supplied engineering and materials for the OFA system upgrade and NO_x reduction of two large combination fuel fired boilers in a mill in Virginia, the No. 7 and No. 8 Power Boilers. Both units burn stoker coal and hogged wood. Unit No. 7 was installed in 1947 by Foster Wheeler with a design steaming rate of 250,000 lb/hr at 700°F and 590 psig. Unit No. 8 was installed in 1954 by B&W with a design steaming rate of 325,000 lb/hr at 700°F and 565 psig.

Five of six Jansen OFA nozzles are shown on the front wall of the No. 7 Power Boiler, including supply windbox, ducting, and supports.

The purpose of the upgrades is to reduce NO_x emissions, improve combustion performance, minimize ash and char carryover, reduce excess air, increase waste wood firing, and reduce coal firing.

Jansen supplied improvements to the combustion systems that included upgraded OFA delivery systems and flue gas recirculation (FGR) systems on both boilers. For one of the units, new wood fuel distributors were also supplied.

The reduction in NO_x emissions will be achieved through the following mechanisms:

1. New OFA delivery allows for a reduction in excess air and at the same time, improved air control reduces carryover and keeps CO at acceptable levels.
2. Recirculated flue gas is delivered to the undergrate air (UGA),

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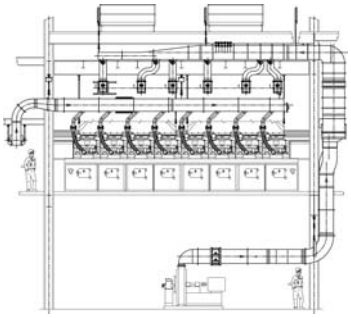
wood and coal fuel distributors, and ash reinjection. This further reduces excess air, maintains UGA flow distribution and mixing, and lowers flame temperatures on the grate.

3. Increase in waste wood burning rates displaced coal that has higher fuel bound nitrogen.

Specific performance guarantees were provided to meet the customer's permitting requirements.



Front view of No. 8 Power Poiler showing new OFA ducting and six OFA nozzles and new fuel distribution air supply.

Jansen was selected over other suppliers because of the complexity of design and installation issues that surrounding these older boilers. Through experience with installations in other mill facilities, the customer had selected Jansen because of their confidence that Jansen could handle these complex issues effectively, assure trouble free installations, and meet tight schedules.

The upgrade of one unit was installed in late September, the second unit will be upgraded in late October. New operating performance results will be reported in our next newsletter.

Mill in Oklahoma. The upgraded OFA delivery system on this unit will be installed during the fall outage in October. The unit, built in the early 1970s, is a CE VU-40 combination fuel boiler, designed to produce 450,000 lb/hr of steam at 925°F and 1,300 psig. The unit presently burns bark, dewatered sludge, old corrugated containers (OCC), and natural gas or No. 6 fuel oil. The objectives of the upgrade are to:

1. Increase the capability to burn bark and thereby reduce the reliance on burning natural gas or fuel oil.
2. Reduce the quantity of excess air used and thereby increase boiler efficiency.
3. Reduce ash and unburned fuel carryover out of the furnace.
4. Reduce CO emissions.

A particular requirement by the mill for the upgrade was that NO_x emissions would not increase. Through CFD modeling conducted early on in the project, Jansen was able to demonstrate that all project goals could be met, including the NO_x emissions performance.

The OFA system upgrade will consist of the following elements: eight Jansen High Energy Combustion Air Nozzles™ (four on each of the side walls), associated ductwork modifications, and OFA system components, such as control dampers, pressure gauges and transmitters, expansion joints, and access platforms.

As shown with the above synopses, each of these OFA system upgrade projects pertains to different biomass boilers with a variety of specific project goals and expectations. Jansen's experience in process and mechanical design engineering has been expanded in recent years through our development and implementation of more than twenty (20) biomass boiler OFA system upgrades. This expertise is what makes our projects successful and why we see repeat customers. Key elements in the Jansen approach and project execution are:

- A thorough initial process evaluation is conducted to characterize the boiler and identify its individual strengths and weaknesses.
- CFD modeling is carried out early to evaluate design options and verify that the project goal(s) can be met.
- A customized, engineered solution is developed that is tailor-made for each boiler.
- Jansen uses relatively few but large High Energy Combustion Air Nozzles™ that provide excellent OFA jet penetration and mixing. The Jansen nozzle efficiency provides high jet velocities without the need for excessive combustion air supply pressures. As a result, in most of our upgrades, the existing FD fan can be used to supply upgrade conditions and no new fans are needed.
- OFA nozzles are placed on the side walls, where there are few, if no, interferences. Therefore, the nozzles can be located to achieve the best combustion performance.
- Uncomplicated installation of OFA nozzles on the side walls is also more cost effective. Installation costs are minimized and boiler down time can be kept within three to five days.

For further information please contact Arie Verloop (ext. 111) or Ned Dye (ext. 125) at 425.825.0500, or by e-mail at firstname.lastname@jansenboiler.com. Additional information and specific project references can be found on our website at: www.jansenboiler.com.

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Jansen Alliance with PSA

Recently, Jansen Combustion and Boiler Technologies, Inc. (Kirkland, Washington) and Power Specialists Assoc., Inc. (PSA) (Somers, Connecticut) reached an agreement to form an alliance to provide comprehensive quality, cost effective services and hardware upgrades to boiler owners and operators. These services and products benefit our customers by providing boiler life extension, enhanced performance, increased fuel burning capacity and availability, increased safety, and improved emissions performance.

The services that are offered by the Jansen/PSA alliance are:

- Boiler condition assessment, visual inspections, and non-destructive testing,
- Boiler performance analyses and evaluations,
- Computational fluid dynamics (CFD) modeling of combustion and heat transfer processes,
- Air flow tuning and measurements,
- Operator training; generic or site specific, class-room seminars, or using simulation and animation techniques, that are CBT based, and self-directed,
- Recovery boiler operational safety audits,
- Feedwater support system audits,
- Water side circulation analyses,
- Boiler modification engineering and design, supply, and construction,
- Design/construct boiler retrofits,
- QA/QC services,
- Start-up services,
- Outage planning and management,
- Maintenance planning and documentation,
- Software based vessel, tank and equipment data and inspection management.

PSA is reached by phoning 860.763.3241 and visiting their web-site at www.psaengineering.com. Jansen is reached by phoning 425.825.0500 and visiting www.jansenboiler.com.

Boiler "Needs" Survey

This spring Jansen distributed a survey to power plant owners and operators to get a better understanding of the type of boiler projects that would be of interest to our customers in the areas of improving the operating performance, waste fuel burning capacity, maintenance upkeep, and useful life span of their large industrial boilers.

The survey covered a variety of technical issues, such as emissions performance, maintenance repairs and replacements, biomass burning capacity, fuel economy, etc.

Survey responses have been returned by over 50 mills/plants and we will report the survey results in our upcoming Winter 2004 newsletter.

If you have not received a copy of this survey, would like to participate and be kept abreast of the survey results, please send an e-mail to Cathy Thomas, at Cathy.Thomas@jansenboiler.com.

Receive Our Newsletter by E-mail

This Newsletter, No. 30 Summer/Fall 2003, is again being sent by e-mail to our contacts of whom we have an e-mail address. It will also be sent via regular postal service.

We are continually expanding the electronic distribution list for our bi-annual newsletter. To receive future newsletters, you are given the following choices:

- Prefer receipt by e-mail (no regular mail)
- Prefer receipt by regular mail (no e-mail)
- Prefer both mailing (e-mail and regular mail)

If we do not hear from you, we will assume the third choice.

To receive this and upcoming Newsletters electronically, please send your e-mail address to editor@jansenboiler.com and you will be included on the list.

PROBLEM SOLUTION

Existing Boilers Perfectly Suited for HVLC NCG Disposal

Because the Cluster Rule legislation becomes effective in 2006, many kraft mills in the U.S. will need to collect and incinerate high volume low concentration non-condensable gases (HVLC NCG) in the next couple of years. Many recovery and power boilers can burn these gases effectively without detrimentally affecting normal operating functions.

These gases, also called dilute non-condensable gases (DNCG), are collected from various sources such as brown stock washers, strippers, chip bins, liquor tanks, and sewers. They contain relatively small amounts of TRS and volatile organics, with moist air making up over 98% of the DNCG stream. As a less expensive alternative to purchasing a dedicated incinerator, this stream can be conveniently combined with the balance of the combustion air in a power boiler (at the level of overfire air) or recovery boiler (secondary and/or tertiary air levels).

Mills are faced with making informed decisions where and how to inject the DNCG stream safely in an existing boiler and in a manner that will not detrimentally affect boiler operation. Jansen is assisting several clients with the disposal of DNCG in the following areas:

- Help select boiler(s) best suited for disposal of DNCG stream.
- Evaluate impact of DNCG injection on boiler efficiency, fuel burning capacity, air emissions, corrosion factors, safety, and potential odor problems.
- Determine best location and method of injection of the DNCG stream into the furnace in order to assure rapid and complete thermal oxidation.
- Conduct computational fluid dynamics (CFD) modeling to evaluate the impact of DNCG injection method and location on boiler operation.
- Define DNCG injection conditions consistent with BLRBAC Recommended Good Practices.
- Define potential secondary (pay-back) benefits of DNCG injection (in combination with a combustion air delivery upgrade).
- Develop budgetary estimate or Class 10 cost to design, supply, and install boiler modifications for the injection of the DNCG stream.
- Design/supply/install DNCG disposal systems in biomass and chemical recovery boilers utilizing the patented Jansen High Energy Combustion Air Nozzles™ for efficient, odor free injection.

Selected portions or all of these activities were carried out for the following companies: Appleton Papers, Bowater, Domtar, Georgia-Pacific, International Paper, MeadWestvaco, Smurfit-Stone, and Weyerhaeuser, most of which with several different mill sites.

The benefits of installing Jansen High Energy Combustion Air Nozzles™ for injection of DNCG in the recovery/power boilers have been proven in many installations. These benefits are:

- Injection method, location, and nozzles are custom designed for each application to fully destroy DNCG and optimize boiler performance.
- Nozzle has clean, open discharge with high jet velocity, and no back flows or tube impingement.
- Nozzle tips are built from corrosion resistant materials.
- System promotes rapid combustion of DNCG components; without emissions excursions.
- Boiler stability is not affected.
- Nozzles have shown no/low maintenance.
- System has easy shut-off capability.

For further information please contact Arie Verloop at 425.825.0500, ext. 111, or by e-mail at Arie.Verloop@jansenboiler.com. Additional information and specific project references can be found on our website at: www.jansenboiler.com.

OUR MISSION

Our Company provides combustion and boiler technology, products, and services.

We are dedicated to working with our clients to achieve their production, 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.
- Working with clients to implement these solutions.

Our team of talented and experienced individuals is committed to the highest standards of professional ethics.

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

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Bark Boiler Workshops Again Well Attended
Look for 2004 Locations

Jansen organized three Bark Boiler Workshops earlier this year that took place in Pensacola (Florida), Bellevue (Washington), and Monroe (Louisiana). The workshops were attended by over 75 participants, representing 35 mills. The workshops were co-sponsored by Jansen Combustion and Boiler Technologies, Process Equipment/Barron Industries, Emerson Atlanta Solutions, and, in part, Power Specialists Associates.

Participants at the Pensacola Bark Boiler Workshop make notes during presentation by Ned Dye.

These two-day workshops consisted of presentations about new technological developments and cost effective solutions to improve the operating performance and economics of operation of existing biomass-fired boilers with the following goals:

1. Increase biomass (wood waste and sludge) burning capacity.
2. Reduce reliance on fossil fuel firing.
3. Increase boiler efficiency.
4. Reduce carryover and unburned char.
5. Improve emissions performance (CO, VOC, NO_x, particulate).
6. Facilitate efficient and safe incineration of DNCG without fossil fuel co-firing.

Upcoming workshops in 2004 are tentatively scheduled to take place in **Charlotte, North Carolina** (February), **Appleton, Wisconsin** (May), and **Vancouver, British Columbia** (September). Participation in our workshops is by invitation and is free of charge. Jansen reserves the right without advance notice to cancel or postpone the workshops at any time without obligation or liability.

For registration and additional information, please call Pat Azeltine at 425.825.0500, ext. 132, or e-mail: pat.azeltine@jansenboiler.com.

Recovery & Power
BOILER NEWS

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