JANSEN
Combustion and Boiler Technologies, Inc.

Recovery & Power BOILER NEWS

No. 31 Summer 2004

Overfire Air System Upgrades by JANSEN on Variety of OEM-Supplied Biomass Boilers

Since 1998, Jansen has been awarded contracts to design/supply overfire air (OFA) system upgrades on twenty-six (26) biomass boilers in the forest products industries (FPI). For seven (7) of these projects Jansen carried complete Engineer-Procure-Construct (EPC) responsibility. With these upgrades (of which several are still under contract for installation in the remainder of 2004), to the best of our knowledge, Jansen supplied the most biomass boiler OFA system upgrades in that period to the industry.

Jansen's OFA delivery system upgrades were installed on biomass boilers with the following breakdown by original equipment manufacturer (OEM):

- Babcock & Wilcox (B&W): nine (9) units
- Combustion Engineering (CE): nine (9) units
- Foster Wheeler (FW): eight (8) units
- Zurn and Erie City: one (1) unit

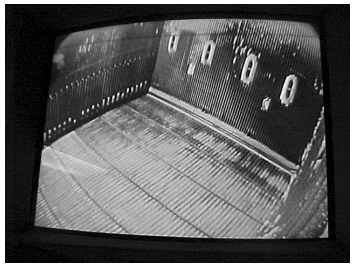
Five of six Jansen OFA nozzles are shown on the front wall of this biomass boiler, including supply windbox, ducting, and supports.

These boilers varied in steaming rate from 120,000 lb/hr to 775,000 lb/hr and burn waste wood alone or in combination with the following fuels: tire-derived-fuel (TDF), old cardboard containers (OCC), mill waste water treatment sludges, low volume high concentration non-condensable gases (LVHC NCG), high volume low concentration non-condensable gases (HVLC NCG), pulverized or stoker coal, fuel oil, and/or natural gas.

As diverse as these boilers and their fuels may be, prior to the Jansen OFA system upgrade, they all shared the commonality of having inadequate, or in some cases, no OFA delivery. Many boiler owners are seeking ways to improve the overall performance of their biomass boilers and a key factor in realizing these performance gains is the capability of the OFA delivery system.

Specifically, owners are seeking more economical and reliable operation of their boilers, and, together with Boiler MACT compliance, may be pursuing the following goals:

1. Increase the biomass or waste fuel burning capacity and reduce fossil fuel firing.



Internal view of a biomass boiler 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.

2. Stabilize combustion over a wide range of fuel characteristics, including high fuel moisture.
3. Improve air emissions, particularly CO, VOC, NO_x, and particulate.
4. Reduce carryover rates and discharge of unburned carbon to landfill.

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Projects in the Waste-to-Energy Industry

Jansen has recently completed, or is currently conducting the following projects for customers in the Waste-to-Energy industry. Specific customer names and locations have been omitted from these brief descriptions due to the confidential nature of many of the projects. For waste fuels, the following acronyms are used:

MSW = Municipal Solid Waste RDF = Refuse Derived Fuel
TDF = Tire Derived Fuel

Project A. Jansen reviewed process design factors for three new MSW boilers that are to be built by this customer. The work included computational fluid dynamics (CFD) modeling of the two-pass furnaces to determine the effectiveness of the proposed combustion air system, identify the elevations for ammonia injection ports, and to verify the furnace exit temperature. An evaluation of the boilers' pressure parts was also

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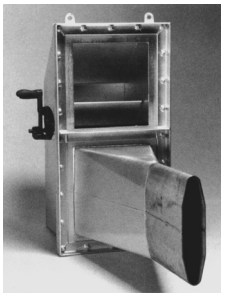
5. Reduce excess air usage thereby increasing boiler efficiency.

Jansen's experience in process and mechanical design engineering is unmatched through our development and implementation of these twenty-six (26) 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 Jansen 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 OFA and no new fans are needed.
- OFA nozzles are placed on the side walls, where there are few 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 downtime can be kept within four to five days.
- Follow-up support to assure that the boiler is operating to the owner's satisfaction.



Jansen High Energy Combustion Air Nozzles™ have been installed on over 50 boilers.

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 in past newsletters and posted on our website at: jansenboiler.com.

News Briefs

In the past year-and-a-half, Jansen conducted the following process and design engineering projects in the Forest Products and Waste-to-Energy industries:

- Biomass boiler engineering evaluations.
- Chemical recovery boiler capacity upgrade studies and reviews.
- Recovery and biomass boiler circulation studies and UFM data collection.
- CFD modeling of biomass, chemical recovery, and other waste-fueled boilers.
- Bark boilers Class 10 preliminary engineering.
- Bark boiler OFA system upgrades, design, supply, and installation.
- Chemical recovery boiler air system upgrades.
- Chemical recovery boiler operations training seminars (RBOTS).
- Chemical recovery boiler audits.
- Boiler NO_X evaluations.
- Evaluation and disposal of HVLC NCG in existing boilers.
- Evaluate and design superheaters for waste fueled boilers.
- Combustion review MSW/RDF boilers.
- Boiler fuel conversion feasibility studies.

This work was conducted for the following companies (in alphabetical order unrelated to the above listing):

- Barlow Group
- Boise
- Bowater Inc.
- Daishowa Marubeni
- Daishowa North America
- Exeter Power
- Georgia-Pacific Corporation
- Green Island Energy Limited
- Hercules Pinova Division
- Inland Pulp & Paper
- International Paper Company
- MeadWestvaco
- Montenay Inc.
- Packaging Corporation of America
- Riverside Forest Products
- Riverwood International
- SAPPI North America
- Simpson Tacoma Kraft
- Smurfit-Stone Container Corporation
- St. Croix Renaissance Group
- Stora Enso North America
- Weyerhaeuser Company
- Wheelabrator Inc.

For further information on this type of work, 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: jansenboiler.com.

Projects in the Waste-to-Energy Industry

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performed to verify adequate water side circulation.

Project B. At this MSW plant, Jansen evaluated superheater erosion and corrosion factors. Concepts for heating surface modifications were developed aimed at reducing the tube metal wastage. Associated budgetary costs for these modifications were also provided.

Project C. Four boilers at this RDF plant experience accelerated corrosion of the superheaters. Jansen was contracted to evaluate superheater erosion and corrosion factors. Concepts for heating surface modifications were developed to reduce tube metal wastage. Associated budgetary costs for these modifications were also provided.

Project D. This plant operates two identical boilers that burn TDF and, over time, the units had experienced deterioration of final steam temperature. Jansen was contracted to 1) verify the root cause and underlying mechanism of the decrease in steam temperature, 2) define technical solutions to restore steam temperature, and 3) develop budgetary costs for the most viable solution. Part of the work involved analyzing the boilers' water side circulation conditions and to verify that the proposed technical solutions would not detrimentally affect circulation conditions.

Project E. Jansen designed new superheaters for three MSW boilers. Process and design engineering were performed for the required boiler modifications and fabrication of the new superheaters, including defining target process conditions, evaluating conceptual design options, sizing the new superheaters, selecting materials, specifying equipment, and providing fabrication and installation drawings.

Project F. Jansen evaluated the suitability and feasibility to convert an existing pulverized coal-fired boiler to incinerate shredded waste materials on a traveling grate. The boiler's waste fuel burning capacity and resulting steaming rate were established and the necessary modifications to the boiler for the fuel conversion were defined. Initial budgetary cost estimates for the fuel conversion were also provided.

Project G. For this project, Jansen is critically reviewing design concepts and proposals for the fuel conversion of a retired chemical recovery boiler to burning RDF. The merits of alternative technical solutions will be evaluated and the associated impact on the overall capital costs to convert the boiler will be provided.

Project H. Jansen is under contract to conduct CFD modeling for two MSW boilers with the specific goal of evaluating combustion and heat transfer parameters of various design options and to determine the affect of these options on the flue gas temperature profile in the furnace.

For further information and specific inquiries, please contact Arie Verloop at 425.825.0500, ext. 111, or by e-mail at Arie.Verloop.@jansenboiler.com.

Boiler House Cartoons on Jansen Website

A collection of boiler house cartoons can be viewed on our website: www.jansenboiler.com. Some 30 cartoons by Gordon Stevens shown previously in this newsletter are presented on the site. Each cartoon depicts a humorous situation with people and equipment in the boiler house. As you will agree, Gord has the rare insight to find humor in the operation of power and recovery boilers and we hope you enjoy his cartoons as much as we do.

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Results Boiler "Needs" Survey

Last year Jansen conducted a survey among power plant owners and operators in forest products industry to get a better understanding of the kind of operational and/or equipment problems people were experiencing with their units. The survey also included questions on the type of projects mills might be pursuing in improving the operational performance, waste fuel burning capacity, economy, maintenance upkeep, and useful life span of these large industrial boilers.

Survey responses were returned by over 50 mills/plants and the results have been summarized on our website. Some highlights of the survey results are:

- Air emissions are clearly the top technical issue facing boiler owners in the forest products industry.
- Most plants would like to burn more biomass or waste fuel to displace costlier fossil fuels.
- A variety of different options are used for the disposal of HVLC NCG.
- More than 2/3rd of respondents noted their boilers are in need of significant maintenance repairs or upgrades.

The complete survey results can be reviewed by visiting the Jansen website at: jansenboiler.com and clicking on the "Boiler Surveys" box. The results can be downloaded from the site.

For a mailed hard copy of the results, please send an e-mail to Cathy Thomas, at Cathy.Thomas@jansenboiler.com.

Receive Our Newsletter by E-mail

This Newsletter, No. 31 Summer 2004, 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

Boiler CFD Modeling

In recent years, through numerous projects, Jansen has greatly enhanced its experience and capabilities in the *Computational Fluid Dynamics (CFD)* modeling of large industrial boilers. The modeled boilers typically burn "difficult" fuels such as chemical spent liquors (black liquor), multi-fuels and biomass (waste wood, sludge, TDF, OCC, fossil fuels), as well as solid waste in the Waste-to-Energy industry (MSW and RDF).

Jansen's in-house CFD modeling is used to analyze fluid flow patterns, fuel combustion processes, fuel capacity, emissions performance, and heat transfer profiles in various boiler-related equipment.

JANSEN applies CFD modeling to evaluate, predict, and/or optimize performance of boiler equipment in various areas, including:

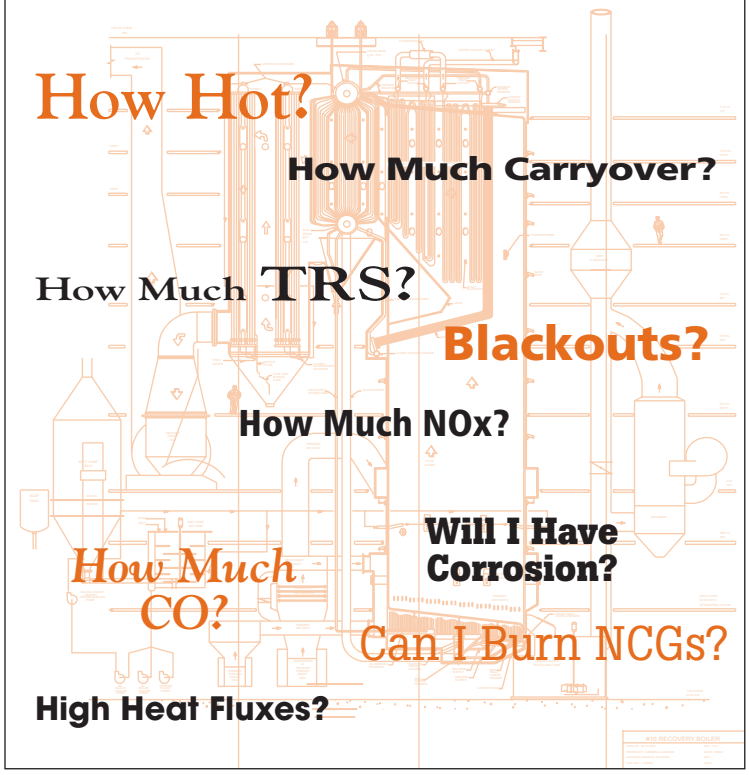
- Evaluate existing conditions in recovery and power boilers (flue gas temperatures, O_2, velocities).
- Optimize modifications to combustion air delivery systems.
- Optimize liquor distribution in recovery boilers.
- Spray cooler, scrubber, and cascade/cyclone evaporator performance predictions.
- Heat transfer analysis in superheaters, generating banks, and economizers.
- Analysis of flow patterns and particulate distribution in inlet ducting to precipitators.
- Evaluation of boiler emissions performance (TRS, CO, SO_2, NO_X, particulates).
- Evaluation of HVLC NCG incineration.

The benefits and advantages of CFD modeling have been clearly demonstrated in the following areas:

1. Troubleshooting of existing boiler performance and root cause identification of specific problems.
2. Low cost evaluation of modification alternatives.
3. Provide valuable input of upgrade arrangement details to the design engineers.
4. Predicting boiler performance after modifications.
5. Develop customer confidence that certain boiler upgrade goals will be met.

For further information please visit our website at jansenboiler.com and/or contact Arie Verloop at 425.825.0500, ext. 111, or by e-mail at: Arie.Verloop.@jansenboiler.com.

CFD modeling can provide direct answers or insights to a variety of commonly asked questions



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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Recovery and Bark Boiler Workshops Well Attended in 2004

Jansen organized one Recovery Boiler Workshop and two Bark Boiler Workshops earlier this year that took place in Pensacola (Florida), Charlotte (North Carolina), and Green Bay (Wisconsin), respectively. As in the prior three years, these workshops were well attended (with over 75 participants, representing over 40 plant locations). The workshops were co-sponsored by Jansen Combustion and Boiler Technologies, Inc., Process Equipment/Barron Industries, Emerson Atlanta Solutions, and Power Specialists Associates, Inc.

The two-day workshops consisted of presentations about new technological developments and cost effective solutions to improve the operating performance, fuel burning capacity, and economics of operation of existing chemical recovery and biomass-fired boilers.

One last Bark Boiler Workshop is scheduled for the remainder of 2004, namely in Vancouver, British Columbia (September 23 & 24), and registration for this workshow is still open. Participation in our workshops is free of charge. Jansen reserves the right to cancel or postpone the workshops at any time without obligation or liability. Bark and Recovery Boiler Workshops will be scheduled for 2005 later this fall.

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

For registration, technical agenda, and hotel accommodations, please call Pat Azeltine at 425.825.0500, ext. 132, or e-mail: pat.azeltine@jansenboiler.com.

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Recovery & Power
BOILER NEWS

Recovery & Power Boiler News is published twice a year by Jansen Combustion and Boiler Technologies, Inc. to provide information to Owners and Operators of boilers.

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