JOHN THOMPSON SPIRAL-TUBE TECHNOLOGY

For High-efficiency Boilers

john thompson

ACTOM

An ALSTOM technology partner

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Introduction

John Thompson (JT) has incorporated spiral-tube technology in its product range as an effective way to reduce operating costs, using high-efficiency firetube boilers. The use of spiral-tube technology has been well proven over many years in boiler and heat exchanger applications. It is common in Japan with oil and gas-fired boilers and in China with coal-fired boilers.

Heat Transfer Improvement

JT's spiral-tubes are manufactured in a custom designed machine at the Bellville, Cape Town Works and feature a single, continuous helical ridge on the inside of the tube wall.

This acts as a heat transfer enhancer by ensuring that the boundary layer between gas and tube surface remains agitated. In comparison, the boundary layer between gas and normal plain-tube surface is stable, reducing effective heat transfer.

In a spiral-tube, convective heat transfer is up to 100% greater than that of a plain-tube under the same gas flow conditions. This results in an improvement in boiler efficiency up to 3 percentage points for a JT boiler with a working pressure of 1 000 kPa which gives a fuel saving of up to 3,8%.

Self Cleaning Characteristic

Agitation of the boundary layer has the added benefit of creating a self-cleaning effect inside the spiral-tubes.

This allows the boiler to be operated for longer periods and at higher efficiency before outage for tube cleaning is necessary.

For coal-fired boilers, sootblowing and associated steam consumption is minimised and downtime for maintenance is reduced considerably.

Gas-side Pressure Drop

The gas-side pressure drop across a boiler fitted with spiral-tubes will increase by about 20% depending upon the design parameters selected for a particular application.

However, careful design optimisation following development at JT's test facility in Bellville, ensures that the gas-side pressure- drop is kept within acceptable limits.

On coal-fired boilers it is actually offset by the decrease in gas volume due to the lower gas outlet temperature achieved. Hence it is not normally necessary to increase the power of the ID fan when using spiral-tubes. However some adjustment to the combustion control settings may be required.

Retrofitting Existing Boilers

Spiral-tubes can also be retrofitted to existing boilers to obtain the cost benefits of higher efficiency and lower maintenance.

For coal-fired boilers, fuel cost savings can be estimated as R0.25/ton of steam for every R100/ton of coal. For example, estimated annual fuel savings for a 10 t/h coal-fired boiler with spiral-tubes, operating at an 80% load factor for 8 000 hours per year, would be R160 000 based upon a coal cost of R1 000/ton.

Similar, additional savings due to reduced maintenance can also be achieved.

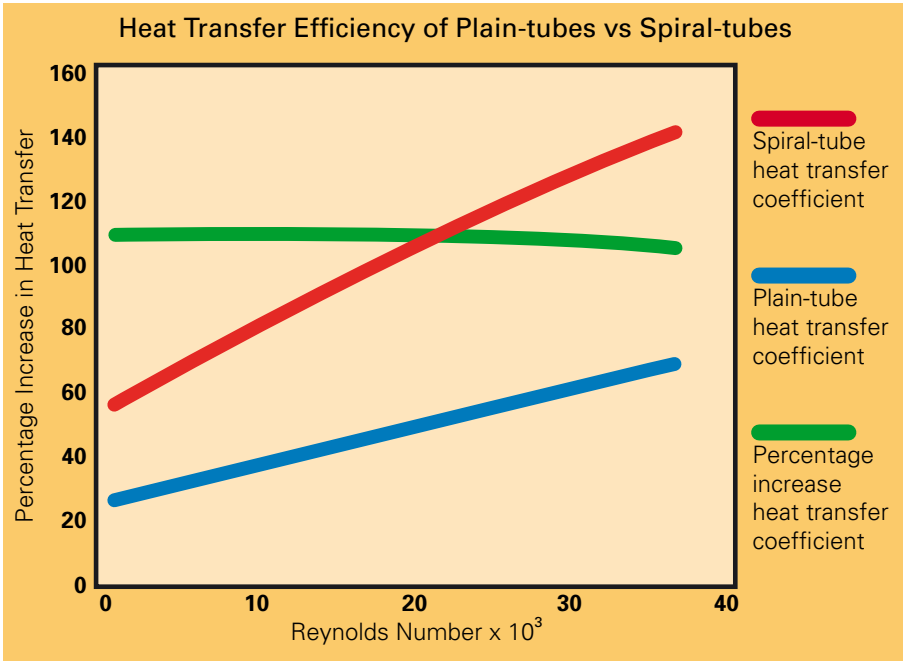
For oil-fired boilers, fuel cost savings can be estimated as R1.25/ton of steam for every R1/litre of oil. For example, estimated annual fuel cost savings for an oil-fired boiler operating under the same above conditions would be R360 000 based upon an oil price of R4.50/litre.

For gas-fired boilers, fuel cost savings can be estimated as R0.56/ton of steam for every R10/GJ gas. For example, estimated annual fuel cost savings for a methane-rich gas operating under the same above conditions would be R270 000 based upon a gas price of R75/GJ.

In reverse-flame boiler designs where plain-tubes with internal retarders are often used, these can also be replaced with spiral-tubes.

Application

Spiral-tube technology can be applied to the full range of JT's firetube boilers: coal-, oil-, gas-, wood-fired and waste-heat designs.



Benefits of Spiral-tubes

- Higher boiler efficiency due to improved heat transfer
- Reduced downtime for maintenance due to self-cleaning characteristic of spiral-tubes
- Reduced operating costs due to lower fuel consumption and lower maintenance costs
- Efficiency of existing boilers can be improved by retrofitting spiral-tubes
- Steam : Fuel ratio – 10 kg steam per kg coal, 16 kg steam per litre heavy oil, 15 kg steam per cubic metre gas.

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Boiler and Environmental Solutions

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