

'ONCE THROUGH' BENSON BOILER WITH VERTICAL TUBE FURNACE

OBJECTIVES

Mitsui Babcock will provide a new furnace to the Benson 'once through' design as a retrofit to a Chinese power plant. The existing unit is based on Chinese technology and has reached the end of its useful life. The new boiler furnace from Mitsui Babcock will correct short falls and ensure the unit is able to match the best world practice. The new equipment will result in an 11% increase in station output and a reduction in nitrogen oxide emissions by over one third.

The principal aim of the project is to validate the performance of the Mitsui Babcock 'once through' vertical ribbed tube boiler technology. The specific objectives of the project are:

- to design new boiler furnace envelope based on vertical ribbed tubes
- to establish steam measurement device suitable for utility boiler water walls
- to assess the new boiler performance incorporating vertical ribbed tubes
- to study oxide growth on the steam side of supercritical boilers in the laboratory

SUMMARY

The Mitsui Babcock 'once through' boiler technology to be employed in the retrofit furnace will be the first large scale demonstration of the vertical ribbed tube. This advanced technology means that 'once through' boilers no longer need to have spiral wound furnace tubing, offering reductions in support steel and improvements in efficiency and operating characteristics.

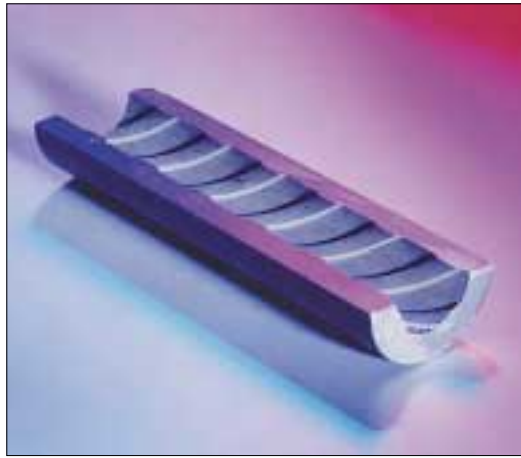
This project will validate the Mitsui Babcock designs for the vertical ribbed tube 'once through' Benson boiler. An assessment of the existing Chinese boiler will address the existing performance of the small bore tubes employed in the furnace walls of the boiler and of the existing corner fired combustion arrangement.

The new vertical ribbed tube 'once through' boiler envelope will be designed based on the assessment of the existing boiler. The design will be carried out to Mitsui Babcock design rules for this technology based on 'bare' scientific design data supplied by Siemens under a licence agreement.

A detailed assessment of new boiler performance will be conducted. The new vertical ribbed boiler furnace tubes will be heavily instrumented and data recorded under different operating regimes (eg turndown) to establish the performance. Study tubes will be representative of the whole boiler geometry (eg corner, centre tubes etc). Data such as heat transfer, metal temperatures, water mass flux rates, water temperatures, location of boiling, steam temperature profile at the furnace wall outlet and individual tube flows etc will be established.

A novel water flow rate measurement device will be developed by Cranfield University and applied to the operating furnace wall tubes. The data will be used to substantiate the Siemens licence information and to refine the design rules applied to future units. A comparison of the design and measured performance will be made. Following commissioning, the boiler operation and maintenance performance will be assessed up to the end of 2002.

Possible oxide growth on advanced materials used in the walls of supercritical boilers is not well defined. An understanding of the oxide growth is an important topic for long term boiler performance. Initial studies of oxide growth on the steam side of the boiler tubing will be carried out in test rigs at Cranfield.



Rifled bore tubing for vertical tube furnace

COST

The cost of this element of the total project is £420 000 with a contribution of £181 570 from the DTI

DURATION

2¹/₂ years – September 2000 to March 2003

CONTRACTOR

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