

## **TEMPERATURE MEASUREMENT FOR MEETING THE EU DIRECTIVE ON WASTE INCINERATION**

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### **ABSTRACT**

During the last couple of years, waste incineration has become more sophisticated and more attention is being paid to waste as an energy resource for normal, solid-fuel boilers. The latest version of the EU directive regarding combustion of waste (Directive 2000/76/EU of December 4, 2000) contains still stricter requirements concerning air and water pollution. A fundamental requirement is that the flue gas shall attain a temperature of at least 850 °C for 2 seconds, thereby ensuring that carbonaceous, post-combustion compounds are fully oxidised.

The possibility of using thermocouples for measuring the temperature of the flue gas has been investigated. The project was divided into two parts: one that compared calculated and measured temperatures in a waste-fuel, grate boiler, and one in which measurements were made in a wood-fuel, bubbling-bed boiler. The conclusions of the two parts are presented here.

Temperature measurements were made in a 20 MW bubbling-bed boiler, manufactured by Kværner Co., using type-N and type-K thermocouples. Due to the weather conditions in April 2002, when the measurements were made, the boiler load was reduced to 11.5 MW during the measurements. It was not possible to increase the number of measuring holes in the boiler wall; we had to use the existing ones. The placing of the measuring holes was not optimal, but good enough for showing that thermocouples can be used in this special application.

The thermal boundary layer at the left hand side of the boiler is at least 350 mm wide, which is thicker than expected, since there is relatively good mixing of the gases. The measurements made close to the roof of the boiler showed that the thermal boundary layer was significantly thinner than at the wall; it was suspected that they should be more equal.

The measurements on the left and right hand side of the boiler revealed that the greatest temperature difference between the two sides depended on the load, the fuel, and some other combustion related factors.

Between the thermocouple and the suction pyrometer, differences of up to 70 K were registered, the biggest ones seen during temperature transients. As expected, the time delay of the thermocouples was longer than for the suction pyrometer.

The conclusions of the measurements are:

- Thermocouples can be used to measure the temperature in a boiler, provided that the measurement errors can be compensated for theoretically.
- Thermocouples of type-N perform better in this application than thermocouples of type-K.