

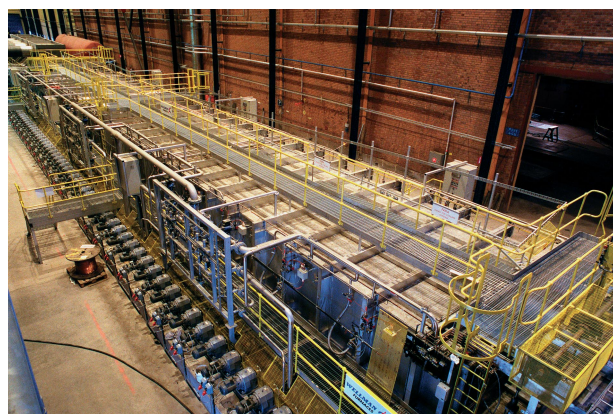
## Reference Installation Summary

**Customer** AvestaPolarit AB,  
Hot Rolled Plate Division,  
Sweden.

**Equipment** Ceramic oxy-fuel burners,  
AGA control system.

**Fuel** Propane

**Installation Date** 1998



### Background

AvestaPolarit group is the second largest stainless steel producer in the world. At the Degerfors plant in Sweden, AvestaPolarit produces stainless slabs, blooms, billets, bar and plate. In order to satisfy the following objectives, they commissioned the building of a new roller-hearth furnace which is fired using an oxy-fuel combustion system supplied by AGA, a member of the Linde group.

### Customer Objectives

- ▶ Increased productivity as a result of moving from a batch to a continuous process.
- ▶ Increase capacity.
- ▶ Reduced operating costs.
- ▶ Maintain or reduce emissions emanating from the heat treatment process.
- ▶ Improve product quality (particularly on the Duplex grades).
- ▶ Reduce surface markings/imperfections on the heat-treated plate.

### Oxy-fuel – Leading Edge Technology

AGA was invited to work with AvestaPolarit and the furnace designers to provide an oxy-fuel combustion system that would help AvestaPolarit achieve their stated objectives.

The result of the co-operation was a furnace, 35.4 m long (inside chamber), 3.5 m wide and 2 m high that is equipped with an oxy-fuel combustion system that uses 59 of the latest AGA designed ultra-low NO<sub>x</sub> staged ceramic burners controlled independently in each of the 13 zones. As the name indicates, these burners are designed to minimise the formation of NO<sub>x</sub>. However, the design offers several other benefits. They are easy to handle and maintain, and as they are selfcooling they require no cooling water which can be a common source of problems with many burners. Each burner is equipped with a flame-watch detection system and a pilot burner for auto ignition.

The total power input capability is 16.5 MW which allows hot or cold material to be charged and heated to a maximum temperature of 1150°C before quenching. The burner power in each zone can be controlled independently via set temperature loops that follow temperature measurements from three thermocouples in each zone. Good flow control accuracy is very important and this is achieved by using a differential pressure V-cone orifice which is then recalculated to a temperature and pressure compensated mass flow. This, coupled with state of the art Bi-linear Generalized Predictive Controllers (BGPC) that

## The Equipment Installation

work with conventional PID's, take account of non-linear characteristics and minimise deviations from the set-point. The resulting benefits are the ability to more accurately control the flows of oxygen and propane when changing power levels. As a result, this allows better control of the resulting atmosphere and ultimately lower  $\text{NO}_x$  values coupled with improved thermal efficiency.

The equipment installed was as follows:

- ▶ 59 ceramic low  $\text{NO}_x$  burners.
- ▶ Separate flow trains for both oxygen and propane to the main burners and pilot burners individually to each zone.
- ▶ A complete control system allowing individual control of each zone using PID in conjunction with bi-linear generalized predictive controllers for optimum control for 12 of the 13 zones.

## Results

The following performance results have been achieved in this furnace:

- ▶ Productivity max. 23.5 t/h
- ▶ Fuel consumption 235 kWh/t
- ▶ Discharge temperature 1140°C
- ▶ Substantial reduction in  $\text{NO}_x$  emissions.
- ▶ Overall flue gas volumes have been reduced by 75% when compared with a comparable furnace that is heated using an air-fuel combustion system.

## Customer Benefits

Several key benefits have been achieved as a result of the use of oxy-fuel combustion technology in this furnace:

- ▶ High productivity furnace when compared with an air-fuel alternative due to faster heating capability.
- ▶ Low specific fuel consumption.
- ▶ More accurate temperature control of the plate material.
- ▶ A cleaner environment with lower noise generation from the furnace operation.
- ▶ Reduced overall flue gas volumes when compared with an alternative air-fuel fired furnace.
- ▶ Substantial reductions in fuel borne emissions such as  $\text{SO}_x$ , CO,  $\text{NO}_x$  and  $\text{CO}_2$ .



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Other leaflets about our complete range of applications and products are available in all sales offices.

Our experts are available for consultation.