

REBOX[®]

Oxyfuel flameless combustion in a catenary furnace



Customer

Complete turnkey project for Outokumpu Stainless AB, Coil Products Nyby, Sweden

Equipment

Flameless oxyfuel burners, control system, rebuilt furnace and flue gas system

Fuel

Oil

Installation date

2003

Background

Outokumpu Stainless (formerly AvestaPolarit Stainless) is a world-leading supplier of stainless steel material to customers with high standards of quality. In 2003, Outokumpu set itself the goal of increasing capacity in its rolling-annealing-pickling line at its Nyby site and, at the same time, fulfilling strict legislation on emissions. The annealed strip is hot-rolled or cold-rolled, with a thickness of 1.5 to 6 mm and a width of up to 1,550 mm. The old furnace is 18 m long and equipped with air burners with recuperators. Strip production depends on this furnace for the supply of material to customers or the cold rolling mill. The location of the furnace excludes the possibility of extending the furnace length.

Outokumpu, and the Nyby site in particular, has a wealth of experience with oxyfuel applications from AGA, a member of the Linde Group. The customer was keen to fully exploit oxyfuel technology, at the same time lowering emission levels and increasing capacity.

Customer objectives

- Increase capacity of existing furnace, not possible to increase length of furnace
- Reduce fuel consumption
- Improve temperature control, uniformity of the material
- Lower NO_x emissions
- Secure total turnkey commitment from Linde
- Installation down-time 25 days (max.)

REBOX[®] – leading-edge technology

Since the beginning of the 1990s, AGA has pioneered the use of 100 % oxyfuel applications in reheat furnaces in close cooperation with customers such as Outokumpu. With an installed base of almost 80 furnaces, AGA had the necessary experience and capacity for this turnkey project. The project involved converting the furnace to oxyfuel as well as revamping the rest of the furnace and flue gas system. Production stoppage time was estimated at max. 25 days.

Flameless combustion

Flameless combustion technology was employed for effective heating in a large furnace with a limited number of burners and to achieve low statutory NO_x emission levels. Flameless combustion has the advantage of reducing the flame temperature and thus the creation of NO_x . It also disperses the combustion gases effectively in the furnace for more effective and uniform heating of the metal.

Using oxyfuel combustion substantially increases the thermal efficiency of a furnace. This is primarily due to the fact that radiant heat transfer of furnace gases produced by oxyfuel combustion is significantly more efficient than that of air-fuel. And due to the absence of nitrogen in the combustion mixture, the volume of exhaust gas is also substantially reduced, thus lowering total heat loss through the exhaust gas. Thanks to improved thermal efficiency, the heating rate and productivity are increased and less fuel is required to heat the product to a given temperature, i.e. specific fuel consumption is reduced. This makes a valuable contribution to reducing the impact of company operations on the local environment.

Equipment installation

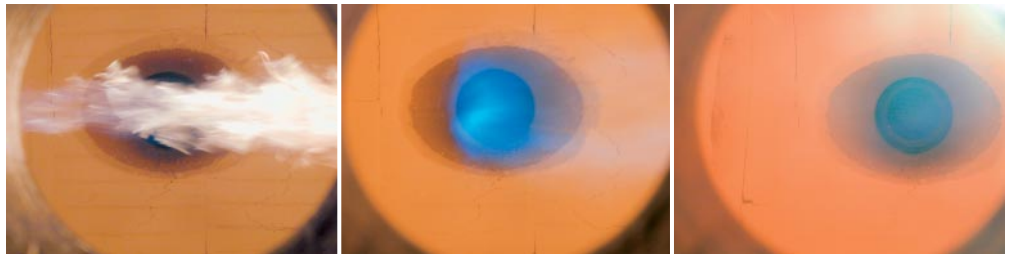
- 18 MW total power installation
- 32 flameless REBOX®-R burners
- Separate flow trains for oxygen to all four zones; the oil system consists of an individual pump to each burner
- Complete control system for the four zones software; to achieve eight temperature zones
- Oxygen supply from ECOVAR® PVSA generator with liquid back-up
- Complete furnace overhaul, including removing old recuperators and replacing flue gas system and furnace lining

Results

- 50 % increased heating capacity in existing furnace length without increasing max. temperature in furnace
- Fuel consumption reduced by approx. 40 %
- Improved temperature control, uniformity of the material
- NO_x emissions below 70 mg/MJ
- Total turnkey commitment from Linde
- Production down time only 23 days to revamp and rebuild the furnace
- Improved surface quality

Customer benefits

- Increased production capacity and flexibility in existing furnace to handle swift changes in incoming orders
- Substantial reductions of CO_2 and NO_x to allow increased production
- Reduced fuel consumption and no electricity required for air blowers
- Flue gases reduced by 80 %, which allows for small size flue gas ducts
- Lower temperature on outside of furnace



Standard oxyfuel mode

Transition mode

Flameless mode

Subject to change
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