Roller Hearth Tempering Furnace

LIBERTY
STEEL

Liberty Speciality Steel

MADE IN BRITAIN

BESPOKE FURNACE MANUFACTURERS

NCS Ltd
Another furnace supplied to a regular client in South Yorkshire, Northern Combustion Systems carried out a turnkey project for a new Roller Hearth Tempering Furnace.

The new furnace was designed to operate in a range of 440°C to 800°C with a temperature uniformity of ±5°C throughout the operating range in accordance with Nadcap class 2 & AMS 2750. Computational Fluid Dynamics (CFD) Modelling was provided to simulate uniformity and thermal heat loss to discuss possible countermeasures to optimise the furnace prior to manufacture.

The survey volume furnace chamber size at (W)2.3m x (L)13m x (H)1.8m

The maximum load at 38 Tonnes comprises a single layer of bars in the range Ø70mm to Ø381mm with a 11 meter maximum roll length.

The furnace door and a roller table are operated via an operator control console. A batch load is transferred by the external roller table through the inlet furnace door operated in the vertical plane, counterbalanced and driven by a motorised gearbox. A pneumatic door clamping and guide system is included to guide and seal the door. 16 Internal furnace rollers were specifically designed to perform at maximum furnace temperature and load driven by individual synchronised gear motors with integral speed invertors. Fast speed for loading and unloading of the furnace and slow speed for continuous oscillation of the rollers during the furnace cycle.

The furnace hearth was lined with fire brick and the furnace side walls roof and doors refractory lined with fibre modules. High grade stainless barriers above the rollers were fitted to prevent damage to the lining by lateral movement of the bars in the furnace.

A rear hinged door was included for internal maintenance access.
The furnace is fired using 8 high level burners in one side wall and 8 low level burners in the opposite wall to provide a connected burner rating at 2320kW. The burners firing at 45° target walls to assist recirculation of combustion products around the load. The burners are controlled in eight equal zones down the length of the furnace capable of operating in two control modes:

- **Fixed Air and Fuel Modulation** - to maintain close temperature uniformity when soaking at low temperatures, by providing a high mass flow of high velocity combustion products at a time of low thermal input demand.
- **Stoichiometric Ratio** - This is the most thermal efficient mode and is used for high temperature operation.

Thermocouples in each zone are fed directly to a Yokogawa DX2020 recorder and transmit to the furnace Eurotherm T2550 controller through a modbus link. Hard wired thermocouples between the recorder and controller also monitor the overtemperature alarms.

Included is a rapid cooling facility, driving all combustion air control valves and flue dampers to maximum to permit rapid cooling through the burners.

The furnace safety system includes burner protection using fully automatic flame control units with a safety warning system written into the furnace software. Gas high and low pressure and air supply pressure is monitored. Automatic pre-purge and low fire ignition is proved by differential pressure switches. System light up is controlled using the T2550 controller.

The system designed to comply with European standard BSEN 746-2 2010 and the customers internal specification for designer’s guide to furnace safety.

Trending of gas flow is recorded to the Yokogawa recorder through a positive displacement gas meter. Full operation of the furnace is monitored and controlled via the Eurotherm HMI. PID loop from a furnace pressure transmitter to the T2550 controller controls the furnace roof mounted motorised dampers. The furnace exhaust products terminate passing through a fibre lined duct routed to a 21 meter high furnace chimney.