

Advanced Heat Treatment Plant



AMRC - Castings Technology International



Heat Treatment Facility for Sheffield University

Northern Combustion Systems submitted a tender to The University of Sheffield for the supply of an Advanced Heat Treatment Facility. Through evaluation we were successfully awarded the contract for our most economically advantageous tender based on price and technical capability.

The fully inclusive package consisted of civil work, one gas fired furnace, one electrical, a transfer charging machine, water quench tank and all appropriate ancillary equipment for the complete heat treatment of castings fully designed, built, installed, commissioned and includes operator training with a service package. The facility installed at Advanced Manufacturing Research Centre, Rotherham, Castings Technology International.

Normalising (Gas) Furnace

The furnace was designed for normalising a load capacity of 2.8 tonnes plus support tray heated in a working zone (W)2250mm x (D)2000mm x (H)2000mm.

The temperature range of the furnace at 400°C to 1250°C was achieved with a temperature uniformity of $\pm 8^\circ\text{C}$ exceeding the requirements of NORSOK ASTM A991.

The furnace is fired using two 400kW self-recuperating gas burners mounted at low level, in diagonally opposite corners of the furnace. This firing pattern is well proven and sets up a high velocity flow of combustion products which circulate around the furnace load, resulting in a high degree of temperature uniformity throughout the combustion chamber.

The system designed to meet with current European safety standards EN746-2 2010.



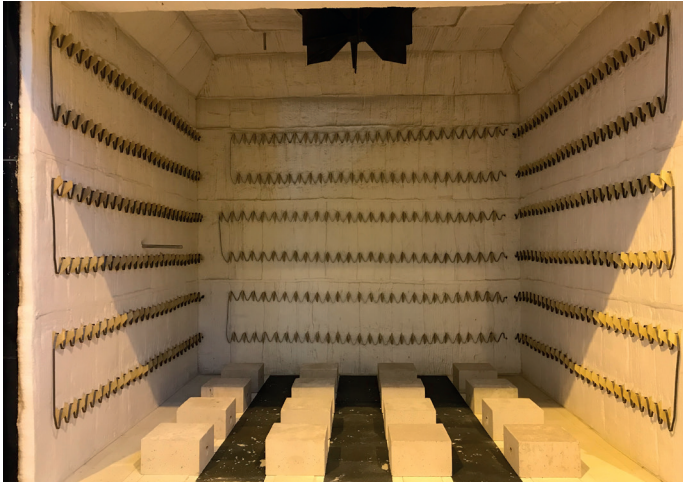
Tempering (Electric) Furnace

The furnace was designed for tempering and a load capacity of 2.8 tonnes plus support tray heated in a working zone (W)2250mm x (D)2000mm x (H)2000mm.

The temperature range of the furnace at 200°C to 920°C was achieved with a temperature uniformity of $\pm 2^\circ\text{C}$ exceeding the requirements of NORSOK ASTM A991

The furnace is heated utilising door, side wall and back wall electrical elements totalling 240kW. Elements are also located in the furnace hearth for rapid heat up.

To assist uniformity a roof mounted high temperature recirculation fan recirculates the air throughout the temperature range.



Water Quench

Positioned centrally between the two furnaces is a shared 95,000 litre water quench tank with high velocity agitation jets.

The volume of water calculated to prevent the water from exceeding 28°C when quenching a 2.8 Tonne load and tray from 1250°C.

The water is vigorously agitated from 4 sides and from below using high velocity jetted water. The agitated water pumped by two 55kW pumps 76 ltr/sec, positioned in an underground service pit and controlled by variable speed drive. Agitation flow rate is 547m³/hr which corresponds to 5.76 volumes of the quenchant per hour.



The system incorporates a circulation pump and sealed cooler capable of a 72kW exceeding the 65kW cooling requirement of the quench water. The water is pumped through the plate exchanger where it is cooled then back to the quench tank. The tank also incorporates a water treatment dosage system for the control of legionella.



Charging Machine

Loading and unloading of the furnaces is by a 3500kg double sided, fully automated, 4-wheel drive charging machine.

The operator transfers the load to a dedicated high temperature alloy tray positioned on a loading table in front of the selected furnace. The operator exiting the fenced off facility, supported with trapped key interlocks, activates new or pre-programmed heat treatment cycles.

The time for opening the door to total immersion of the load into the quench is critical and achieved in less than 30 seconds.



Control and data acquisition

The heat treatment facility is fully controlled via a central control station located external of the fenced area for safe operation, using a network of Siemens S7 Series PLC's and a central touch screen HMI (Human machine interface).

Operators can create and save heat treatment programs via the HMI using a user friendly 12 segment programmer developed by NCS eliminating the need for complex third-party controllers.

All data from the furnace's PID setpoints, control and load thermocouple process values are recorded on a Eurotherm 6100xio, networked for remote access and data archiving.

