

# Roller hearth furnace plant



for  
heat  
treatment  
of  
forging parts  
under  
atmosphere

## ▶ Technical Data

Throughput capacity :	max. 3.000 kg/hr gross	Single weights :	0,5 - 120 kg
Cycle time :	typical 23 minutes	Length of plant	53 m
Tray loading :	max. 900 kg net	Heating :	Natural gas in HTF, electrical in LTF
T max. High temperature furnace(HTF) :	980 ° C	High temperature furnace :	32 NOXMAT Recuperator gas burners
Tmax. Low temperature furnace(LTF) :	750 ° C	Low temperature furnace :	50 Electric heating elements

## ▶ Description of plant

Two large roller hearth furnace plants for the heat treatment of forging parts had recently been commissioned at a German heat treatment center.

The plants enable hardening, hardening and tempering, annealing and isothermal conversion in the perlite stage (isothermal annealing) for work pieces made of unalloyed or alloyed tempering steels. Both plants are provided to handle a throughput capacity of around 8.5 t/hr together.

The shorter one of the two plants is used for heat treatment under protective gas. The protective gas atmosphere avoids oxidation and scaling as well as a surface decarburization of the heat treatment goods. The plant includes the roller hearth furnace for austenitisation or annealing, a gas quick cooling station, a chamber for quenching in oil, a tempering furnace, an air cooling station as well as a special soundproof station, each for loading and deloading.

The plant is charged with baskets. They are each loaded by an automatically working soundproof loading station filling the baskets weight-controlled with up to 900 kg from a storage bin via a vibrating chute and can be placed and stored above the furnace. The baskets are charged into the high temperature furnace by passing through a nitrogen-purged lock chamber. Through the opened - otherwise gas tight - intermediate door the charging basket is rolled over a quick track into the approx. 11 m long high temperature furnace with space for 6 charging baskets. The first three zones serve for heating up, while in the last zone the charge is soaked at a maximum temperature of 980 °C.

32 Noxmat-gilled-pipe recuperator gas burners generate the approx. 1 MW of heat required for a throughput capacity of max. 3 t/hr. The hearth rollers are driven by a gear motor with constant speed and allow a variable transportation speed. At the end of the furnace a basket can be charged with acceleration into the cooling station through an undockable quick track, which can be separately driven. Besides it is possible to reverse baskets out of the plant in case of transportation failures. The position of the charging baskets are scanned by light barriers.

The atmosphere is controlled by lambda probes and adjusted by adding gas.

Each basket is rolled on a quick track through an intermediate door into the quick cooling zone and is blown at with air directly in a multipart muffle. The cooling down (e.g. to 600 till 620 °C for isothermal annealing) is executed in an enclosed circuit via an internal cooler.

Alternatively a charging basket can be directly run through the quick cooling zone into the heated oil bath. The recooling is also done by a heat exchanger with air.

After quenching the charging basket is conveyed further on into the low temperature furnace for tempering (hardening and tempering). This furnace enables temperatures between 600 and 750 °C are possible. The temperature is controlled in 5 heating zones. In the first two zones the heating up is done and in the last three zones the soaking. Nitrogen is used as protective gas; at temperatures above 750 °C it is also possible to use endothermic gas.

A cooling station with reversing continuous run follows directly behind the tempering furnace. Here two charging baskets each can be cooled down in a multipart gas guiding muffle to approx. 300 °C. Then the charges come into a vacuum lock, which can be evacuated by a multi-stage vacuum pump. Afterwards the charge is purged with nitrogen and cooled down further until its removal.

The charging baskets are then conveyed to the deloading station and dumped by a tilting station into the transportation containers.

The plant is equipped with an automatic nitrogen gas supply for the furnace chambers in case of current failure, temperature undershoot or drop of gas pressure, a protective gas burn-off at the furnaces, a lambda measuring probe to check the residual oxygen content, contact devices for the gradual shutoff of the moving processes by light barriers, monitoring of the oil bath levels and CO<sub>2</sub>-fire extinguishing units.

A Siemens S7 controls both plants. The operation is done by the operating and monitoring unit Siemens OP27.

The preset data are taken over from the loading station, such as workpiece description, material and heat treatment for each charge (charging recipe). On a display the operating condition (temperature, C-level) of the plant can be visualized and the run of the charges through the furnace can be followed up. Process data and failure messages are acquired and recorded.

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