



Pit Furnaces

for operation with controlled atmosphere

Technological applications of pit furnaces

- Gas carburizing
- Hardening
- Bright Annealing
- Normalising
- Carbonitriding



Typical load types

- Automotive industry: crankshafts, camshafts, pistons, pins, pumps, engine accessories, shafts, racks
- Aircraft industry: tooth wheels, conical and spiral wheels, under-carriage parts
- Machine building industry: shafts, sleeves, pins, tooth wheels, chains
- Mining industry: drilling rods, mono-blocks, bits
- Bearing industry: bulky bearing elements
- Wind energy industry: large power transmission components as: sun pinions, pinions, gear wheels, plants
- Marine industry: large power transmission components as: sun pinions, pinions, gear wheels



Versions available

- Adapted for operation with atmosphere
 - retort pit furnaces to work with controlled atmospheres
 - non-retort pit furnaces to work with natural air or nitrogen atmosphere
- Type of pit furnace design
 - retort pit furnaces-retort with closed bottom
 - retort pit furnaces-retort with opened bottom and fixed hearth
- Type of pit furnace heating system
 - electrically heated furnaces
 - gas fired furnaces

Main technical data for standard sizes of pit furnaces

Standard size of the useful chamber dimension in cm	60x90	80x120	100x150	120x200	150x250	180x300	200x350
Max working temperature *	1000°C	1000°C	1000°C	1000°C	1000°C	1000°C	1000°C
Operating temperature range	750-950 °C	750-950 °C	750-950 °C	750-950 °C	750-950 °C	750-950 °C	750-950 °C
Temperature uniformity **	(+/-5)°C	(+/-5)°C	(+/-5)°C	(+/-5)°C	(+/-5)°C	(+/-5)°C	(+/-5)°C
Maximum gross load weight-kg	300	750	1500	3000	5000	10000	12000
Max heating power [kW] electric/gas	80/128	120/192	160/256	260/416	280/448	312/512	360/576

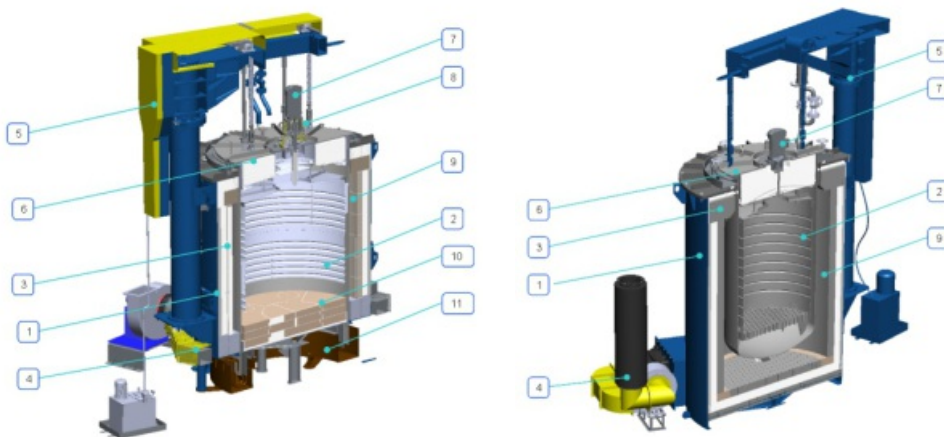
* Temporary working conditions
 ** Steady state working conditions

Customized dimensions of the working chamber and temperature range can be designed at request.

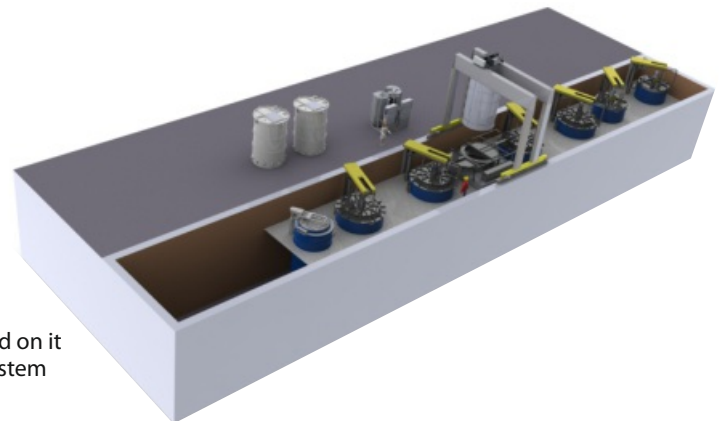
Key construction features

- Maximum temperature: up to 1000 °C
- High temperature uniformity in the working space of $\pm 5^\circ\text{C}$
- Highly efficient atmosphere circulation system
- Highly efficient system for load cooling
- Use of the most precise and modern instrumentation currently available

Pit furnaces designed for operation with controlled atmosphere are equipped with the following main systems and subassemblies:



1. Robust and stable cylinder-type housing
2. Gas-tight retort with water cooling of flange
3. Ceramic-fiber insulation, with reduced heat accumulation
4. Furnace cooling system
5. Hydraulic or mechanical lid lifting mechanism
6. Special lid, designed to extend its life
7. Highly efficient atmosphere mixer
8. Carbon potential control system, integrated with furnace and cascade furnace temperature control; standard equipment includes an oxygen probe, while a CO-CO₂ analyzer is available as an option
9. Multi-zone electrical heated or gas fired heating system
10. Furnace hearth with hard insulation, enabling loads to be placed on it
11. Oil gutter for the sealing system together with an oil-cooling system

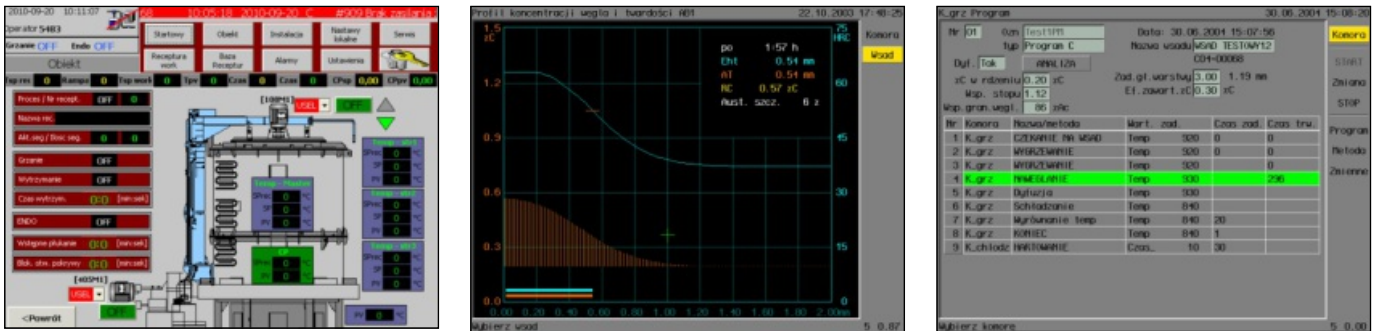


Automatic control of retort pit furnaces operation

The furnace control system includes all functions required for heat treatment process control of the furnace equipment operation. The required process parameters are entered using process recipes that determine temperature and carbon potential versus time course. The control system provides full visualization of furnace operation and alarm conditions monitoring. Standard equipment applied in SECO/WARWICK retort pit furnaces includes carbon potential and temperature control system based on oxygen probe.

Every retort pit type furnace is equipped with cascade furnace temperature control. This provides minimized heat-up time of the load and required temperature control accuracy. Basic functions of the control system include programmed control of processes as well as archiving of all necessary heat treatment process parameters. The control systems of individual furnaces can be connected to a SCADA computer system (Supervisory Control and Data Acquisition). This system provides archiving of all the necessary process parameters and databases for the materials, heat treated parts, process recipes and for finished heat treatment processes.

The carbon potential and temperature control system enables the following functions to be performed:

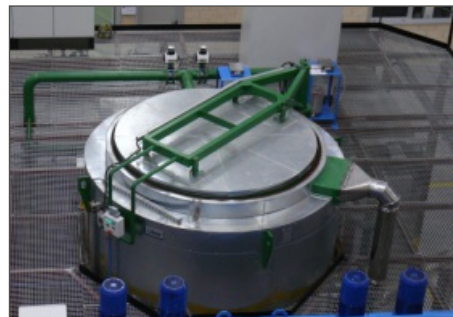
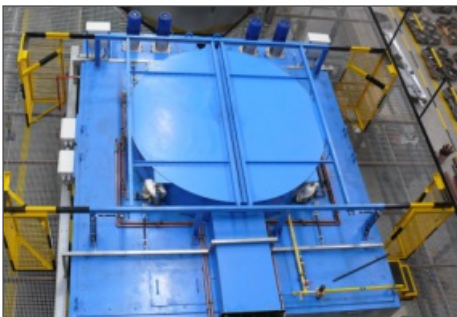


- Programming of process recipes
- On-line calculation of carbon diffusion during carburizing
- Calculation of the furnace atmosphere parameters
- Alarm handling
- Viewing and recording of process parameters
- Programming of service inspections

Complete technological lines incorporating pit furnaces

SECO/WARWICK is able to provide various furnace configurations. Auxiliary equipment that can be incorporated into the pit furnace production line includes:

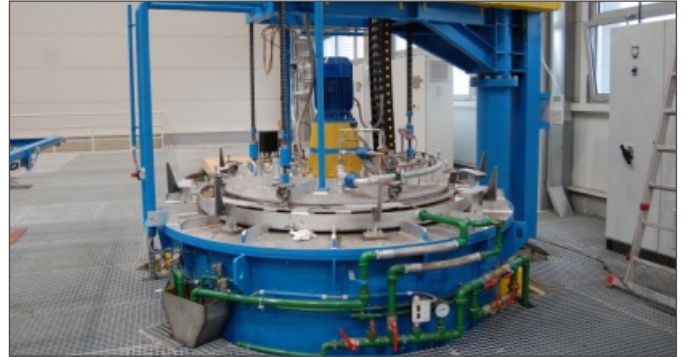
- PEG non-retort pit furnaces for tempering and annealing
- Spray washing and immersion-spray washing equipment
- Quenching tanks for hardening in hot oil, water, polymers and salt
- Cooling stations
- Atmosphere generators
- Nitrogen cylinder stands
- Batching appliances for liquid organic compounds
- Control cabinets
- Special instrumentation
- Load covering system (bell)
- Sub-zero treatment



The configuration of technological lines incorporating SECO/WARWICK pit furnaces is made up depending on the individual requirements of each customer and the specifics of relevant technological processes.

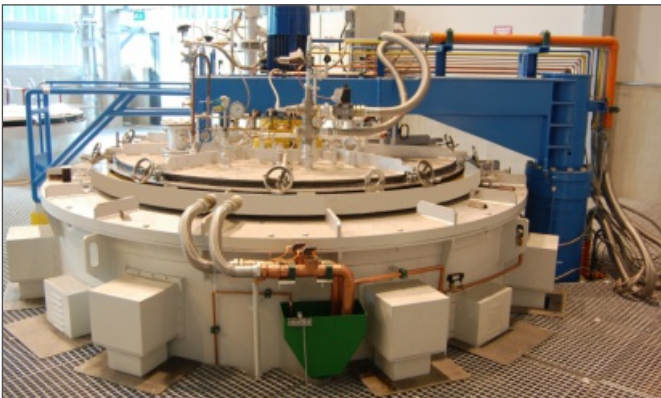
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Main advantages of pit furnaces processes

- Work flexibility, resulting from the speed of heating and cooling of the load
- Economic effectiveness, due to the relatively small requirements for media needed for furnace operation
- Easy service and maintenance
- Very high repeatability of processes and very precise heat treatment of various parts
- High accuracy of process control (temperature and carbon potential)
- Safe operation
- Ability to treat large parts
- Conformity with the AMS 2750 D





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