

Which Furnace for Which Process?

Preheating for Forging

- Press Hardening
- Heating of sheet metals
- Preheating of molds


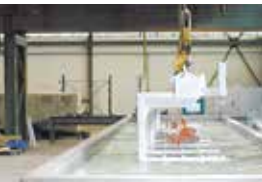
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- Continuous furnaces
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Annealing furnace with electro-hydraulic lift door on portable base for preheating of large steel sheets for the automotive industry see page 50

Hardening, Annealing

- Ageing
- Austempering
- Diffusion annealing
- Pack hardening
- Recovery annealing
- Coarse grain annealing
- Hardening
- Solution annealing
- Annealing
- Recrystallization annealing
- Stress-relieving
- Soft annealing

- | | | |
|--|--|---|
| in Air | under Protective Gases,
Reaction Gases or in Vacuum | in Salt Bath |
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| Strand annealing furnaces
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Quenching

- Water
- Air
- Oil
- Polymer

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- Quench tanks
page 57
- Water quench tanks
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Tempering, Annealing

Tempering Plants

- Tempering
- Precipitation annealing
- Ageing annealing
- Recovery annealing
- Solution annealing
- Preheating
- Reduced hydrogen annealing

- Solution annealing
- Quenching
- Artificial ageing

in Air

under Protective Gases, Reaction Gases or in Vacuum

in Salt Bath

Tempering Plants

- Chamber dryers
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- Forced convection chamber furnaces > 560 liters
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- Forced convection chamber furnaces < 675 liters
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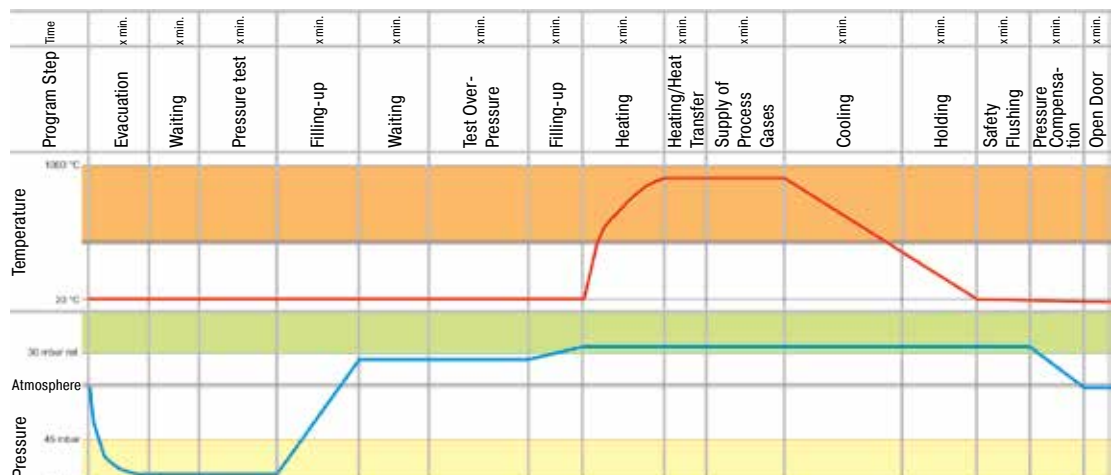
- Martempering furnaces
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- Fully automatic tempering plant
page 72/73
- Manual tempering plant
page 74/75



Manual tempering plant for hardening of steel rods see page 74/75

Process flow chart



Which Furnace for Which Process?

Brazing/Soldering

Curing, Tempering, Drying

- Soft soldering
- Brazing
- High-temperature brazing
- Dip brazing of steel
- Dip brazing of aluminum

- Composites
- Molds
- Adhesive
- Plastics
- Lacquers
- PTFE
- Silicone
- Surface Drying
- Preheating
- Vulcanizing
- Conditioning

in Salt Bath

in Vacuum

under Protective Gases

Solvent Based

Water Based

Salt-bath furnaces
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Hot-wall retort furnaces
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Hot-wall retort furnaces
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Hot-wall retort furnaces
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Chamber dryers
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Cold-wall retort furnaces
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Cold-wall retort furnaces
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Chamber dryers
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Forced convection chamber furnaces
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Forced convection chamber furnaces with annealing box, page 25

Forced convection chamber furnaces EN 1539
page 38

Ovens
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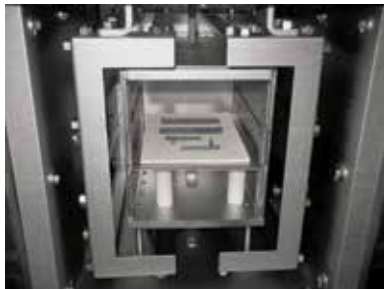
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Rotary hearth furnaces
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Continuous furnaces
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Sintering of MIM titan parts in a VHT furnace



Brazing in a gas-supply box



VHT 500/22-GR H₂ with graphite insulation and heating see page 16

**Thermal/Thermo-Chemical Processes
 Surface Treatment, Cleaning**

**Sintering
 & Debinding**

- Carburizing
- Blueing (e.g. with water steam)
- Nitriding/nitrocarborizing
- Deoxidizing under hydrogen
- Pyrolysis
- Heat cleaning
- Oxidizing

- Debinding
- MIM
- CIM
- Sintering

in Powders

**under Protective
 Gases, Reaction Gases**

in Salt Bath

in Air

**under Protective Gases,
 Reaction Gases or in Vacuum**

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Overview annealing boxes page 58				

Thermal Separation Processes

Process	..DB.. Debinding and sintering in oxidising atmosphere	..LS Debinding and sintering in oxidising atmosphere	..IDB.. Debinding inert atmos- phere	NB..CL Heat Clean- ing in inert atmosphere	..BO Heat Cleaning in oxidising atmosphere	NB..WAX Dewaxing and burn off
Avoid igniting	✓	✓	✓	✓		
Provoke igniting					✓	✓
Diluted atmosphere	✓	✓				
Inerted atmosphere			✓	✓		
Open combustion					✓	✓
O ₂ content	≥ 20 %	≥ 20 %	0-3 %	≤ 3 %	<> 20 % varies	<> 20 % varies
Vaporisation speed	slow	fast	slow	slow - fast	slow - fast	very fast
Loading / unloading	cold/cold	cold/cold hot/hot	cold/cold	cold/cold	cold/cold	> 750 °C/ > 750 °C
Tmax	1800 °C	450 °C	850 °C	500 °C	1400 °C	850 °C
Electrically heated	✓	✓	✓		✓	
Gas-fired				✓	✓	✓
External TNV	✓	(✓)	✓		✓	
Internal TNV				✓	✓	✓
External KNV	✓	(✓)	(✓)			



Blueing of drills in water steam atmosphere in a furnace of the NRA range see page 14