Glass

Furnaces and Plants for

Tempering
Bending, Slumping, Annealing
Welding
Laminating
Fusing
Melting
Photovoltaics
Quartz Glass Technology
Fiber Optics
Heat Soak
Laboratory

www.nabertherm.com
Made in Germany
Nabertherm with 450 employees worldwide have been developing and producing industrial furnaces for many different applications for over 60 years. As a manufacturer, Nabertherm offers the widest and deepest range of furnaces worldwide. 150,000 satisfied customers in more than 100 countries offer proof of our commitment to excellent design, quality and cost efficiency. Short delivery times are ensured due to our complete inhouse production and our wide variety of standard furnaces.

Setting Standards in Quality and Reliability
Nabertherm does not only offer the widest range of standard furnaces. Professional engineering in combination with inhouse manufacturing provide for individual project planning and construction of tailor-made thermal process plants with material handling and charging systems. Complete thermal processes are realized by customized system solutions.

Innovative Nabertherm control technology provides for precise control as well as full documentation and remote monitoring of your processes. Our engineers apply state-of-the-art technology to improve the temperature uniformity, energy efficiency, reliability and durability of our systems with the goal of enhancing your competitive edge.

Global Sales and Service Network – Close to you
Centralized engineering and manufacturing and decentralized sales and service define our strategy to live up to your needs. Long term sales and distribution partners in all important world markets ensure individual on-site customer service and consultation. There are various reference customers in your neighborhood who have similar furnaces or plants.

Large Customers Test Center
What furnace is the right choice for this specific process? This question cannot always be answered easily. Therefore, we have set up our modern test center which is unique in respect to size and variety. A representative number of furnaces is available for tests for our customers.

Customer Service and Spare Parts
Our professional service engineers are available for you worldwide. Due to our complete inhouse production, we can despatch most spare parts from stock over night or produce with short delivery time.

Experience in Many Fields of Thermal Processing
In addition to furnaces for the glass industry, Nabertherm offers a wide range of standard furnaces and plants for many other thermal processing applications. The modular design of our products provides for customized solutions to your individual needs without expensive modifications.
# Table of Contents

## Air Circulation Furnaces
- Air circulation bogie hearth furnaces, electrically heated or gas-fired ......................................................... 4
- Chamber ovens and dryers, electrically heated or gas-fired
  - heat soak test ovens for toughened safety glass (TSG) ........................................................................ 6
- Chamber dryers, electrically heated or gas-fired, ovens for laminated safety glass (LSG) .............................. 8
- Ovens, electrically heated also with safety technology according to EN 1539 .............................................10
- Chamber furnaces with air circulation, electrically heated ................................................................. 12

## Clean Room Solutions
......................................................................................................................... 13

## Furnaces with Radiation Heating
- Bogie hearth furnaces with wire heating up to 1400 °C ............................................................................14
- High-temperature bogie hearth furnaces with SiC rod heating up to 1550 °C ..............................................17
- Chamber furnaces with wire heating up to 1400 °C ................................................................................. 18
- Lift-top or lift-bottom furnaces with wire heating up to 1400 °C ............................................................... 22
- Top-hat furnaces with SiC rod heating ...................................................................................................... 24
- Pit-type and top-loading furnaces, electrically heated or gas-fired with or without air circulation ........... 25

## High-Temperature Furnaces
- High-temperature chamber furnaces with molybdenum disilicide heating elements with fiber insulation up to 1800 °C .................................................................................................. 26
- High-temperature chamber furnaces with SiC rod heating up to 1550 °C .................................................. 29
- Chamber furnaces with molybdenum disilicide heating elements with refractory insulation up to 1700 °C ...... 30
- Gas-fired chamber furnaces up to 1600 °C ............................................................................................31
- Lift-top and lift-bottom furnaces with molybdenum disilicide heating elements up to 1800 °C .......... 32

## Continuous Furnaces, Electrically Heated or Gas-Fired................................................................. 36

## Salt Bath Furnaces for Chemical Hardening of Glass, Electrically Heated or Gas-Fired ..................... 38

## Annealing and Hardening Furnaces with Wire Heating, Preheating Furnaces for Molds ......................... 39

## Fusing Furnaces, Tub Furnaces and Top-Hat Furnaces
- Fusing furnaces with fixed table ......................................................................................................... 40
- Fusing furnaces with wire heating with movable table ............................................................................ 42
- Tub furnaces with wire heating ........................................................................................................... 44
- Top-hat furnaces with wire heating with table ....................................................................................... 46

## Retort Furnaces
- Hot-wall retort furnaces up to 1100 °C ................................................................................................. 48
- Cold-wall retort furnaces up to 2400 °C ............................................................................................. 52
- Lift-bottom-retort furnace up to 2400 °C for production ........................................................................ 56
- Pit-type cold-wall retort furnaces up to 2400 °C or up to 3000 °C ....................................................... 57

## Float-Glass Test Kiln with Wire Heating ...................................................................................................... 58

## Laboratory Melting Furnace SC 8 with SiC Rod Heating ................................................................. 58

## Fast-Firing Decoring Furnaces with Infrared Heating ............................................................................. 59

## Temperature Uniformity and System Accuracy ..........................................................................................60

## Process Control and Documentation ......................................................................................................61
Bogie hearth furnaces with powerful air circulation are used when an optimal temperature uniformity in the low temperature range is required. They are particularly useful for processes like glass tempering or cooling. With the wide range of additional equipment the furnaces can be individually adapted to the individual process.

- Tmax 600 °C or 850 °C
- Dual shell housing with rear ventilation provides for low shell temperatures for the 850 °C models
- Swing door hinged on the right side
- Heating from chrome steel heating elements in the intake area of the air circulation system for the 600 °C models
- Heating from three sides (both side walls and the trolley) for the 850 °C models
- High-performance air circulation fan with vertical circulation
- Temperature uniformity up to +/- 5 °C according to DIN 17052-1 see page 60
- Bottom heating protected by SiC tiles on the bogie providing level stacking surface for the 850 °C models
- Furnace chamber fitted with inner sheets made of stainless steel 1.4301 for 600 °C models and of 1.4828 for 850 °C models
- Insulation structured with high-quality mineral wool for 600 °C models
- Insulation made of high-quality, non-classified fiber material for 850 °C models
- Bogies with flanged wheels running on rails for easy and precise movement of heavy loads
- Electric chain-driven bogie in combination with rail operation for smooth movement of heavy loads from model W 4800
- Over-temperature limiter with manual reset for thermal protection class 2 in accordance with EN 60519-2 as temperature limiter to protect the furnace and load
- Defined application within the constraints of the operating instructions
Additional equipment
- Direct gas heating or upon request with indirect gas heating with radiation tube
- Electric chain-driven bogie in combination with rail operation for smooth movement of heavy loads up to Model W 4000
- Optimization of the temperature uniformity up +/- 3 °C according to DIN 17052-1 see page 60
- Bogie running on steel wheels with gear rack drive, no rails in front of the furnace necessary
- Different possibilities for an extension to a bogie hearth furnace system:
  - Additional bogies
  - Bogie transfer system with parking rails to exchange bogies running on rails or to connect multiples furnaces
  - Motor-driven bogies and cross-traversal system
  - Fully automatic control of the bogie exchange
- Electro-hydraulic lift door
- Motor-driven exhaust air flaps, adjustable via the program
- Uncontrolled or controlled cooling system with frequency-controlled cooling fan and motor-driven exhaust air flap
- Multi-zone control adapted to the particular furnace model provides for optimum temperature uniformity in the 850 °C models
- Commissioning of the furnace with test firing and temperature uniformity measurement (also with load) for the purpose of process optimization
- Designed for Tmax 950 °C, fan blade driven indirectly via a belt to protect the air recirculation motor against over-heating
- Process control and documentation with Controltherm MV software package and the Nabertherm NCC control center for monitoring, documentation and control see page 62

<table>
<thead>
<tr>
<th>Model</th>
<th>T_max °C</th>
<th>Inner dimensions in mm</th>
<th>Volume in l</th>
<th>Outer dimensions in mm</th>
<th>Connected load/kW</th>
<th>Electrical connection</th>
</tr>
</thead>
<tbody>
<tr>
<td>W 1000/..A</td>
<td>800</td>
<td>1600</td>
<td>800</td>
<td>1000</td>
<td>1800</td>
<td>2390</td>
</tr>
<tr>
<td>W 1600/..A</td>
<td>1000</td>
<td>1600</td>
<td>1000</td>
<td>1600</td>
<td>2000</td>
<td>2390</td>
</tr>
<tr>
<td>W 2200/..A</td>
<td>1000</td>
<td>2250</td>
<td>1000</td>
<td>2200</td>
<td>2000</td>
<td>2390</td>
</tr>
<tr>
<td>W 3300/..A</td>
<td>600</td>
<td>1200</td>
<td>2250</td>
<td>1200</td>
<td>2000</td>
<td>2390</td>
</tr>
<tr>
<td>W 4000/..A</td>
<td>1500</td>
<td>2250</td>
<td>1200</td>
<td>4000</td>
<td>2500</td>
<td>2390</td>
</tr>
<tr>
<td>W 4800/..A</td>
<td>1500</td>
<td>3300</td>
<td>1200</td>
<td>6000</td>
<td>2500</td>
<td>2390</td>
</tr>
<tr>
<td>W 6600/..A</td>
<td>1200</td>
<td>4600</td>
<td>1200</td>
<td>6600</td>
<td>2200</td>
<td>5390</td>
</tr>
<tr>
<td>W 7500/..A</td>
<td>1400</td>
<td>3850</td>
<td>1400</td>
<td>7500</td>
<td>2400</td>
<td>4640</td>
</tr>
<tr>
<td>W 8300/..A</td>
<td>1500</td>
<td>4600</td>
<td>1200</td>
<td>8300</td>
<td>2500</td>
<td>5390</td>
</tr>
</tbody>
</table>

*Please see page 61 for more information about supply voltage
These chamber ovens are available for maximum working temperatures of 260 °C or 450 °C. They are suitable for numerous processes such as pre-heating of moulds, ageing or drying.

The version suitable for temperatures up to 450 °C is recommended for Heat Soak testing of Toughened Safety Glass (TSG). During a Heat Soak Test in accordance with EN 14179-1 the panes are exposed to a temperature of 290 °C for at least four hours in order to transform nickel sulfide inclusions and hence to prevent the pane from breaking spontaneously later. The documentation of the heat treatment process is strongly recommended. Program entry, visualization and the documentation of the process are achieved by means of the PLC-control in combination with the powerful Nabertherm Control Center (NCC), which registers and archives the temperatures at different measuring points on the pane.

- Tmax 260 °C or 450 °C
- Heated electrically or with gas
- Electrical heating by means of heater coils
- Direct gas heating or optionally indirect gas heating with temperature transfer via steel tube or heat exchanger
- Available with horizontal (type/HA) or vertical air circulation (type/A) for optimal uniformity in your charge
- Ground level charging without floor insulation for 260 °C models
- Temperature uniformity up to ΔT 6 K according to DIN 17052-1 see page 60
- Optimal air circulation for your charge by means of adjustable air outlets
- Furnace chamber lined with alloy 314 (AISI)/(DIN material no. 1.4841)
- Low shell temperature by means of high quality mineral wool insulation
- Manually adjustable air inlet and exhaust air vent
- High air exchange for fast drying processes
- Furnace sizes suitable for common charging systems, such as pallets, baskets, etc.
- Double-winged door for models with an internal width of more than 1500 mm, smaller models are equipped with a single-winged door
- Over-temperature limiter with manual reset for thermal protection class in accordance with EN 60519-2 as temperature limiter controller to protect the oven and load
- Defined application within the constraints of the operating instructions
- Controls description see page 61
Additional equipment

- Data recording via Nabertherm Control Center (NCC) in accordance with the requirements of EN 14179-1 for Heat Soak Tests of Tempered Safety Glass (TSG)
- Racks for loading of standing glass panes
- Optional floor insulation for improved temperature uniformity on 260 °C models
- Entry ramp or track cutouts for floor-level charging cart of models with insulated bottom
- Electro-hydraulic lift door
- Fan system for faster cooling with manual or automatic control
- Motor-driven control of exhaust air flaps for better ventilation of the furnace chamber
- Window and furnace chamber illumination
- Safety technology according to EN 1539 for charges containing solvents
- Catalytic or thermal exhaust gas cleaning systems

<table>
<thead>
<tr>
<th>Model</th>
<th>Tmax</th>
<th>Inner dimensions in mm</th>
<th>Volume in l</th>
<th>Circulation rate m³/h</th>
<th>Connected load/kW</th>
<th>Electrical connections</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>°C</td>
<td>w</td>
<td>d</td>
<td>h</td>
<td></td>
<td>260 °C</td>
</tr>
<tr>
<td>N 9900/..</td>
<td>260 or 450</td>
<td>1500</td>
<td>3000</td>
<td>2200</td>
<td>9900</td>
<td>21500</td>
</tr>
<tr>
<td>N 17600/..</td>
<td>260 or 450</td>
<td>2000</td>
<td>4000</td>
<td>2200</td>
<td>17600</td>
<td>33000</td>
</tr>
<tr>
<td>N 41600/..</td>
<td>260 or 450</td>
<td>2000</td>
<td>6500</td>
<td>3200</td>
<td>41600</td>
<td>64000</td>
</tr>
<tr>
<td>N 560/..</td>
<td>260 or 450</td>
<td>750</td>
<td>1000</td>
<td>750</td>
<td>560</td>
<td>900</td>
</tr>
<tr>
<td>N 1000/..</td>
<td>260 or 450</td>
<td>1000</td>
<td>1000</td>
<td>1000</td>
<td>1000</td>
<td>3600</td>
</tr>
<tr>
<td>N 1500/..</td>
<td>260 or 450</td>
<td>1500</td>
<td>1000</td>
<td>1500</td>
<td>1500</td>
<td>3600</td>
</tr>
<tr>
<td>N 1500/..1</td>
<td>260 or 450</td>
<td>500</td>
<td>1500</td>
<td>1500</td>
<td>1500</td>
<td>3600</td>
</tr>
<tr>
<td>N 2000/..</td>
<td>260 or 450</td>
<td>1500</td>
<td>1100</td>
<td>1200</td>
<td>2000</td>
<td>6400</td>
</tr>
<tr>
<td>N 2000/..1</td>
<td>260 or 450</td>
<td>1100</td>
<td>1500</td>
<td>1200</td>
<td>2000</td>
<td>6400</td>
</tr>
<tr>
<td>N 2010/..</td>
<td>260 or 450</td>
<td>1000</td>
<td>1200</td>
<td>2000</td>
<td>2000</td>
<td>7200</td>
</tr>
<tr>
<td>N 2880/..</td>
<td>260 or 450</td>
<td>1200</td>
<td>1000</td>
<td>1200</td>
<td>2000</td>
<td>9000</td>
</tr>
<tr>
<td>N 4000/..</td>
<td>260 or 450</td>
<td>1500</td>
<td>2000</td>
<td>1200</td>
<td>1200</td>
<td>9000</td>
</tr>
<tr>
<td>N 4000/..1</td>
<td>260 or 450</td>
<td>2200</td>
<td>1500</td>
<td>1200</td>
<td>4000</td>
<td>9000</td>
</tr>
<tr>
<td>N 4010/..</td>
<td>260 or 450</td>
<td>1000</td>
<td>2000</td>
<td>2000</td>
<td>4000</td>
<td>9000</td>
</tr>
<tr>
<td>N 4500/..</td>
<td>260 or 450</td>
<td>1500</td>
<td>1500</td>
<td>2000</td>
<td>1500</td>
<td>12800</td>
</tr>
<tr>
<td>N 5600/..</td>
<td>260 or 450</td>
<td>1500</td>
<td>1500</td>
<td>1500</td>
<td>1500</td>
<td>5600</td>
</tr>
<tr>
<td>N 6750/..</td>
<td>260 or 450</td>
<td>1500</td>
<td>3000</td>
<td>1500</td>
<td>6750</td>
<td>19200</td>
</tr>
<tr>
<td>N 7200/..</td>
<td>260 or 450</td>
<td>2000</td>
<td>1500</td>
<td>2400</td>
<td>7200</td>
<td>18000</td>
</tr>
<tr>
<td>N 10000/..</td>
<td>260 or 450</td>
<td>2000</td>
<td>2500</td>
<td>2000</td>
<td>10000</td>
<td>25600</td>
</tr>
</tbody>
</table>

¹Reduced connected power for plastics applications
*Please see page 61 for more information about supply voltage

Temperature recording in accordance with EN 14179-1
Chamber Dryers, Electrically Heated or Gas-Fired Ovens for Laminated Safety Glass (LSG)

The chamber dryers of the KTR range can be used for complex drying processes and heat treatment of charges of normal weight and packing density to an application temperature of 260 °C. The high-performance air circulation enables optimum temperature uniformity throughout the work space. A wide range of accessories allow the furnace to be modified to meet specific process requirements.

The chamber dryers can also be used for production of laminated safety glass (LSG). During this process two panes are bonded using a laminating foil and entered into the oven inside a vacuum bag. From outside the furnace a vacuum is generated via hose connection in order to avoid air inclusions between the panes during the heat treatment.

- Tmax 260 °C
- Electrically heated (via a heating register with integrated chrome steel heating elements) or gas-fired (direct gas heating including injection of the hot air into the intake duct)
- Temperature uniformity up to ΔT 6 K according to DIN 17052-1 (for design without track cutouts) see page 60

Standard models

Vacuum bag for laminated safety glass

Air circulation in the chamber dryer

Charging cart with pull-out trays

KTR 8000 with clean room specs
High-quality mineral wool insulation provides for outer temperatures of < 20 °C above room temperature

High air exchange for fast drying processes

Double-wing door for furnaces KTR 3100 and larger

Over-temperature limiter with manual reset for thermal protection class 2 in accordance with EN 60519-2 as temperature limiter to protect the dryer and load

Incl. floor insulation

Defined application within the constraints of the operating instructions

Controls description see page 61

Additional equipment

Entry ramp for pallet trucks or track cutouts for charging cart

Connection ports for vacuum bags inside the oven for laminated safety glass (LSG). The vacuum pump is connected on the outside of the furnace.

Optimal air circulation for individual charges by means of adjustable air outlets

Fan system for faster cooling with manual or motor-driven control

Programmed opening and closing of exhaust air flaps

Observation window and furnace chamber lighting

Safety technology according to EN 1539 for charges containing solvents

Charging cart with or without rack system

Design for clean room heat treatment processes see page 13

Process control and documentation with Controltherm MV software package see page 63

<table>
<thead>
<tr>
<th>Model</th>
<th>T_max °C</th>
<th>Inner dimensions in mm</th>
<th>Volume in l</th>
<th>Outer dimensions in mm</th>
<th>Connected load kW</th>
<th>Electrical connection</th>
</tr>
</thead>
<tbody>
<tr>
<td>KTR 1500</td>
<td>260</td>
<td>1000 x 1000 x 1500</td>
<td>1500</td>
<td>1950 x 1430 x 2315</td>
<td>21.0</td>
<td>3-phase</td>
</tr>
<tr>
<td>KTR 3100</td>
<td>260</td>
<td>1250 x 1250 x 2000</td>
<td>3100</td>
<td>2160 x 1680 x 2880</td>
<td>30.0</td>
<td>3-phase</td>
</tr>
<tr>
<td>KTR 4500</td>
<td>260</td>
<td>1500 x 1500 x 2000</td>
<td>4500</td>
<td>2410 x 1930 x 2880</td>
<td>48.0</td>
<td>3-phase</td>
</tr>
<tr>
<td>KTR 6125</td>
<td>260</td>
<td>1750 x 1750 x 2000</td>
<td>6125</td>
<td>2660 x 2180 x 3000</td>
<td>50.0</td>
<td>3-phase</td>
</tr>
<tr>
<td>KTR 8000</td>
<td>260</td>
<td>2000 x 2000 x 2000</td>
<td>8000</td>
<td>2910 x 2430 x 3000</td>
<td>59.0</td>
<td>3-phase</td>
</tr>
</tbody>
</table>

*Please see page 61 for more information about supply voltage
Ovens, Electrically Heated
also with Safety Technology According to EN 1539

TR 60 - TR 1050
With their maximum working temperature of up to 300 °C and forced air circulation, the ovens achieve a perfect temperature uniformity which is much better than in ovens of most competitors. They can be used for various applications such as e.g. drying, sterilizing or warm storing. Ample warehousing of standard models provides for short delivery times.

- Tmax 300 °C
- Working temperature range: +5 °C above room temperature up to 300 °C
- Models TR 60 - TR 240 designed as tabletop models
- Models TR 450 and TR 1050 designed as floor standing models
- Horizontal, forced air circulation results in temperature uniformity better than +/- 5 °C see page 60
- Stainless steel chamber, alloy 304 (AISI)/(DIN material no. 1.4301), rust-resistant and easy to clean
- Large handle to open and close the door
- Charging in multiple layers possible using removeable grids (number of removeable grids included, see table to the right)
- Large, wide-opening swing door, hinged on the right with quick release for models TR 60 - TR 450
- Double swing door with quick release for TR 1050
- TR 1050 equipped transport rollers
- Infinitely adjustable exhaust at the rear wall with operation from the front
- PID microprocessor control with self-diagnosis system
- Solid state relays provide for low noise operation
- Defined application within the constraints of the operating instructions
- Controls description see page 61

Additional equipment
- Over-temperature limiter with manual reset for thermal protection class 2 in accordance with EN 60519-2 as temperature limiter to protect the furnace and load
- Infinitely adjustable fan speed of the air circulation fan
Window for charge observing
Further removeable grids with rails
Side inlet
Stainless steel collecting pan to protect the furnace chamber
Safety Technology according to EN 1539 for charges (TRS) containing liquid solvents up to model TRS 240, achievable temperature uniformity +/- 8 °C see page 60
Transport costors for model TR 450
Various modifications available for individual needs
Upgrading available to meet the quality requirements of AMS 2750 E or FDA
Process control and documentation with Controltherm MV software package see page 63

| Model | Tmax °C | Inner dimensions in mm | Volume in l | Outer dimensions in mm | Connected load kW | Electrical connection | Weight in kg | Grids included | Grids max. | Max. total load¹ |
|-------|---------|------------------------|-------------|------------------------|------------------|----------------------|-------------|----------------|------------|----------------|------------------|
| TR 60 | 300     | 450 380 350            | 60          | 700 650 690            | 3.0              | 1-phase              | 90          | 1 4           |           | 120           |
| TRS 60| 260     | 450 380 350            | 57          | 700 680 690            | 6.3              | 3-phase              | 92          | 1 4           |           | 120           |
| TR 120| 300     | 500 450 350            | 120         | 900 850 840            | 3.1              | 1-phase              | 120         | 2 7           | 150       |                |
| TRS 120| 260    | 500 450 350           | 117         | 900 880 840            | 6.3              | 3-phase              | 122         | 2 7           | 150       |                |
| TR 240| 300     | 550 450 360            | 240         | 1000 850 940           | 3.1              | 1-phase              | 165         | 2 8           | 150       |                |
| TRS 240| 260    | 550 450 360           | 235         | 1000 880 940           | 6.3              | 3-phase              | 167         | 2 8           | 150       |                |
| TR 450| 300     | 550 450 360            | 450         | 1000 820 940           | 6.3              | 3-phase              | 235         | 3 15          | 180       |                |
| TRS 450| 260    | 550 450 360           | 450         | 1000 820 940           | 6.3              | 3-phase              | 450         | 4 14          | 250       |                |
| TR 1050| 300    | 630 555 450           | 1050        | 1470 955 1920          | 9.3              | 3-phase              | 450         | 4 14          | 250       |                |

¹Max load per layer 30 kg
²If EN 1539 is ordered power rating will increase

*Please see page 61 for more information about supply voltage
Chamber Furnaces with Air Circulation, Electrically Heated

N 15/65HA, N 30/45/45HA - N 500/85HA

These chamber furnaces with air circulation are characterized by their extremely high temperature uniformity. Hence, they are especially suitable for processes such as cooling, crystalizing, pre-heating, curing, but also for numerous processes in tool making. Due to the modular concept, the furnaces can be adjusted to the process requirements by adding suitable equipment.

- Tmax 450 °C, 650 °C, or 850 °C
- Horizontal air circulation
- Swing door hinged on the right
- Temperature uniformity up to +/- 5 °C according to DIN 17052-1 (model N 15/65 HA up to +/- 7 °C see page 60
- Optimum air flow and temperature uniformity through high circulation rates
- One shelf and rails for two additional shelves included (N 15/65 HA without removable tray)
- Stainless steel air-baffles in the furnace for optimum air circulation
- Base frame included in the delivery, N 15/65 HA designed as table-top model
- Switchgear with solid-state relays
- Defined application within the constraints of the operating instructions

Controls description see page 61

---

For additional information about chamber furnaces with air circulation please ask for our separate catalog!

---

<table>
<thead>
<tr>
<th>Model</th>
<th>Tmax °C</th>
<th>Inner dimensions in mm</th>
<th>Volume in l</th>
<th>Outer dimensions in mm</th>
<th>Connected load kW</th>
<th>Electrical connection</th>
<th>Weight in kg</th>
</tr>
</thead>
<tbody>
<tr>
<td>NA 30/45</td>
<td>450</td>
<td>290 420 260</td>
<td>30</td>
<td>1040 1290 1385</td>
<td>3.6</td>
<td>1-phase</td>
<td>195</td>
</tr>
<tr>
<td>NA 60/45</td>
<td>450</td>
<td>350 500 350</td>
<td>60</td>
<td>1100 1370 1475</td>
<td>6.6</td>
<td>3-phase</td>
<td>240</td>
</tr>
<tr>
<td>NA 120/45</td>
<td>450</td>
<td>450 600 450</td>
<td>120</td>
<td>1200 1470 1575</td>
<td>9.6</td>
<td>3-phase</td>
<td>310</td>
</tr>
<tr>
<td>NA 250/45</td>
<td>450</td>
<td>600 750 600</td>
<td>250</td>
<td>1350 1650 1725</td>
<td>19.0</td>
<td>3-phase</td>
<td>610</td>
</tr>
<tr>
<td>NA 500/45</td>
<td>450</td>
<td>750 1000 750</td>
<td>500</td>
<td>1500 1850 1800</td>
<td>28.0</td>
<td>3-phase</td>
<td>1030</td>
</tr>
<tr>
<td>NA 675/45</td>
<td>450</td>
<td>750 1200 750</td>
<td>675</td>
<td>1500 2050 1800</td>
<td>28.0</td>
<td>3-phase</td>
<td>1350</td>
</tr>
<tr>
<td>N 15/65 HA¹</td>
<td>650</td>
<td>295 340 170</td>
<td>15</td>
<td>470 845 460</td>
<td>2.7</td>
<td>1-phase</td>
<td>55</td>
</tr>
<tr>
<td>N 30/65 HA</td>
<td>650</td>
<td>290 420 260</td>
<td>30</td>
<td>607 + 255 1175 1315</td>
<td>6.0</td>
<td>3-phase²</td>
<td>195</td>
</tr>
<tr>
<td>N 60/65 HA</td>
<td>650</td>
<td>350 500 350</td>
<td>60</td>
<td>667 + 255 1250 1400</td>
<td>9.6</td>
<td>3-phase</td>
<td>240</td>
</tr>
<tr>
<td>N 120/65 HA</td>
<td>650</td>
<td>450 600 450</td>
<td>120</td>
<td>767 + 255 1350 1500</td>
<td>13.6</td>
<td>3-phase</td>
<td>310</td>
</tr>
<tr>
<td>N 250/65 HA</td>
<td>650</td>
<td>600 750 600</td>
<td>250</td>
<td>1002 + 255 1636 1860</td>
<td>21.0</td>
<td>3-phase</td>
<td>610</td>
</tr>
<tr>
<td>N 500/65 HA</td>
<td>650</td>
<td>750 1000 750</td>
<td>500</td>
<td>1152 + 255 1886 2010</td>
<td>31.0</td>
<td>3-phase</td>
<td>1030</td>
</tr>
<tr>
<td>N 675/65 HA</td>
<td>650</td>
<td>750 1200 750</td>
<td>675</td>
<td>1152 + 255 2100 2010</td>
<td>31.0</td>
<td>3-phase</td>
<td>1350</td>
</tr>
<tr>
<td>N 30/85 HA</td>
<td>850</td>
<td>290 420 260</td>
<td>30</td>
<td>607 + 255 1175 1315</td>
<td>6.0</td>
<td>3-phase²</td>
<td>195</td>
</tr>
<tr>
<td>N 60/85 HA</td>
<td>850</td>
<td>350 500 350</td>
<td>60</td>
<td>667 + 255 1250 1400</td>
<td>9.6</td>
<td>3-phase</td>
<td>240</td>
</tr>
<tr>
<td>N 120/85 HA</td>
<td>850</td>
<td>450 600 450</td>
<td>120</td>
<td>767 + 255 1350 1500</td>
<td>13.6</td>
<td>3-phase</td>
<td>310</td>
</tr>
<tr>
<td>N 250/85 HA</td>
<td>850</td>
<td>600 750 600</td>
<td>250</td>
<td>1002 + 255 1636 1860</td>
<td>21.0</td>
<td>3-phase</td>
<td>610</td>
</tr>
<tr>
<td>N 500/85 HA</td>
<td>850</td>
<td>750 1000 750</td>
<td>500</td>
<td>1152 + 255 1886 2010</td>
<td>31.0</td>
<td>3-phase</td>
<td>1030</td>
</tr>
<tr>
<td>N 675/85 HA</td>
<td>850</td>
<td>750 1200 750</td>
<td>675</td>
<td>1152 + 255 2100 2010</td>
<td>31.0</td>
<td>3-phase</td>
<td>1350</td>
</tr>
</tbody>
</table>

¹Table-top model
²Heating only between two phases
³Please see page 61 for more information about supply voltage
Clean Room Solutions

Clean room applications impose particularly high requirements to the design of the chosen furnace. If the complete furnace is operated in a clean room an essential contamination of the clean room atmosphere must be avoided. Especially, the particle contamination must be reduced to a minimum.

The specific application determines the choice of the required furnace technology. In many cases air circulation furnaces are required to achieve the necessary temperature uniformity at lower temperatures. For higher temperatures, Nabertherm has also delivered many furnaces with radiant heating.

Furnace Installation in the Clean Room
If the complete furnace is supposed to be positioned in the clean room, then it is important that both the furnace chamber and the furnace housing as well as the controls provide for good protection against contamination. Surfaces must be easy to clean. The furnace chamber is tightly sealed to the insulation behind it. If necessary, additional equipment such as filters for the fresh air supply or the air circulation in the furnace can be used to improve the cleanliness class. It is recommended to install the switchgear and the furnace controls outside the clean room.

Furnace Installation in the Grey Room, Furnace Charging from the Clean Room
Optimal results with respect to cleanliness will be achieved by placing the furnace in the grey room with charging from the clean room. This significantly reduces the amount of costly space needed in the clean room to a minimum. The front and the furnace interior in the clean room are designed for easy cleaning. With this configuration even the highest clean room classes can be achieved.

Sluice Furnace between Grey Room and Clean Room
Logistics between clean room and grey room can often be easily sorted out. Lock furnaces with one door in the grey room and the other door in the clean room are the perfect choice for these applications. The inner chamber as well as the furnace front in the clean room will be especially designed for lowest particle contamination.

Please contact us if you are looking for a heat treatment solution under clean room conditions. We would be pleased to quote for the oven or furnace model that meets best your requirements.
Bogie Hearth Furnaces with Wire Heating up to 1400 °C

When cooling, decorating, glazing or sintering special glass during production, bogie hearth furnaces offer numerous advantages. Due to their very good temperature uniformity, these models are perfectly suited for burning in a separation layer of silicon nitride in crucibles for the solar industry. The bogie can be charged outside the furnace. Several shuttles can be used, so that one shuttle can be charged while the other shuttle is in the furnace.

- **Tmax 1280 °C, 1340 °C or 1400 °C**
- Dual shell housing with rear ventilation, provides for low shell temperatures
- Swing door hinged on the right side
- Heating from five sides (four sides and bogie) provides for an optimum temperature uniformity
- Bogie heating receives power via blade contacts when driven in
- Heating elements mounted on support tubes provide for free radiation and long service life
- Bottom heating protected by SiC tiles on the bogie providing level stacking surface
- Multi-layer insulation consisting of lightweight refractory bricks backed by microporous silica insulation
- Self-supporting and long-life ceiling construction with bricks laid in arched construction, for models up to 1340 °C or as fiber insulation
- Roof made of high-quality fiber material for models with Tmax 1400 °C
- Freely moveable bogie with rubber wheels up to model W 3300
- Adjustable air inlet damper
- Manual exhaust air flap on the furnace roof
- Over-temperature limiter with manual reset for thermal protection class 2 in accordance with EN 60519-2 as temperature limiter to protect the furnace and load
- Defined application within the constraints of the operating instructions
Additional equipment

- Fiber insulation also in combination with meander shaped heating for short heating times
- Bogies with flanged wheels running on rails for easy and precise movement of high loads or complex kiln furniture
- Electric chain-driven bogie in combination with rail operation for smooth movement of heavy loads
- Bogie running on steel wheels with gear rack drive, no rails in front of the furnace necessary
- Different possibilities for an extension to a bogie hearth furnace system:
  - Additional bogies
  - Bogie transfer system with parking rails to exchange bogies running on rails or to connect multiples furnaces
  - Motor-driven bogies and cross-traversal system
  - Fully automatic control of the bogie exchange
- Electro-hydraulic lift door
- Customized kiln furniture
- Motor-driven exhaust air flap, switchable via the program
- Uncontrolled or controlled cooling system with frequency-controlled cooling fan and motor-driven exhaust air flap
- Multi-zone control adapted to the particular furnace provides model for optimal the temperature uniformity
- Commissioning of the furnace with test firing and temperature uniformity measurement (also with load) for the purpose of process optimization
- Thermal or catalytic exhaust cleaning systems
- Process documentation and control with Controtherm MV software package, NTLog and NTGraph for the basic furnace or Nabertherm Control Center (NCC) for monitoring, documentation and control see page 62
Bogie Hearth Furnaces with Wire Heated up to 1400 °C

Combi furnace system consisting of two furnaces W 5000/H and two additional bogies incl. bogie transfer system and incl. necessary park rails

<table>
<thead>
<tr>
<th>Model</th>
<th>Tmax °C</th>
<th>Inner dimensions in mm</th>
<th>Volume in l</th>
<th>Outer dimensions in mm</th>
<th>Connected load kW</th>
<th>Electrical connection*</th>
<th>Weight in kg</th>
</tr>
</thead>
<tbody>
<tr>
<td>W 1000/G</td>
<td>900</td>
<td>800 1600 800</td>
<td>1000</td>
<td>1470 2410 1915</td>
<td>40</td>
<td>3-phase</td>
<td>3000</td>
</tr>
<tr>
<td>W 1500/G</td>
<td>900</td>
<td>900 1900 900</td>
<td>1500</td>
<td>1570 2710 2030</td>
<td>57</td>
<td>3-phase</td>
<td>3500</td>
</tr>
<tr>
<td>W 2200/G</td>
<td>900</td>
<td>1000 2200 1000</td>
<td>2200</td>
<td>1670 3010 2140</td>
<td>75</td>
<td>3-phase</td>
<td>4500</td>
</tr>
<tr>
<td>W 3300/G</td>
<td>900</td>
<td>1000 2800 1200</td>
<td>3300</td>
<td>1670 3610 2355</td>
<td>110</td>
<td>3-phase</td>
<td>5300</td>
</tr>
<tr>
<td>W 5000/G</td>
<td>900</td>
<td>1000 3600 1400</td>
<td>5000</td>
<td>1670 4410 2555</td>
<td>140</td>
<td>3-phase</td>
<td>7300</td>
</tr>
<tr>
<td>W 7500/G</td>
<td>900</td>
<td>1000 5400 1400</td>
<td>7500</td>
<td>1670 6210 2555</td>
<td>185</td>
<td>3-phase</td>
<td>11300</td>
</tr>
<tr>
<td>W 10000/G</td>
<td>900</td>
<td>1000 7100 1400</td>
<td>10000</td>
<td>1670 7910 2555</td>
<td>235</td>
<td>3-phase</td>
<td>12500</td>
</tr>
<tr>
<td>W 1000</td>
<td>1280</td>
<td>800 1600 800</td>
<td>1000</td>
<td>1470 2410 1915</td>
<td>57</td>
<td>3-phase</td>
<td>3000</td>
</tr>
<tr>
<td>W 1500</td>
<td>1280</td>
<td>900 1900 900</td>
<td>1500</td>
<td>1570 2710 2030</td>
<td>75</td>
<td>3-phase</td>
<td>3500</td>
</tr>
<tr>
<td>W 2200</td>
<td>1280</td>
<td>1000 2200 1000</td>
<td>2200</td>
<td>1670 3010 2140</td>
<td>110</td>
<td>3-phase</td>
<td>4500</td>
</tr>
<tr>
<td>W 3300</td>
<td>1280</td>
<td>1000 2800 1200</td>
<td>3300</td>
<td>1670 3610 2355</td>
<td>140</td>
<td>3-phase</td>
<td>5300</td>
</tr>
<tr>
<td>W 5000</td>
<td>1280</td>
<td>1000 3600 1400</td>
<td>5000</td>
<td>1670 4410 2555</td>
<td>185</td>
<td>3-phase</td>
<td>7300</td>
</tr>
<tr>
<td>W 7500</td>
<td>1280</td>
<td>1000 5400 1400</td>
<td>7500</td>
<td>1670 6210 2555</td>
<td>235</td>
<td>3-phase</td>
<td>10300</td>
</tr>
<tr>
<td>W 10000</td>
<td>1280</td>
<td>1000 7100 1400</td>
<td>10000</td>
<td>1670 7910 2555</td>
<td>300</td>
<td>3-phase</td>
<td>12500</td>
</tr>
<tr>
<td>W 1000/H</td>
<td>1340</td>
<td>800 1600 800</td>
<td>1000</td>
<td>1470 2410 1915</td>
<td>75</td>
<td>3-phase</td>
<td>3500</td>
</tr>
<tr>
<td>W 1500/H</td>
<td>1340</td>
<td>900 1900 900</td>
<td>1500</td>
<td>1570 2710 2030</td>
<td>110</td>
<td>3-phase</td>
<td>4000</td>
</tr>
<tr>
<td>W 2200/H</td>
<td>1340</td>
<td>1000 2200 1000</td>
<td>2200</td>
<td>1670 3010 2140</td>
<td>140</td>
<td>3-phase</td>
<td>5000</td>
</tr>
<tr>
<td>W 3300/H</td>
<td>1340</td>
<td>1000 2800 1200</td>
<td>3300</td>
<td>1670 3610 2355</td>
<td>185</td>
<td>3-phase</td>
<td>6000</td>
</tr>
<tr>
<td>W 5000/H</td>
<td>1340</td>
<td>1000 3600 1400</td>
<td>5000</td>
<td>1670 4410 2555</td>
<td>235</td>
<td>3-phase</td>
<td>8000</td>
</tr>
<tr>
<td>W 7500/H</td>
<td>1340</td>
<td>1000 5400 1400</td>
<td>7500</td>
<td>1670 6210 2555</td>
<td>370</td>
<td>3-phase</td>
<td>11300</td>
</tr>
<tr>
<td>W 10000/H</td>
<td>1340</td>
<td>1000 7100 1400</td>
<td>10000</td>
<td>1670 7910 2555</td>
<td>440</td>
<td>3-phase</td>
<td>13800</td>
</tr>
<tr>
<td>W 1000/14</td>
<td>1400</td>
<td>800 1600 800</td>
<td>1000</td>
<td>1470 2410 1915</td>
<td>75</td>
<td>3-phase</td>
<td>3300</td>
</tr>
<tr>
<td>W 1500/14</td>
<td>1400</td>
<td>900 1900 900</td>
<td>1500</td>
<td>1570 2710 2030</td>
<td>110</td>
<td>3-phase</td>
<td>3800</td>
</tr>
<tr>
<td>W 2200/14</td>
<td>1400</td>
<td>1000 2200 1000</td>
<td>2200</td>
<td>1670 3010 2140</td>
<td>140</td>
<td>3-phase</td>
<td>4800</td>
</tr>
<tr>
<td>W 3300/14</td>
<td>1400</td>
<td>1000 2800 1200</td>
<td>3300</td>
<td>1670 3610 2355</td>
<td>185</td>
<td>3-phase</td>
<td>5700</td>
</tr>
<tr>
<td>W 5000/14</td>
<td>1400</td>
<td>1000 3600 1400</td>
<td>5000</td>
<td>1670 4410 2555</td>
<td>235</td>
<td>3-phase</td>
<td>7700</td>
</tr>
<tr>
<td>W 7500/14</td>
<td>1400</td>
<td>1000 5400 1400</td>
<td>7500</td>
<td>1670 6210 2555</td>
<td>370</td>
<td>3-phase</td>
<td>10900</td>
</tr>
<tr>
<td>W 10000/14</td>
<td>1400</td>
<td>1000 7100 1400</td>
<td>10000</td>
<td>1670 7910 2555</td>
<td>440</td>
<td>3-phase</td>
<td>13300</td>
</tr>
</tbody>
</table>

*Please see page 61 for more information about supply voltage.
Bogie hearth furnaces equipped with SiC rod heating can be used for processes up to 1550 °C. The WHTC product line with especially robust design can hold heavy charges including kiln furniture. The furnace chamber is equipped with a high-quality insulation made of high-temperature fiber blocks. The bogie insulation is structured in multi-layer lightweight refractory bricks on the heating chamber side.

The furnace is heated along both sides by vertically installed SiC heating rods. This heating technology permits processes requiring working temperatures above 1350 °C which cannot be achieved with wire heating elements. The SiC rods are controlled by thyristor controller which counteract the aging of the heating elements by means of automatic power compensation.

- Tmax 1550 °C
- Dual shell housing with rear ventilation, provides for low shell temperatures
- Swing door hinged on the right side
- Heating from both sides via vertically mounted SiC rods
- Thyristor controllers with automatic output compensation counteract the aging of SiC rods
- Multi-layer insulation with high-quality fiber modules on the heating chamber side
- Bogie for heavy loads lined with lightweight refractory bricks
- Bogie hand driven on rubber tires
- Motor-driven exhaust air flap on the furnace roof
- Over-temperature limiter with manual reset for thermal protection class 2, as defined in EN 60519-2, to protect the furnace and charge
- Defined application within the constraints of the operating instructions

Additional equipment

The WHTC bogie hearth furnaces can be equipped with extensive additional equipment to be optimally adapted to individual processes. For additional equipment see page 15.
Chamber Furnaces with Wire Heating up to 1400 °C

N 100 - N 2200/14

These high-quality chamber furnaces for firing, sintering and tempering have qualified themselves with the reliability for many years in daily use. Thanks to their five-side heating, the furnaces provide for a very good temperature uniformity. A wide range of additional equipment perfectly adapt these models to the process requirements.

- Tmax 1300 °C, 1340 °C or 1400 °C
- Five-side heating provide for good temperature uniformity
- Heating elements on support tubes provide for free heat radiation and long service life
- Vapour vent in the middle of the roof (excellent ventilation)
- Smoothly adjustable and easy-to-operate air inlet flap or sliding damper
- Self-supporting and long-life ceiling construction, with bricks laid in arched construction
- Special door lock for easy handling
- Multi-layer insulation consisting of lightweight refractory bricks and backed by special fiber insulation
- Models up to N 300/.. with removable stand
- Bottom heating elements protected by SiC tiles for level stacking surface
- Defined application within the constraints of the operating instructions
- Controls description see page 61

Additional equipment
- Motor-driven exhaust air flap
- Fan system for faster cooling with manual or automatic control
- Protective gas connection for purging the furnace with non-flammable protective or reaction gases
- Manual or automatic gas supply systems
- Fiber-insulation for shorter cycle times, especially cooling periods
- Multi-zone control for optimal temperature uniformity in the work space
- Over-temperature limiter with manual reset for thermal protection class 2 in accordance with EN 60519-2 as temperature limiter to protect the furnace and load
<table>
<thead>
<tr>
<th>Model</th>
<th>Tmax °C</th>
<th>Inner dimensions in mm</th>
<th>Volume in l</th>
<th>Outer dimensions in mm</th>
<th>Connected load kW</th>
<th>Electrical connection*</th>
<th>Weight in kg</th>
</tr>
</thead>
<tbody>
<tr>
<td>N 100/G</td>
<td>900</td>
<td>400 530 460</td>
<td>100</td>
<td>710 1150 1440</td>
<td>7</td>
<td>3-phase 275</td>
<td></td>
</tr>
<tr>
<td>N 150/G</td>
<td>900</td>
<td>450 530 590</td>
<td>150</td>
<td>760 1150 1570</td>
<td>9</td>
<td>3-phase 320</td>
<td></td>
</tr>
<tr>
<td>N 200/G</td>
<td>900</td>
<td>500 530 720</td>
<td>200</td>
<td>810 1150 1700</td>
<td>11</td>
<td>3-phase 345</td>
<td></td>
</tr>
<tr>
<td>N 250/G</td>
<td>900</td>
<td>550 700 780</td>
<td>300</td>
<td>860 1320 1760</td>
<td>15</td>
<td>3-phase 450</td>
<td></td>
</tr>
<tr>
<td>N 300/G</td>
<td>900</td>
<td>600 750 1000</td>
<td>450</td>
<td>1000 1470 1830</td>
<td>20</td>
<td>3-phase 780</td>
<td></td>
</tr>
<tr>
<td>N 400/G</td>
<td>900</td>
<td>600 1100 1000</td>
<td>660</td>
<td>1000 1820 1830</td>
<td>26</td>
<td>3-phase 950</td>
<td></td>
</tr>
<tr>
<td>N 600/G</td>
<td>900</td>
<td>800 1250 1000</td>
<td>1000</td>
<td>1390 1760 2000</td>
<td>40</td>
<td>3-phase 1680</td>
<td></td>
</tr>
<tr>
<td>N 800/G</td>
<td>900</td>
<td>900 1400 1000</td>
<td>1500</td>
<td>1490 1960 2150</td>
<td>57</td>
<td>3-phase 2200</td>
<td></td>
</tr>
<tr>
<td>N 1000/G</td>
<td>900</td>
<td>1000 1400 1600</td>
<td>2200</td>
<td>1590 2160 2350</td>
<td>75</td>
<td>3-phase 2800</td>
<td></td>
</tr>
<tr>
<td>N 1500/G</td>
<td>900</td>
<td>1000 1400 1400</td>
<td>1500</td>
<td>1490 1960 2150</td>
<td>75</td>
<td>3-phase 2500</td>
<td></td>
</tr>
<tr>
<td>N 2000/G</td>
<td>900</td>
<td>1000 1400 1600</td>
<td>2200</td>
<td>1590 2160 2350</td>
<td>110</td>
<td>3-phase 3100</td>
<td></td>
</tr>
<tr>
<td>N 100/H</td>
<td>1340</td>
<td>400 530 460</td>
<td>100</td>
<td>740 1170 1440</td>
<td>11</td>
<td>3-phase 325</td>
<td></td>
</tr>
<tr>
<td>N 150/H</td>
<td>1340</td>
<td>450 530 590</td>
<td>150</td>
<td>790 1170 1570</td>
<td>15</td>
<td>3-phase 380</td>
<td></td>
</tr>
<tr>
<td>N 200/H</td>
<td>1340</td>
<td>500 530 720</td>
<td>200</td>
<td>840 1170 1700</td>
<td>20</td>
<td>3-phase 430</td>
<td></td>
</tr>
<tr>
<td>N 250/H</td>
<td>1340</td>
<td>550 700 780</td>
<td>300</td>
<td>890 1340 1760</td>
<td>27</td>
<td>3-phase 550</td>
<td></td>
</tr>
<tr>
<td>N 300/H</td>
<td>1340</td>
<td>600 750 1000</td>
<td>450</td>
<td>1000 1470 1830</td>
<td>40</td>
<td>3-phase 880</td>
<td></td>
</tr>
<tr>
<td>N 400/H</td>
<td>1340</td>
<td>600 1100 1000</td>
<td>660</td>
<td>1000 1820 1830</td>
<td>52</td>
<td>3-phase 1080</td>
<td></td>
</tr>
<tr>
<td>N 600/H</td>
<td>1340</td>
<td>800 1250 1000</td>
<td>1000</td>
<td>1390 1760 2000</td>
<td>75</td>
<td>3-phase 2320</td>
<td></td>
</tr>
<tr>
<td>N 800/H</td>
<td>1340</td>
<td>900 1400 1000</td>
<td>1500</td>
<td>1490 1960 2150</td>
<td>110</td>
<td>3-phase 2700</td>
<td></td>
</tr>
<tr>
<td>N 1000/H</td>
<td>1340</td>
<td>1000 1400 1600</td>
<td>2200</td>
<td>1590 2160 2350</td>
<td>140</td>
<td>3-phase 3600</td>
<td></td>
</tr>
</tbody>
</table>

*Please see page 61 for more information about supply voltage

Chamber furnace with fiber insulation for shorter cycle times

Charging trolley for N 2200

N 1680/S for long parts
Chamber Furnaces with Wire Heating with Brick Insulation or Fiber Insulation

The LH 15/12 - LF 120/14 laboratory furnaces have been trusted for many years as professional chamber furnaces for the laboratory. These furnaces are available with either a robust insulation of light refractory bricks (LH models) or with a combination insulation of refractory bricks in the corners and low heat storage, quickly cooling fiber material (LF models). With a wide variety of optional equipment, these models can be optimally adapted to your processes.

- Tmax 1200 °C, 1300 °C, or 1400 °C
- Five-sided heating for very good temperature uniformity
- Heating elements on support tubes ensure free heat radiation and a long service life
- Protection of bottom heating and flat stacking surface provided by embedded SiC plate in the floor
- LH models: multi-layered, fiber-free insulation of light refractory bricks and special backup insulation

- LF models: high-quality fiber insulation with corner bricks for shorter heating and cooling times
- Door with brick-on-brick seal, hand fitted
- Short heating times due to high installed power
- Side vent with bypass connection for exhaust pipe
- Self-supporting arch for high stability and greatest possible protection against dust
- Quick lock on door
- Freely adjustable air slide intake in furnace floor
- Stand included
- Defined application within the constraints of the operating instructions
- Controls description see page 61

Additional equipment
- Parallel swinging door, pivots away from operator, for opening when hot
- Lift door with electro-mechanic linear drive
Parallel swinging door for opening when hot

**LH 216/12SW with scale to measure weight reduction during annealing**

- Separate wall-mounting or floor standing cabinet for switchgear
- Motor-driven exhaust air flap
- Cooling fan for shorter cycle times
- Protective gas connection to purge with non-flammable protective or reaction gases
- Process box made of quartz glass for very clean atmosphere, quartz glass covered door with lid function
- Manual or automatic gas supply system
- Scale to measure weight reduction during annealing

---

### Table: Specifications

<table>
<thead>
<tr>
<th>Model</th>
<th>Tmax °C</th>
<th>Inner dimensions in mm</th>
<th>Outer dimensions in mm</th>
<th>Connected load kW</th>
<th>Electrical connection</th>
<th>Weight in kg</th>
</tr>
</thead>
<tbody>
<tr>
<td>LH 15/12</td>
<td>1200</td>
<td>250 x 250 x 250</td>
<td>15 x 570 x 790 x 1170</td>
<td>5.0</td>
<td>3-phase¹</td>
<td>150</td>
</tr>
<tr>
<td>LH 30/12</td>
<td>1200</td>
<td>320 x 320 x 320</td>
<td>30 x 640 x 860 x 1240</td>
<td>7.0</td>
<td>3-phase¹</td>
<td>170</td>
</tr>
<tr>
<td>LH 60/12</td>
<td>1200</td>
<td>400 x 400 x 400</td>
<td>60 x 720 x 1010 x 1320</td>
<td>8.0</td>
<td>3-phase¹</td>
<td>260</td>
</tr>
<tr>
<td>LH 120/12</td>
<td>1200</td>
<td>500 x 500 x 500</td>
<td>120 x 900 x 1210 x 1530</td>
<td>12.0</td>
<td>3-phase</td>
<td>340</td>
</tr>
<tr>
<td>LH 216/12</td>
<td>1200</td>
<td>600 x 600 x 600</td>
<td>216 x 900 x 1210 x 1530</td>
<td>20.0</td>
<td>3-phase</td>
<td>400</td>
</tr>
<tr>
<td>LH 15/13</td>
<td>1300</td>
<td>250 x 250 x 250</td>
<td>15 x 570 x 790 x 1170</td>
<td>7.0</td>
<td>3-phase¹</td>
<td>150</td>
</tr>
<tr>
<td>LH 30/13</td>
<td>1300</td>
<td>320 x 320 x 320</td>
<td>30 x 640 x 860 x 1240</td>
<td>8.0</td>
<td>3-phase¹</td>
<td>170</td>
</tr>
<tr>
<td>LH 60/13</td>
<td>1300</td>
<td>400 x 400 x 400</td>
<td>60 x 720 x 1010 x 1320</td>
<td>11.0</td>
<td>3-phase</td>
<td>260</td>
</tr>
<tr>
<td>LH 120/13</td>
<td>1300</td>
<td>500 x 500 x 500</td>
<td>120 x 900 x 1210 x 1530</td>
<td>15.0</td>
<td>3-phase</td>
<td>340</td>
</tr>
<tr>
<td>LH 216/13</td>
<td>1300</td>
<td>600 x 600 x 600</td>
<td>216 x 900 x 1210 x 1530</td>
<td>22.0</td>
<td>3-phase</td>
<td>400</td>
</tr>
<tr>
<td>LH 15/14</td>
<td>1400</td>
<td>250 x 250 x 250</td>
<td>15 x 570 x 790 x 1170</td>
<td>8.0</td>
<td>3-phase¹</td>
<td>150</td>
</tr>
<tr>
<td>LH 30/14</td>
<td>1400</td>
<td>320 x 320 x 320</td>
<td>30 x 640 x 860 x 1240</td>
<td>10.0</td>
<td>3-phase¹</td>
<td>170</td>
</tr>
<tr>
<td>LH 60/14</td>
<td>1400</td>
<td>400 x 400 x 400</td>
<td>60 x 720 x 1010 x 1320</td>
<td>12.0</td>
<td>3-phase</td>
<td>260</td>
</tr>
<tr>
<td>LH 120/14</td>
<td>1400</td>
<td>500 x 500 x 500</td>
<td>120 x 900 x 1210 x 1530</td>
<td>18.0</td>
<td>3-phase</td>
<td>340</td>
</tr>
<tr>
<td>LH 216/14</td>
<td>1400</td>
<td>600 x 600 x 600</td>
<td>216 x 900 x 1210 x 1530</td>
<td>26.0</td>
<td>3-phase</td>
<td>400</td>
</tr>
<tr>
<td>LF 15/13</td>
<td>1300</td>
<td>250 x 250 x 250</td>
<td>15 x 570 x 790 x 1170</td>
<td>7.0</td>
<td>3-phase¹</td>
<td>130</td>
</tr>
<tr>
<td>LF 30/13</td>
<td>1300</td>
<td>320 x 320 x 320</td>
<td>30 x 640 x 860 x 1240</td>
<td>8.0</td>
<td>3-phase¹</td>
<td>150</td>
</tr>
<tr>
<td>LF 60/13</td>
<td>1300</td>
<td>400 x 400 x 400</td>
<td>60 x 720 x 1010 x 1320</td>
<td>11.0</td>
<td>3-phase</td>
<td>230</td>
</tr>
<tr>
<td>LF 120/13</td>
<td>1300</td>
<td>500 x 500 x 500</td>
<td>120 x 900 x 1210 x 1530</td>
<td>15.0</td>
<td>3-phase</td>
<td>300</td>
</tr>
<tr>
<td>LF 15/14</td>
<td>1400</td>
<td>250 x 250 x 250</td>
<td>15 x 570 x 790 x 1170</td>
<td>8.0</td>
<td>3-phase¹</td>
<td>130</td>
</tr>
<tr>
<td>LF 30/14</td>
<td>1400</td>
<td>320 x 320 x 320</td>
<td>30 x 640 x 860 x 1240</td>
<td>10.0</td>
<td>3-phase¹</td>
<td>150</td>
</tr>
<tr>
<td>LF 60/14</td>
<td>1400</td>
<td>400 x 400 x 400</td>
<td>60 x 720 x 1010 x 1320</td>
<td>12.0</td>
<td>3-phase</td>
<td>230</td>
</tr>
<tr>
<td>LF 120/14</td>
<td>1400</td>
<td>500 x 500 x 500</td>
<td>120 x 900 x 1210 x 1530</td>
<td>18.0</td>
<td>3-phase</td>
<td>300</td>
</tr>
</tbody>
</table>

¹Heating only between two phases

*Please see page 61 for more information about supply voltage
Lift-Top or Lift-Bottom Furnaces with Wire Heating up to 1400 °C

**H 1000/LB**

These furnaces were specially developed for cooling complex structures or when the process requires the treatment of warm glass, e.g., the welding process in glass apparatus manufacturing. The wide-opening electro-hydraulically driven hood allows furnace opening even at high temperatures and provides easy access from 3 sides.

- Tmax 1280 °C
- Dual shell housing with rear ventilation for low shell temperatures
- Electrohydraulically driven hood with fixed table
- Five-sided heating from all four sides and from the table provides for a good temperature uniformity
- Heating elements mounted on support tubes provide for free radiation and long service life of the heating wire
- Bottom heating protected by SiC tiles which provide for a level stacking surface

**H 125/LB or LT - H 3000/LB or LT**

- Defined application within the constraints of the operating instructions

Additional equipment
- Tmax to 1400 °C
- Lift-bottom furnace version with driven table and fixed hood
- Uncontrolled or controlled cooling system with frequency-controlled cooling fan and motor-driven exhaust air vent
- Protective gas connection for purging the furnace with non-flammable protective or reaction gases

Lift-top furnace H 240/S. Table accessible from four sides for welding quartz glass constructions by vertical and horizontal moveable top-hat
Manual or automatic gas supply systems
- Multi-zone control adapted to the particular furnace provides model for optimal temperature uniformity
- Commissioning of the furnace with test firing and temperature uniformity measurement (also with load) for the purpose of process optimization
- Additional tables, table changing system, also motor-driven
- Motor-driven exhaust air flap, switchable via the program
- Exhaust air and exhaust gas piping
- Thermal or catalytic exhaust cleaning systems
- Heat recovery systems
- Process documentation and control with Controltherm MV software package, NTLog and NTGraph for the basic furnace or Nabertherm Control Center (NCC) for monitoring, documentation and control see page 62

<table>
<thead>
<tr>
<th>Model</th>
<th>Tmax °C</th>
<th>Inner dimensions in mm</th>
<th>Volume in l</th>
<th>Outer dimensions in mm</th>
<th>Connected load kW</th>
<th>Electrical connection*</th>
<th>Weight in kg</th>
</tr>
</thead>
<tbody>
<tr>
<td>H 125/LB, LT</td>
<td>1280</td>
<td>800 400 400</td>
<td>125</td>
<td>1570 1280 2000</td>
<td>12</td>
<td>3-phase</td>
<td>1250</td>
</tr>
<tr>
<td>H 250/LB, LT</td>
<td>1280</td>
<td>1000 500 500</td>
<td>250</td>
<td>1770 1380 2200</td>
<td>18</td>
<td>3-phase</td>
<td>1400</td>
</tr>
<tr>
<td>H 500/LB, LT</td>
<td>1280</td>
<td>1200 600 600</td>
<td>500</td>
<td>2050 1780 2500</td>
<td>36</td>
<td>3-phase</td>
<td>1800</td>
</tr>
<tr>
<td>H 1000/LB, LT</td>
<td>1280</td>
<td>1600 800 800</td>
<td>1000</td>
<td>2250 2000 2900</td>
<td>48</td>
<td>3-phase</td>
<td>2800</td>
</tr>
<tr>
<td>H 1350/LB, LT</td>
<td>1280</td>
<td>1280 620 780</td>
<td>1380</td>
<td>3750 2050 3050</td>
<td>75</td>
<td>3-phase</td>
<td>3500</td>
</tr>
<tr>
<td>H 3000/LB, LT</td>
<td>1280</td>
<td>3000 1000 1000</td>
<td>3000</td>
<td>4000 2100 3200</td>
<td>140</td>
<td>3-phase</td>
<td>6200</td>
</tr>
</tbody>
</table>

*Please see page 61 for more information about supply voltage
Top-Hat Furnaces with SiC Rod Heating

**HC 665 - HC 1500**

For temperatures beyond 1350 °C we recommend furnaces with SiC rod heating. The top-hat construction with 4-sides heating provides for exceptional temperature uniformity.

- Tmax of 1400 °C, 1450 °C or 1500 °C
- SiC rod heating on 4 sides of the furnace hood for short cycle times and high temperature uniformity
- High electrical connected power for short cycle times
- Hood insulation made from fiber materials provides for short cycle time and low energy consumption
- Table built from lightweight refractory bricks allows for heavy loads and level stacking surface
- Electro-hydraulic driven hood for vibration-free opening and closing of furnace hood
- Thyristor powered heating
- Defined application within the constraints of the operating instructions
- Controls description see page 61

<table>
<thead>
<tr>
<th>Model</th>
<th>Tmax °C</th>
<th>Tmax Inner dimensions in mm: w x d x h</th>
<th>Volume in l</th>
<th>Outer dimensions in mm: W x D x H</th>
<th>Connected load kW</th>
<th>Electrical connection*</th>
<th>Weight in kg</th>
</tr>
</thead>
<tbody>
<tr>
<td>HC 665</td>
<td>1400</td>
<td>1100 x 550 x 1100</td>
<td>2350</td>
<td>186</td>
<td>3-phase</td>
<td>3000</td>
<td></td>
</tr>
<tr>
<td>HC 1275</td>
<td>1400</td>
<td>850 x 1000 x 1500</td>
<td>2100</td>
<td>180</td>
<td>3-phase</td>
<td>4100</td>
<td></td>
</tr>
<tr>
<td>HC 1440</td>
<td>1400</td>
<td>840 x 2400 x 840</td>
<td>1690</td>
<td>400</td>
<td>3-phase</td>
<td>4700</td>
<td></td>
</tr>
<tr>
<td>HC 1500</td>
<td>1400</td>
<td>1000 x 1500 x 1500</td>
<td>1500</td>
<td>400</td>
<td>3-phase</td>
<td>5300</td>
<td></td>
</tr>
<tr>
<td>HC 1280</td>
<td>1450</td>
<td>800 x 1600 x 1000</td>
<td>1280</td>
<td>151</td>
<td>3-phase</td>
<td>4200</td>
<td></td>
</tr>
<tr>
<td>HC 700</td>
<td>1500</td>
<td>800 x 800 x 1100</td>
<td>700</td>
<td>100</td>
<td>3-phase</td>
<td>3100</td>
<td></td>
</tr>
<tr>
<td>HC 1400</td>
<td>1500</td>
<td>800 x 1600 x 1100</td>
<td>1400</td>
<td>151</td>
<td>3-phase</td>
<td>4500</td>
<td></td>
</tr>
</tbody>
</table>

*Please see page 61 for more information about supply voltage
Pit-Type and Top-Loading Furnaces, Electrically Heated or Gas-Fired with or without Air Circulation

Our top-loading furnaces are perfectly suited for the heat treatment of longer or heavier components. The furnace is usually charged with a factory crane. Due to their high-performance air recirculation system, the furnaces provide for excellent temperature uniformity up to a maximum temperature of 850 °C. The top-loading furnaces for the temperature range up to 1280 °C provide for very good temperature uniformity due to their five-side heating. Alternatively, these furnaces can also be provided with gas heating. Customized dimensions are designed and produced to accommodate the size and weight of the components to be treated.

- Tmax 260 °C, 450 °C, 600 °C or 850 °C for furnaces with air recirculation
- Tmax 900 °C or 1280 °C for furnaces with radiant heating
- Electrically heated or gas-fired
- Heating from both long sides for furnaces with air recirculation
- Heating from all four sides and the floor with SiC plates in the floor as level stacking support for models to 900 °C or 1280 °C
- High-quality insulation, adapted to the specific maximum temperature
- Electrohydraulic opening system of the lid with two-hand operation
- Closable air supply vents in the lower area of the furnace chamber
- Closable exhaust air vents in the lid
- Over-temperature limiter with manual reset for thermal protection class 2 in accordance with EN 60519-2 as temperature limiter to protect the furnace and load
- Defined application within the constraints of the operating instructions

Additional equipment
- Motor-driven exhaust air flaps for faster cooling
- Controlled fan cooling with motor-driven exhaust air flaps
- Multi-zone control of the heating provides for optimum temperature uniformity
- Furnace chamber can be divided in length for short workparts, partitions can be controlled separately
- Designed for Tmax 950 °C, fan blade driven indirectly via a belt to protect the air recirculation motor against over-heating
- Process control and documentation with Controltherm MV software package see page 63
High-Temperature Chamber Furnaces with Molybdenum Disilicide Heating Elements with Fiber Insulation up to 1800 °C

The high-temperature chamber furnaces HT 04/16 - HT 450/18 have proven reliable over many years in laboratory and production. Whether for quartz glass or glass ceramics, for sintering CIM components or for other processes up to a maximum temperature of 1800 °C, these furnaces afford the optimal solution for the sintering process.

High-temperature chamber furnaces can either be insulated with fiber material or lightweight refractory bricks. Furnaces with fiber insulation achieve significantly shorter heating up times because of the low thermal mass. An insulation made of lightweight refractory bricks (see HFL models on page 30), on the other hand, has the advantage of better chemical stability.

- Tmax 1600 °C, 1750 °C or 1800 °C
- Dual shell housing with fan cooling for low shell temperatures
- Heating from both sides via molybdenum disilicide heating elements
- High-quality fiber insulation backed by special insulation
- Side insulation constructed with tongue and groove blocks provides for low heat loss to the outside
- Long-life roof insulation with special suspension
- Chain-guided parallel swivel door for defined opening and closing of the door
- Labyrinth sealing ensures the least possible temperature loss in the door area
- Specially reinforced furnace floor for accommodating high charge weights for model HT 40 and above
- Exhaust air opening in the furnace roof
- Heating elements switched via SCR’s
- Over-temperature limiter with manual reset for thermal protection class 2 in accordance with EN 60519-2 as temperature limiter to protect the furnace and load
- Defined application within the constraints of the operating instructions
Additional equipment

- Uncontrolled or controlled cooling system with frequency-controlled cooling fan and motor-driven exhaust air flap
- Commissioning of the furnace with test firing and temperature uniformity measurement (also with load) for the purpose of process optimization
- Temperature measurement with thermocouples, types B and type S with automatic pull-out device for precise control results in the low temperature range
- Protection grid in front of the heating elements to prevent mechanical damages see page 30
- Special heating elements for zirconia sintering provide for longer service life with respect to chemical interaction between charge and heating elements
- Protective gas connection to purge with non-flammable protective or reaction gases
- Manual or automatic gas supply system
- Gas supply system in the furnace chamber with ceramic bell jar, protective gas inlet and outlet from below for better sealing when operating with protective gases and/or to prevent from chemical interactions between the load and the insulation or the heating elements
- Parallel swivel door opening upwards, also motor driven
- Bottom insulation made of durable lightweight refractory bricks for heavy charge weights
- Motorized exhaust air flap, switchable via the program
- Exhaust air and exhaust gas piping
- Thermal or catalytic exhaust cleaning systems
- Process documentation, display and control via HiproSystems control system see page 62
High-Temperature Chamber Furnaces with Molybdenum Disilicide Heating Elements with Fiber Insulation up to 1800 °C

HT 1000/17 with two movable door segments and fourside heating for sintering hanging ceramic tubes up to 1700 °C

<table>
<thead>
<tr>
<th>Model</th>
<th>Tmax °C</th>
<th>Inner dimensions in mm</th>
<th>Volume in l</th>
<th>Outer dimensions in mm</th>
<th>Connected load kW</th>
<th>Electrical connection*</th>
<th>Weight in kg</th>
</tr>
</thead>
<tbody>
<tr>
<td>HT 04/16</td>
<td>1600</td>
<td>150 150 150</td>
<td>4</td>
<td>670 470 1400</td>
<td>5.2</td>
<td>3-phase¹</td>
<td>150</td>
</tr>
<tr>
<td>HT 08/16</td>
<td>1600</td>
<td>150 300 150</td>
<td>8</td>
<td>730 640 1400</td>
<td>8.0</td>
<td>3-phase¹</td>
<td>200</td>
</tr>
<tr>
<td>HT 16/16</td>
<td>1600</td>
<td>200 300 260</td>
<td>16</td>
<td>810 700 1500</td>
<td>12.0</td>
<td>3-phase¹</td>
<td>270</td>
</tr>
<tr>
<td>HT 40/16</td>
<td>1600</td>
<td>300 350 350</td>
<td>40</td>
<td>1000 800 1620</td>
<td>12.0</td>
<td>3-phase¹</td>
<td>380</td>
</tr>
<tr>
<td>HT 64/16</td>
<td>1600</td>
<td>400 400 400</td>
<td>64</td>
<td>1130 900 1670</td>
<td>18.0</td>
<td>3-phase¹</td>
<td>550</td>
</tr>
<tr>
<td>HT 128/16</td>
<td>1600</td>
<td>500 550 550</td>
<td>160</td>
<td>1245 1040 1900</td>
<td>21.0</td>
<td>3-phase¹</td>
<td>750</td>
</tr>
<tr>
<td>HT 276/16</td>
<td>1600</td>
<td>1000 550 550</td>
<td>276</td>
<td>1140 1470 1900</td>
<td>36.0</td>
<td>3-phase¹</td>
<td>1100</td>
</tr>
<tr>
<td>HT 450/16</td>
<td>1600</td>
<td>1150 780 840</td>
<td>450</td>
<td>1200 1620 2060</td>
<td>64.0</td>
<td>3-phase¹</td>
<td>1500</td>
</tr>
</tbody>
</table>

HT 04/17 | 1750   | 150 150 150            | 4           | 610 470 1400          | 5.2               | 3-phase¹              | 150         |
| HT 08/17 | 1750   | 150 300 150            | 8           | 730 640 1400          | 8.0               | 3-phase¹              | 200         |
| HT 16/17 | 1750   | 200 300 260            | 16          | 810 700 1500          | 12.0              | 3-phase¹              | 270         |
| HT 40/17 | 1750   | 300 350 350            | 40          | 1000 800 1620         | 12.0              | 3-phase¹              | 380         |
| HT 64/17 | 1750   | 400 400 400            | 64          | 1130 900 1670         | 18.0              | 3-phase¹              | 550         |
| HT 128/17| 1750   | 500 550 550            | 160         | 1245 1040 1900        | 21.0              | 3-phase¹              | 750         |
| HT 276/17| 1750   | 1000 550 550           | 276         | 1140 1470 1900        | 36.0              | 3-phase¹              | 1100        |
| HT 450/17| 1750   | 1150 780 840           | 450         | 1200 1620 2060        | 64.0              | 3-phase¹              | 1500        |

HT 04/18 | 1800   | 150 150 150            | 4           | 610 470 1400          | 5.2               | 3-phase¹              | 150         |
| HT 08/18 | 1800   | 150 300 150            | 8           | 730 640 1400          | 9.0               | 3-phase¹              | 200         |
| HT 16/18 | 1800   | 200 300 260            | 16          | 810 700 1500          | 12.0              | 3-phase¹              | 270         |
| HT 40/18 | 1800   | 300 350 350            | 40          | 1000 800 1620         | 12.0              | 3-phase¹              | 380         |
| HT 64/18 | 1800   | 400 400 400            | 64          | 1130 900 1670         | 18.0              | 3-phase¹              | 550         |
| HT 128/18| 1800   | 500 550 550            | 160         | 1245 1040 1900        | 21.0              | 3-phase¹              | 750         |
| HT 276/18| 1800   | 1000 550 550           | 276         | 1140 1470 1900        | 36.0              | 3-phase¹              | 1100        |
| HT 450/18| 1800   | 1150 780 840           | 450         | 1200 1620 2060        | 64.0              | 3-phase¹              | 1500        |

¹Heating only between two phases
*Please see page 61 for more information about supply voltage

Inner process hood with gas injection through the furnace bottom protects the furnace chamber against contamination and/or prevents chemical interaction between the charge and heating elements.

Gas supply system for non-flammable protective or reaction gases.
High-Temperature Chamber Furnaces with SiC Rod Heating up to 1550 °C

HTC 16/16 - HTC 450/16

The high-temperature chamber furnaces HTC 16/16 - HTC 450/16 are heated by vertically hung SiC rods, which makes them especially suitable for sintering processes up to a maximum operating temperature of 1550 °C. The basic construction of these furnaces make them comparable with the already familiar models in the HT product line and they can be upgraded with the same additional equipment.

- Tmax 1550 °C
- Dual shell housing with fan cooling for low shell temperatures
- Heating from both sides via vertically mounted SiC rods
- High-quality fiber insulation backed by special insulation
- Side insulation constructed with tongue and groove blocks provides for low heat loss to the outside
- Long-life roof insulation with special suspension
- Chain-guided parallel swivel door for defined opening and closing of the door
- Labyrinth sealing ensures the least possible temperature loss in the door area
- Specially reinforced furnace floor for accommodating high charge weights for model HTC 16 and above
- Exhaust air opening in the furnace roof
- Heating elements switched via SCR’s
- Over-temperature limiter with manual reset for thermal protection class 2 in accordance with EN 60519-2 as temperature limiter to protect the furnace and load
- Defined application within the constraints of the operating instructions
- Controls description see page 61

For additional equipment see models HT 04/16 - HT 450/18

<table>
<thead>
<tr>
<th>Model</th>
<th>Tmax °C</th>
<th>Inner dimensions in mm</th>
<th>Volume in l</th>
<th>Outer dimensions in mm</th>
<th>Connected load kW</th>
<th>Electrical connection*</th>
<th>Weight in kg</th>
</tr>
</thead>
<tbody>
<tr>
<td>HTC 16/16</td>
<td>1550</td>
<td>200 300 260</td>
<td>16</td>
<td>810 700 1500</td>
<td>12,0</td>
<td>3-phase¹</td>
<td>270</td>
</tr>
<tr>
<td>HTC 40/16</td>
<td>1550</td>
<td>300 350 350</td>
<td>40</td>
<td>1000 800 1620</td>
<td>12,0</td>
<td>3-phase</td>
<td>380</td>
</tr>
<tr>
<td>HTC 64/16</td>
<td>1550</td>
<td>400 400 400</td>
<td>64</td>
<td>1130 900 1670</td>
<td>18,0</td>
<td>3-phase</td>
<td>550</td>
</tr>
<tr>
<td>HTC 128/16</td>
<td>1550</td>
<td>400 800 400</td>
<td>128</td>
<td>1130 1290 1670</td>
<td>26,0</td>
<td>3-phase</td>
<td>750</td>
</tr>
<tr>
<td>HTC 160/16</td>
<td>1550</td>
<td>500 550 550</td>
<td>160</td>
<td>1245 1034 1900</td>
<td>21,0</td>
<td>3-phase</td>
<td>890</td>
</tr>
<tr>
<td>HTC 128/16</td>
<td>1550</td>
<td>500 1000 550</td>
<td>276</td>
<td>1140 1470 1900</td>
<td>36,0</td>
<td>3-phase</td>
<td>1100</td>
</tr>
<tr>
<td>HTC 276/16</td>
<td>1550</td>
<td>500 1150 780</td>
<td>450</td>
<td>1200 1620 2060</td>
<td>64,0</td>
<td>3-phase</td>
<td>1500</td>
</tr>
</tbody>
</table>

¹Heating only between two phases  *Please see page 61 for more information about supply voltage
Chamber Furnaces with Molybdenum Disilicide Heating Elements with Refractory Insulation up to 1700 °C

HFL 295/13 with lift door and transformer in stand

Protection grid in front of heating elements prevent against mechanical damages

Gas supply system for non-flammable protective or reaction gases

HFL 160/17 with gas supply system

HFL 295/13 with lift door and transformer in stand

**HFL 16/16 - HFL 160/17**

The HFL 16/16 HFL 160/17 product line is characterized by its lining with robust light weight refractory bricks. Compared with the fiber-insulated models of the HT product line, these furnaces are recommended when high charge weights have to be sintered. In most cases lightweight refractory brick insulation is also significantly more resistant to gas emissions occurring during heat treatment.

Standard equipment like HT models, except:
- Tmax 1600 °C or 1700 °C
- Sturdy lightweight refractory bricks and special backing insulation
- Furnace floor made of lightweight refractory bricks accommodates high charge weights
- Defined application within the constraints of the operating instructions

Additional equipment like HT models

<table>
<thead>
<tr>
<th>Model</th>
<th>Tmax °C</th>
<th>Inner dimensions in mm</th>
<th>Volume in l</th>
<th>Outer dimensions in mm</th>
<th>Connected load kW</th>
<th>Electrical connection</th>
<th>Weight in kg</th>
</tr>
</thead>
<tbody>
<tr>
<td>HFL 16/16</td>
<td>1600</td>
<td>200 300 260</td>
<td>16</td>
<td>770 830 1550</td>
<td>12</td>
<td>3-phase¹</td>
<td>500</td>
</tr>
<tr>
<td>HFL 40/16</td>
<td>1600</td>
<td>300 350 350</td>
<td>40</td>
<td>880 880 1710</td>
<td>12</td>
<td>3-phase</td>
<td>660</td>
</tr>
<tr>
<td>HFL 64/16</td>
<td>1600</td>
<td>400 400 400</td>
<td>64</td>
<td>980 930 1830</td>
<td>18</td>
<td>3-phase</td>
<td>880</td>
</tr>
<tr>
<td>HFL 160/16</td>
<td>1600</td>
<td>500 550 550</td>
<td>160</td>
<td>1090 1080 2030</td>
<td>21</td>
<td>3-phase</td>
<td>1140</td>
</tr>
<tr>
<td>HFL 16/17</td>
<td>1700</td>
<td>200 300 260</td>
<td>16</td>
<td>770 830 1550</td>
<td>12</td>
<td>3-phase¹</td>
<td>530</td>
</tr>
<tr>
<td>HFL 40/17</td>
<td>1700</td>
<td>300 350 350</td>
<td>40</td>
<td>880 880 1710</td>
<td>12</td>
<td>3-phase</td>
<td>690</td>
</tr>
<tr>
<td>HFL 64/17</td>
<td>1700</td>
<td>400 400 400</td>
<td>64</td>
<td>980 930 1830</td>
<td>18</td>
<td>3-phase</td>
<td>920</td>
</tr>
<tr>
<td>HFL 160/17</td>
<td>1700</td>
<td>500 550 550</td>
<td>160</td>
<td>1090 1080 2030</td>
<td>21</td>
<td>3-phase</td>
<td>1190</td>
</tr>
</tbody>
</table>

¹Heating only between two phases

*Please see page 61 for more information about supply voltage
Gas-Fired Chamber Furnaces up to 1600 °C

The gas-fired high-temperature furnaces of the HTB product line are specially developed for applications requiring fast heating up ramps. Gas-fired furnaces are preferred also if inflammable gases are produced in large amounts during the process. A large content of the gas emissions are already burned in the furnace chamber, so that downstream equipment like thermal and catalytic exhaust cleaners can accordingly be downsized. The furnaces are insulated with highly heat-resistant and long-life lightweight refractory brick insulation or fiber materials.

- Tmax 1600 °C
- Powerful, sturdy high-speed burners with pulse control and special flame guidance in the furnace chamber provide for good temperature uniformity
- Operation with natural gas, propane or liquefied gas
- Fully automatic PLC control of the temperature, including monitoring of the burner function
- Gas fittings according to DVGW (German Technical and Scientific Association for Gas and Water) with flame monitoring and safety valve
- Reduction-resistant fiber insulation with low heat storage provides for short heating and cooling times
- Dual shell housing provides for low outside temperatures
- Exhaust hood with fittings for further discharge of the exhaust gases
- Defined application within the constraints of the operating instructions
- PLC control with touch panel as user interface see page 62

Additional equipment
- Automatic lambda control to set the furnace atmosphere
- Exhaust air and exhaust gas piping
- Recuperator burners
- Thermal or catalytic exhaust cleaning systems
- Process display and documentation via Nabertherm Control Center (NCC) see page 62
Lift-Top and Lift-Bottom Furnaces with Molybdenum Disilicide Heating Elements up to 1800 °C

For charging complex settings we recommend lift-top or lift-bottom furnaces. Also small workparts can be conveniently loaded on different layers. Up to an application temperature of 1500 °C the furnaces are heated by SiC rods (HTC models). For sintering temperatures above 1500 °C these furnaces with molybdenum disilicide heating elements (HT models). Possible potential chemical interaction between the charge and the heating method can also affect the selection of heating system.

The basic furnace comes with one table. Depending on the technical requirements are equipped, a lift-top or lift-bottom version will be the choice. The system can be expanded with one or more changeable tables, either manually or electrically driven. Other additional equipment, like controlled cooling systems to short process cycles provide for tailored solution for individual needs.

- Tmax 1400 °C or 1500 °C (HTC models with SiC rod heating)
- Tmax 1600 °C, 1750 °C or 1800 °C (HT models with molybdenum disilicide heating elements)
- Dual shell housing with fan cooling provides for low shell temperatures
- Designed as lift-top furnace with driven hood (LT) or lift-bottom furnace
- Gently running, low-vibration spindle drive or electrohydraulic drive for larger models
- Safe and tight closing of the furnace due to labyrinth seal and sand cup
- Heating from all four sides provides for good temperature uniformity
- High-quality fiber insulation backed by special insulation
- Side insulation constructed with tongue and groove blocks provides for low heat dissipation to the outside
- Long-life roof insulation with special suspension
- Furnace table with special bottom reinforcement to accommodate high charge weights
- Motor-driven exhaust air flap in the furnace roof, switchable at the program
- PLC controls with state-of-the-art touch panel as user interface see page 62
- Over-temperature limiter with manual reset for thermal protection class 2 in accordance with EN 60519-2 as temperature limiter to protect the furnace and load
- Defined application within the constraints of the operating instructions
Additional equipment

- Uncontrolled or controlled cooling system with frequency-controlled cooling fan and motor-driven exhaust air flap
- Commissioning of the furnace with test firing and temperature uniformity measurement (also with load) for the purpose of process optimization
- Temperature measurement with thermocouples, types B and type S with automatic pull-out device for precise control results in the low temperature range
- Heat from all sides and between the stack or with heating elements, positioned above each other to optimize temperature uniformity
- Protective gas connection to purge with non-flammable protective or reaction gases
- Manual or automatic gas supply systems
- Gas supply system in the furnace chamber with ceramic bell jar, protective gas inlet and outlet from below for better sealing when operating with protective gases and/or to prevent from chemical interactions between the load and the insulation or the heating elements
- Alternative table changing systems
- Exhaust air and exhaust gas piping
- Automatic changing system for thermocouple type S/B for precise measurement and control quality at lowes temperatures
- Thermal or catalytic exhaust cleaning systems
- Process documentation, display and control via HiproSystems control system see page 62
Lift-Top and Lift-Bottom Furnaces with Molybdenum Disilicide Heating Elements up to 1800 °C

Combi high-temperature plant HT 1440/17 LBS with catalytic afterburning system for debinding and sintering in one process

Measurement setup to determine the temperature uniformity in a high-temperature lift-bottom furnace

Production system consisting of a bogie hearth furnace for debinding and a high-temperature furnace for residual debinding and sintering with shared catalytic afterburning system
<table>
<thead>
<tr>
<th>Model</th>
<th>Tmax in °C</th>
<th>Inner dimensions in mm</th>
<th>Volume in l</th>
<th>Outer dimensions in mm</th>
<th>Connected load kW</th>
<th>Electrical connection*</th>
<th>Weight in kg</th>
</tr>
</thead>
<tbody>
<tr>
<td>HT 64/16 LB, LT</td>
<td>1600</td>
<td>400 400 400</td>
<td>64</td>
<td>950 1750 2350</td>
<td>36.0</td>
<td>3-phase 1000</td>
<td>36</td>
</tr>
<tr>
<td>HT 166/16 LB, LT</td>
<td>1600</td>
<td>550 550 550</td>
<td>166</td>
<td>1095 2060 2450</td>
<td>42.0</td>
<td>3-phase 1600</td>
<td>42</td>
</tr>
<tr>
<td>HT 276/16 LB, LT</td>
<td>1600</td>
<td>550 550 550</td>
<td>216</td>
<td>1550 2090 2600</td>
<td>50.0</td>
<td>3-phase 2000</td>
<td>50</td>
</tr>
<tr>
<td>HT 400/16 LB, LT</td>
<td>1600</td>
<td>600 550 600</td>
<td>400</td>
<td>1750 2200 2600</td>
<td>72.0</td>
<td>3-phase 2200</td>
<td>72</td>
</tr>
<tr>
<td>HT 1000/16 LB, LT</td>
<td>1600</td>
<td>1000 1000 1000</td>
<td>1000</td>
<td>1550 2600 3200</td>
<td>146.0</td>
<td>3-phase 3000</td>
<td>146</td>
</tr>
<tr>
<td>HT 1030/16 LB, LT</td>
<td>1600</td>
<td>2200 600 780</td>
<td>1030</td>
<td>2800 2500 3000</td>
<td>163.0</td>
<td>3-phase 3000</td>
<td>163</td>
</tr>
<tr>
<td>HT 1440/16 LB, LT</td>
<td>1600</td>
<td>1800 800 1000</td>
<td>1440</td>
<td>3000 2800 3700</td>
<td>330.0</td>
<td>3-phase 4000</td>
<td>330</td>
</tr>
<tr>
<td>HT 64/17 LB, LT</td>
<td>1750</td>
<td>400 400 400</td>
<td>64</td>
<td>950 1750 2350</td>
<td>36.0</td>
<td>3-phase 1000</td>
<td>36</td>
</tr>
<tr>
<td>HT 166/17 LB, LT</td>
<td>1750</td>
<td>550 550 550</td>
<td>166</td>
<td>1095 2060 2450</td>
<td>42.0</td>
<td>3-phase 1600</td>
<td>42</td>
</tr>
<tr>
<td>HT 276/17 LB, LT</td>
<td>1750</td>
<td>550 550 550</td>
<td>216</td>
<td>1550 2090 2600</td>
<td>50.0</td>
<td>3-phase 2000</td>
<td>50</td>
</tr>
<tr>
<td>HT 400/17 LB, LT</td>
<td>1750</td>
<td>600 550 600</td>
<td>400</td>
<td>1750 2200 2600</td>
<td>72.0</td>
<td>3-phase 2200</td>
<td>72</td>
</tr>
<tr>
<td>HT 1000/17 LB, LT</td>
<td>1750</td>
<td>1000 1000 1000</td>
<td>1000</td>
<td>1550 2600 3200</td>
<td>146.0</td>
<td>3-phase 3000</td>
<td>146</td>
</tr>
<tr>
<td>HT 1030/17 LB, LT</td>
<td>1750</td>
<td>2200 600 780</td>
<td>1030</td>
<td>2800 2500 3000</td>
<td>163.0</td>
<td>3-phase 3000</td>
<td>163</td>
</tr>
<tr>
<td>HT 1440/17 LB, LT</td>
<td>1750</td>
<td>1800 800 1000</td>
<td>1440</td>
<td>3000 2800 3700</td>
<td>330.0</td>
<td>3-phase 4000</td>
<td>330</td>
</tr>
</tbody>
</table>

*Please see page 61 for more information about supply voltage

High-temperature furnace HT 273/17S with table by transportable fork lift
Continuous furnaces are the right choice for processes with fixed cycle times such as drying or pre-heating, curing or degassing, etc. The furnaces are available for various temperatures up to a maximum of 1000 °C. The furnace design depends on the required throughput, the process requirements for heat treatment and the required cycle time. The conveyor technology (e.g. belt, rollers) is tailored to the required working temperature and the geometry of the charge. The conveyor speed and the number of control zones are defined by the process specifications.

Alternative furnace design subject to process specifications:

Conveyor concepts
- Conveyor belt
- Metal conveyor belt with adjusted mesh gauges
- Drive chain
- Roller conveyors
- Pusher-type furnace
Heating systems
- Electric heating, radiant or convection
- Direct or indirect gas-firing
- Infrared heating
- Heating with the use of external heat sources

Temperature cycles
- Control of working temperature across the whole length of the furnace, such as for drying or pre-heating
- Automatic control of a process curve applying defined heat-up, dwell and cooling time
- Control of a temperature curve including a final quenching of the charge

Process atmosphere
- In air
- In non-flammable protective or reactive gases such as nitrogen, argon or forming gas
- In flammable protective or reactive gases such as hydrogen incl. the necessary safety technology

Basic configuration criteria
- Conveyor speed
- Temperature uniformity
- Operating temperature
- Process curve
- Work space width
- Charge weights
- Cycle time or throughput
- Length of charge and discharge zone
- Generated exhaust gases
- Specific industry standards such as AMS, CQI-9, FDA etc.
- Other individual customer requirements
Chemical hardening is mostly applied for the solidification of thin glasses with a thickness of up to 3 mm. Chemical pretensioning is recommended because the surface flatness can be maintained. Producers of copy machines, solar modules, microwave devices, measuring instruments as well as companies in the lighting industry, the automotive industry and other users of flat glass need to apply the toughest possible glass in their products. Nearly all glasses containing a large percentage of sodium can be strengthened by means of ion exchange.

TS 20/15 - TSB 90/80

Chemical hardening is mostly applied for the solidification of thin glasses with a thickness of up to 3 mm. Chemical pretensioning is recommended because the surface flatness can be maintained. Producers of copy machines, solar modules, microwave devices, measuring instruments as well as companies in the lighting industry, the automotive industry and other users of flat glass need to apply the toughest possible glass in their products. Nearly all glasses containing a large percentage of sodium can be strengthened by means of ion exchange.

Crucibles
- Type P: low carbon steel and CrNi plated for carburizing baths up to 950 °C, neutral salt and annealing baths up to 850 °C
- Type C: high alloy CrNi steel for neutral salt and annealing baths up to 1000 °C and for dip brazing of Aluminium

Additional equipment
- Exhaust gas collection at rim for connection to an exhaust system
- Enhanced safety systems for heat treatment of aluminium and magnesium in the salt bath with second over-temperature limiter with manual reset and PLC-bath control with thermocouples in the salt bath and in the furnace chamber

<table>
<thead>
<tr>
<th>Model</th>
<th>Tmax °C²</th>
<th>Inner dimensions crucible Ø in mm</th>
<th>h in mm</th>
<th>Volume in l</th>
<th>Outer dimensions in mm W</th>
<th>D</th>
<th>H</th>
<th>Connected load kW¹</th>
<th>Electrical connection*</th>
<th>Weight in kg</th>
</tr>
</thead>
<tbody>
<tr>
<td>TS 20/15</td>
<td>750</td>
<td>230</td>
<td>500</td>
<td>20</td>
<td>850</td>
<td>850</td>
<td>800</td>
<td>17</td>
<td>3-phase 650</td>
<td></td>
</tr>
<tr>
<td>TS 30/18</td>
<td>750</td>
<td>300</td>
<td>500</td>
<td>30</td>
<td>950</td>
<td>950</td>
<td>800</td>
<td>20</td>
<td>3-phase 700</td>
<td></td>
</tr>
<tr>
<td>TS 40/30</td>
<td>750</td>
<td>400</td>
<td>500</td>
<td>60</td>
<td>1050</td>
<td>1050</td>
<td>800</td>
<td>33</td>
<td>3-phase 750</td>
<td></td>
</tr>
<tr>
<td>TS 50/48</td>
<td>750</td>
<td>500</td>
<td>600</td>
<td>110</td>
<td>1150</td>
<td>1150</td>
<td>970</td>
<td>53</td>
<td>3-phase 1000</td>
<td></td>
</tr>
<tr>
<td>TS 60/63</td>
<td>750</td>
<td>610</td>
<td>800</td>
<td>220</td>
<td>1250</td>
<td>1250</td>
<td>970</td>
<td>70</td>
<td>3-phase 1200</td>
<td></td>
</tr>
<tr>
<td>TS 70/72</td>
<td>750</td>
<td>700</td>
<td>1000</td>
<td>370</td>
<td>1350</td>
<td>1350</td>
<td>1370</td>
<td>80</td>
<td>3-phase 1500</td>
<td></td>
</tr>
<tr>
<td>TS 90/80</td>
<td>750</td>
<td>900</td>
<td>1000</td>
<td>500</td>
<td>1600</td>
<td>1600</td>
<td>1400</td>
<td>100</td>
<td>3-phase 1700</td>
<td></td>
</tr>
<tr>
<td>TS, TSB 20/20</td>
<td>1000</td>
<td>230</td>
<td>500</td>
<td>20</td>
<td>850</td>
<td>850</td>
<td>800</td>
<td>22</td>
<td>3-phase 650</td>
<td></td>
</tr>
<tr>
<td>TS, TSB 30/30</td>
<td>1000</td>
<td>300</td>
<td>500</td>
<td>30</td>
<td>950</td>
<td>950</td>
<td>800</td>
<td>33</td>
<td>3-phase 700</td>
<td></td>
</tr>
<tr>
<td>TS, TSB 40/40</td>
<td>1000</td>
<td>400</td>
<td>500</td>
<td>60</td>
<td>1050</td>
<td>1050</td>
<td>800</td>
<td>44</td>
<td>3-phase 750</td>
<td></td>
</tr>
<tr>
<td>TS, TSB 50/60</td>
<td>1000</td>
<td>500</td>
<td>600</td>
<td>110</td>
<td>1150</td>
<td>1150</td>
<td>970</td>
<td>66</td>
<td>3-phase 1000</td>
<td></td>
</tr>
<tr>
<td>TS, TSB 60/63</td>
<td>1000</td>
<td>610</td>
<td>800</td>
<td>220</td>
<td>1250</td>
<td>1250</td>
<td>970</td>
<td>80</td>
<td>3-phase 1200</td>
<td></td>
</tr>
<tr>
<td>TS, TSB 70/72</td>
<td>1000</td>
<td>700</td>
<td>1000</td>
<td>370</td>
<td>1350</td>
<td>1350</td>
<td>1370</td>
<td>100</td>
<td>3-phase 1500</td>
<td></td>
</tr>
<tr>
<td>TS, TSB 90/80</td>
<td>1000</td>
<td>900</td>
<td>1000</td>
<td>500</td>
<td>1600</td>
<td>1600</td>
<td>1400</td>
<td>120</td>
<td>3-phase 1700</td>
<td></td>
</tr>
</tbody>
</table>

¹Only for electric version
²Salt bath temperature
*Please see page 61 for more information about supply voltage
Annealing and Hardening Furnaces with Wire Heating, Preheating Furnaces for Molds

N 7/H - N 641/13
The models N 31/H ff. have been specially developed for preheating of moulds but also for hardening jobs when toolmaking.

- Compact, robust design
- Three-sides heating: from both side walls and bottom
- Heating elements protected in grooves
- Bottom heating protected by heat conducting SiC tiles
- Parallel guided downward swinging door (user protected from heat radiation)
- Stainless steel upper door jamb protects furnace structure when furnace is opened hot
- Exhaust opening in the side of the furnace, or on back wall of furnace in the N 31/H models and higher
- Temperature uniformity up to +/- 10 °C according to DIN 17052-1 see page 60
- Low energy consumption due to multi-layer insulation
- Gas spring dampers provide for easy door opening and closing
- Heat resistant zinc paint for protection of door and door frame (for model N81 and larger)
- Defined application within the constraints of the operating instructions
- Controls description see page 61

<table>
<thead>
<tr>
<th>Model</th>
<th>Tmax °C</th>
<th>Inner dimensions in mm</th>
<th>Volume in l</th>
<th>Outer dimensions in mm</th>
<th>Connected load/kW</th>
<th>Electrical connection*</th>
<th>Weight in kg</th>
</tr>
</thead>
<tbody>
<tr>
<td>N 7/H¹</td>
<td>1280</td>
<td>250 250 120</td>
<td>7</td>
<td>720 640 510</td>
<td>3.0</td>
<td>1-phase</td>
<td>60</td>
</tr>
<tr>
<td>N 11/H¹</td>
<td>1280</td>
<td>250 350 140</td>
<td>11</td>
<td>720 790 510</td>
<td>3.6</td>
<td>1-phase</td>
<td>70</td>
</tr>
<tr>
<td>N 17/H²¹</td>
<td>1280</td>
<td>250 500 140</td>
<td>17</td>
<td>720 890 510</td>
<td>6.4</td>
<td>3-phase²</td>
<td>90</td>
</tr>
<tr>
<td>N 31/H</td>
<td>1280</td>
<td>350 350 250</td>
<td>30</td>
<td>840 1010 1320</td>
<td>15.0</td>
<td>3-phase²</td>
<td>210</td>
</tr>
<tr>
<td>N 41/H</td>
<td>1280</td>
<td>350 500 250</td>
<td>40</td>
<td>840 1160 1320</td>
<td>15.0</td>
<td>3-phase²</td>
<td>260</td>
</tr>
<tr>
<td>N 51/H</td>
<td>1280</td>
<td>350 750 250</td>
<td>60</td>
<td>840 1410 1320</td>
<td>20.0</td>
<td>3-phase²</td>
<td>400</td>
</tr>
<tr>
<td>N 87/H</td>
<td>1280</td>
<td>350 1000 250</td>
<td>60</td>
<td>840 1660 1320</td>
<td>25.0</td>
<td>3-phase²</td>
<td>480</td>
</tr>
<tr>
<td>N 81</td>
<td>1200</td>
<td>500 750 250</td>
<td>80</td>
<td>1140 1900 1790</td>
<td>20.0</td>
<td>3-phase²</td>
<td>820</td>
</tr>
<tr>
<td>N 161</td>
<td>1200</td>
<td>550 750 400</td>
<td>160</td>
<td>1180 1930 1980</td>
<td>30.0</td>
<td>3-phase²</td>
<td>910</td>
</tr>
<tr>
<td>N 321</td>
<td>1200</td>
<td>750 1000 500</td>
<td>640</td>
<td>1690 2670 2240</td>
<td>70.0</td>
<td>3-phase²</td>
<td>2100</td>
</tr>
<tr>
<td>N 641</td>
<td>1200</td>
<td>1000 1300 500</td>
<td>640</td>
<td>1770 2730 2290</td>
<td>80.0</td>
<td>3-phase²</td>
<td>2500</td>
</tr>
</tbody>
</table>

¹Table-top model
²Heating only between two phases

*Please see page 61 for more information about supply voltage
Fusing Furnaces with fixed Table

GF 75 - GF 1425
The furnaces in the GF75 - GF 1425 product line were conceived for professional glass artists. The heating elements, closely arranged, protected in quartz tubes, ensure a very high degree of temperature uniformity during fusing or during bending across the whole table surface. The optimized insulation, made of non-classified fibrous material in the furnace hood and robust lightweight refractory bricks in the furnace floor allow clean and safe operation. High current connection capacities assure that the furnace can be rapidly warmed up. The complete firing sequence is controlled by the intuitively operated Controller P300.

- Tmax 950 °C
- Heating element, protected in quartz tubes
- High current connection capacities for short warm-up times and energy-saving way of working
- Arranged closely beside each other on the top, heating elements ensure direct and uniform radiation of the glass
- Level table surface with insulation made of robust lightweight refractory bricks and marked charge surface
- Hood insulation made of non-classified ceramic fibers for rapid warming up and cooling down
- Solid state relays provide for low-noise operation
- Fast power switching for precise temperature uniformity
- Type “K” (NiCr-Ni) thermocouple inside the furnace chamber for precise temperature measurement
- Double-wall, adjustable hood made of structured stainless steel with lid made of perforated sheet metal
- Attractive and professional design enhances your image
- Hood very easy to open and close, supported by high-quality compressed-gas springs
- Adjustable, large quick-release fasteners - can be used while working in gloves
- Large handles on the left and right side of the hood for opening and closing the furnace
- Angled sight ports with plugs let you see the progress of your work and cool quickly
- Robust base on rollers (two of them can be locked down) with tray for glass and tools
- Controller integrated to save space on the right side of the furnace
- Other sizes or custom designs available on request

"Combing" in a GF 240

Exhaust air flap as additional equipment
<table>
<thead>
<tr>
<th>Model</th>
<th>Tmax °C</th>
<th>Inner dimensions in mm</th>
<th>Outer dimensions in mm</th>
<th>Connected load kW</th>
<th>Electrical connection*</th>
<th>Weight in kg</th>
</tr>
</thead>
<tbody>
<tr>
<td>GF 75</td>
<td>950</td>
<td>620 620 310</td>
<td>1010 965 1310</td>
<td>3.6</td>
<td>1-phase</td>
<td>180</td>
</tr>
<tr>
<td>GF 75 R</td>
<td>950</td>
<td>620 620 310</td>
<td>1480 965 1400</td>
<td>6.0</td>
<td>1-phase</td>
<td>245</td>
</tr>
<tr>
<td>GF 190 LE</td>
<td>1010 620 400</td>
<td>965 1480 965 1400</td>
<td>1480 1155 1400</td>
<td>6.4</td>
<td>3-phase</td>
<td>245</td>
</tr>
<tr>
<td>GF 240</td>
<td>1010 810 400</td>
<td>1680 1465 1400</td>
<td>1680 1525 1400</td>
<td>11.0</td>
<td>3-phase</td>
<td>250</td>
</tr>
<tr>
<td>GF 380</td>
<td>1210 1100 400</td>
<td>1480 1315 1400</td>
<td>2130 1310 1400</td>
<td>15.0</td>
<td>3-phase</td>
<td>450</td>
</tr>
<tr>
<td>GF 420</td>
<td>1660 950 400</td>
<td>1480 1315 1400</td>
<td>2130 1310 1400</td>
<td>18.0</td>
<td>3-phase</td>
<td>500</td>
</tr>
<tr>
<td>GF 520</td>
<td>1210 1160 400</td>
<td>1680 1525 1400</td>
<td>2130 1310 1400</td>
<td>15.0</td>
<td>3-phase</td>
<td>550</td>
</tr>
<tr>
<td>GF 600</td>
<td>2010 1010 400</td>
<td>1680 1525 1400</td>
<td>2130 1310 1400</td>
<td>22.0</td>
<td>3-phase</td>
<td>600</td>
</tr>
<tr>
<td>GF 920</td>
<td>2110 1160 400</td>
<td>1480 1315 1400</td>
<td>2130 1310 1400</td>
<td>26.0</td>
<td>3-phase</td>
<td>850</td>
</tr>
<tr>
<td>GF 1050</td>
<td>2310 1210 400</td>
<td>2580 1525 1400</td>
<td>2580 1525 1400</td>
<td>32.0</td>
<td>3-phase</td>
<td>1050</td>
</tr>
<tr>
<td>GF 1425</td>
<td>2510 1510 400</td>
<td>2880 1875 1400</td>
<td>2880 1875 1400</td>
<td>32.0</td>
<td>3-phase</td>
<td>1250</td>
</tr>
</tbody>
</table>

1 Heating only between two phases
2 Fusing of 32 A if connected to 230 V
3 Base included

- Comfortable charging height with base of 870 mm
- Exhaust air flap on hood for rapid cooling as additional equipment
- Defined application within the constraints of the operating instructions
- Controls description see page 61

*Please see page 61 for more information about supply voltage
Fusing Furnaces with Wire Heating with movable Table

GFM 1050

Locking device provides for defined hood opening in different positions and accelerated cooling

GFM 420 - GFM 1050

The GFM product line was developed to meet the special requirements of production. For different applications different table depths can be supplied. Standard is a table for fusing. Various tables and tubs with different heights and numerous additional equipments are available as system add-ons. Especially economical is the alternating table system, in which one table is loaded while the other one is in the furnace.

- Tmax 950 °C
- Infrared heated in hood which is attached to stand
- Delivered with one table
- Table on wheels, freely movable
- Level table surface with insulation made of robust lightweight refractory bricks and marked charge surface
- Comfortable charging height with base of 870 mm
- Heating element, protected in quartz tubes
- High current connection capacities for short warm-up times and energy-saving way of working
- Arranged closely beside each other on the top, heating elements ensure direct and uniform radiation of the glass
- Solid state relays provide for low-noise operation
- NiCr-Ni thermocouple inside the furnace for precise temperature measurement
- Dual shell housing, adjustable hood made of structured stainless steel with lid made of perforated sheet metal
- Hood insulation made of non-classified ceramic fibers for rapid warming up and cooling down
- Attractive design and solid construction
- Hood very easy to open and close, supported by high-quality compressed-gas springs
- Adjustable, large quick-release fasteners - can be used while working in gloves
- Supply air and glass inspection ports with insulated doors, viewing window as an additional equipment
- Defined application within the constraints of the operating instructions
- Controls description see page 61
Additional equipment for fusing furnaces GF and GFM

- Motor-driven lid opening for faster cooling, programmable via the extra controller function, for models GF 380 and/or GFM 380 up
- Bottom heating for uniform through heating of large objects as additional equipment
- Cooling fan for accelerated cooling with closed lid
- Additional tables for extension of the furnace system
- Exchangeable table system for utilization of the residual heat of the furnace. Cycle times can be shortened by changing the tables in warm condition (depending on the ability of the respective glass to cope with temperature change)
- Exhaust air flap on hood for rapid cooling
- Air inlet flap with window for observing the glass

### Specifications

<table>
<thead>
<tr>
<th>Model</th>
<th>Tmax °C</th>
<th>Inner dimensions in mm</th>
<th>Outer dimensions in mm</th>
<th>Connected load kW</th>
<th>Electrical connection</th>
<th>Weight in kg</th>
</tr>
</thead>
<tbody>
<tr>
<td>GFM 420</td>
<td>950</td>
<td>1650 850 380</td>
<td>2400 1460 1400</td>
<td>18</td>
<td>3-phase</td>
<td>410</td>
</tr>
<tr>
<td>GFM 520</td>
<td>950</td>
<td>1200 1150 380</td>
<td>1950 1780 1400</td>
<td>15</td>
<td>3-phase</td>
<td>430</td>
</tr>
<tr>
<td>GFM 600</td>
<td>950</td>
<td>2000 1000 380</td>
<td>2750 1630 1400</td>
<td>22</td>
<td>3-phase</td>
<td>610</td>
</tr>
<tr>
<td>GFM 920</td>
<td>950</td>
<td>2100 1150 380</td>
<td>2850 1780 1400</td>
<td>26</td>
<td>3-phase</td>
<td>740</td>
</tr>
<tr>
<td>GFM 1050</td>
<td>950</td>
<td>2300 1200 380</td>
<td>3050 1830 1400</td>
<td>32</td>
<td>3-phase</td>
<td>860</td>
</tr>
</tbody>
</table>

*Please see page 61 for more information about supply voltage.
Tub Furnaces with Wire Heating

GW 830 - GW 8000

For slumping and bending of complex glass parts, e.g. glass furniture, shower cabins, etc., tub furnaces are the right choice. Full coverage heating: from the lid, all 4 sides and the tub bottom. Due to the modular system additional tubs in customized dimensions can be provided.

- Tmax 900 °C
- Full coverage heating: from lid, all 4 sides and bottom
- 3-zone temperature control from top to bottom for optimal temperature uniformity
- Heating elements mounted on ceramic support tubes for free heat radiation and long service life
- Bottom heating covered by SiC tiles
- Hood insulated with high-quality fiber materials
- Tub bottom insulated with multi-layer of insulation, lightweight refractory bricks on the hot face
- Hinged hood as standard version
- Gas operated dampers provide for easy hood opening
- Manually operated exhaust air flaps
- Tub on wheels can be pulled out manually
- Rails on floor for perfect tub guidance included
- Defined application within the constraints of the operating instructions
- Controls description see page 61

Additional equipment

- Interchangeable table system on rails, electrically driven on request
- Electro-hydraulically driven hood instead of hinged cover
- Tub insert to elevate bottom height, in order to use the furnace for glass fusing applications (in this product version the tub heating can be switched off)

<table>
<thead>
<tr>
<th>Model</th>
<th>Tmax °C</th>
<th>Inner dimensions in mm</th>
<th>Volume in L</th>
<th>Outer dimensions in mm</th>
<th>Connected load kW</th>
<th>Electrical connection*</th>
<th>Weight in kg</th>
</tr>
</thead>
<tbody>
<tr>
<td>GW 830</td>
<td>900</td>
<td>1200 x 1150 x 600</td>
<td>830</td>
<td>2140 x 1980 x 1250</td>
<td>36</td>
<td>3phase</td>
<td>820</td>
</tr>
<tr>
<td>GW 840</td>
<td>900</td>
<td>1650 x 850 x 600</td>
<td>840</td>
<td>2590 x 1680 x 1250</td>
<td>36</td>
<td>3phase</td>
<td>980</td>
</tr>
<tr>
<td>GW 1200</td>
<td>900</td>
<td>2000 x 1000 x 600</td>
<td>1200</td>
<td>2940 x 1830 x 1250</td>
<td>40</td>
<td>3phase</td>
<td>1210</td>
</tr>
<tr>
<td>GW 1500</td>
<td>900</td>
<td>2100 x 1150 x 600</td>
<td>1450</td>
<td>3040 x 1980 x 1250</td>
<td>70</td>
<td>3phase</td>
<td>1420</td>
</tr>
<tr>
<td>GW 1660</td>
<td>900</td>
<td>2300 x 1200 x 600</td>
<td>1660</td>
<td>3240 x 2030 x 1250</td>
<td>80</td>
<td>3phase</td>
<td>1780</td>
</tr>
<tr>
<td>GW 2200</td>
<td>900</td>
<td>2300 x 1200 x 800</td>
<td>2200</td>
<td>3240 x 2030 x 1400</td>
<td>90</td>
<td>3phase</td>
<td>2160</td>
</tr>
<tr>
<td>GW 8000</td>
<td>900</td>
<td>3700 x 2700 x 800</td>
<td>8000</td>
<td>9000 x 4750 x 1400</td>
<td>180</td>
<td>3phase</td>
<td>2980</td>
</tr>
</tbody>
</table>

*Please see page 61 for more information about supply voltage

Indirect cooling behind the insulation for reduction of turbulences in the furnace chamber

Bottom heating covered by SiC tiles to create level stacking support
Automatic lid opening for faster cooling, programmable via the controller extra function
Motor-driven exhaust air flaps in the hood for preselected cooling
Powerful cooling system
An efficient fan system, mounted to the furnace, cools the dual shell housing from the back. This system shortens cooling times by up to 50% subject to cycles and charge. Direct contact between the cooling air and charge, hence turbulences in the firing chamber are avoided, protecting the glass from any damage.

Interchangeable table system running on rails
To shorten process times and optimise operational capacity, two or more furnace tubs, placed alternately under the hood, can be used. An automatic tub changing system is also available on request.
Nabertherm markets this range of top-hat furnaces for bending and slumping of large glass parts. The standard furnace is equipped with one table running on rails which can be pulled out for easy charging. As accessory an additional table can be integrated, which is charged while the other table is in the furnace. The furnace is heated from the ceiling and from the table.

- Tmax 900 °C
- Heating from lid and table
- 3-zone temperature control (lid-inner circular element, lid-outer circular element, table) for optimal temperature uniformity
- Table heating can be switched-off for fusing
- Heating elements on supporting tubes provide for long service life
- Table heating elements covered by SiC tiles for level stacking support
- Hood insulated with high-quality fiber materials
- Table insulated with multi-layer resistant, lightweight refractory bricks
- Top-hat to be opened by overhead crane in floor shop
- Protection guides for easy hood opening and closing
<table>
<thead>
<tr>
<th>Model</th>
<th>Tmax °C</th>
<th>Inner dimensions in mm</th>
<th>Floor space in m²</th>
<th>Outer dimensions in mm</th>
<th>Connected load kW</th>
<th>Electrical connection*</th>
<th>Weight in kg</th>
</tr>
</thead>
<tbody>
<tr>
<td>HG 750</td>
<td>900</td>
<td>2100 1200 300</td>
<td>2.52</td>
<td>2550 1800 1350</td>
<td>35</td>
<td>3-phase</td>
<td>1200</td>
</tr>
<tr>
<td>HG 1000</td>
<td>900</td>
<td>1750 1000 550</td>
<td>1.75</td>
<td>2200 1450 1600</td>
<td>33</td>
<td>3-phase</td>
<td>1500</td>
</tr>
<tr>
<td>HG 1500</td>
<td>900</td>
<td>2100 1250 550</td>
<td>2.63</td>
<td>2550 1700 1600</td>
<td>44</td>
<td>3-phase</td>
<td>2000</td>
</tr>
<tr>
<td>HG 1800</td>
<td>900</td>
<td>2450 1850 400</td>
<td>4.35</td>
<td>2950 2350 1600</td>
<td>45</td>
<td>3-phase</td>
<td>2500</td>
</tr>
<tr>
<td>HG 2000</td>
<td>900</td>
<td>2450 1500 550</td>
<td>3.68</td>
<td>2900 1950 1600</td>
<td>55</td>
<td>3-phase</td>
<td>2500</td>
</tr>
<tr>
<td>HG 2640</td>
<td>900</td>
<td>3000 2200 400</td>
<td>6.60</td>
<td>3500 2700 1450</td>
<td>75</td>
<td>3-phase</td>
<td>3400</td>
</tr>
<tr>
<td>HG 3000</td>
<td>900</td>
<td>3500 2200 400</td>
<td>7.70</td>
<td>4000 2800 1600</td>
<td>75</td>
<td>3-phase</td>
<td>3800</td>
</tr>
<tr>
<td>HG 4800</td>
<td>900</td>
<td>5500 2100 400</td>
<td>11.55</td>
<td>6000 2700 1600</td>
<td>90</td>
<td>3-phase</td>
<td>4500</td>
</tr>
<tr>
<td>HG 5208/S</td>
<td>900</td>
<td>3100 2100 800</td>
<td>6.51</td>
<td>3990 2590 3140</td>
<td>110</td>
<td>3-phase</td>
<td>5000</td>
</tr>
<tr>
<td>HG 7608/S</td>
<td>900</td>
<td>3800 2500 800</td>
<td>9.50</td>
<td>4690 2990 3140</td>
<td>143</td>
<td>3-phase</td>
<td>7000</td>
</tr>
</tbody>
</table>

*Please see page 61 for more information about supply voltage

- Manually-operated exhaust air flap
- Furnace table on fixed chassis for user-friendly charging height (800 mm)
- Defined application within the constraints of the operating instructions
- Controls description see page 61

Additional equipment
- Hood side heating in case of high hood dimensions
- Design without table heating or with disengageable table heating for fusing
- Interchangeable table system on rails, electrically powered on request
- Electro-hydraulically driven hood
- Cooling system
- Table on wheels for free movement
- Motor-driven exhaust air flaps

Top-hat furnace HG 1196/S with hood and table heating; table heating can be switched-off during fusing

Motor-driven exhaust air flaps as additional equipment

Heating elements in furnace hood
Hot-Wall Retort Furnaces up to 1100 °C

NRA 75/06 with automatic gas injection and touch panel H 3700

NRA 17/06 with gas supply system

NRA 17/06 - NRA 1000/1

These gas tight retort furnaces are equipped with direct or indirect heating depending on temperature. They are perfectly suited for various heat treatment processes requiring a defined protective or a reaction gas atmosphere. These compact models can also be laid out for heat treatment under vacuum up to 600 °C. The furnace chamber consists of a gas tight retort with water cooling around the door to protect the special sealing. Equipped with the corresponding safety technology, retort furnaces are also suitable for applications under reaction gases, such as hydrogen or, in combination with the IDB package, for inert debinding or for pyrolysis processes.

Different model versions are available depending on the temperature range required for the process:

Models NRA ../06 with Tmax 650 °C
- Heating elements located inside the retort
- Temperature uniformity up to +/- 6 °C inside the worke space from 100 °C - 600 °C see page 60
- Retort made of 1.4571
- Gas circulation fan in the back of the retort provides for optimal temperature uniformity

Models NRA ../09 with Tmax 950 °C
- Outside heating with heating elements surrounding the retort as well as an additional door heater
- Temperature uniformity up to +/- 6 °C inside the worke space from 200 °C - 900 °C see page 60
- Retort made of 1.4841
- Fan in the back of the retort provides for optimal temperature uniformity

Models NR ../11 with Tmax 1100 °C
- Outside heating with heating elements surrounding the retort as well as an additional door heater
- Temperature uniformity up to +/- 8 °C inside the worke space from 200 °C - 1050 °C see page 60
- Retort made of 1.4841
Basic version

- Compact housing in frame design with removable stainless steel sheets
- Controls and gas supply integrated in the furnace housing
- Welded charging supports in the retort or air-baffle box in the furnace with air circulation
- Swivel door hinged on right side with open cooling water system
- Multi-zone control for 950 °C and 1100 °C version, separated by furnace chamber and door. Depending on furnace chamber additionally subdivided into one or several heating zones
- Temperature control as charge control with temperature measurement inside and outside the retort
- Gas supply system for one non-flammable protective or reaction gas with flow meter and solenoid valve, switchable via the control system
- Operation under vacuum up to 600 °C with optional single-stage rotary vane pump
- Port for vacuum pump for cold evacuation
- Defined application within the constraints of the operating instructions
- PLC controls with touch panel H 700 for data input (resp. P 300 for 650 °C-version) see page 82

Additional equipment

- Upgrade for other non-flammable gases
- Automatic gas injection, including MFC flow controller for alternating volume flow, PLC controlled with touch panel H 3700
- Vacuum pump for evacuating of the retort up to 600 °C, attainable vacuum up to 10⁻⁸ mbar subject to selected pump
- Cooling system for shortening process times
- Heat exchanger with closed-loop cooling water circuit for door cooling
- Measuring device for residual oxygen content
**Bayonet quick-lock for the retort, also with electric drive as additional equipment**

NR 200/11 H₂ for heat treatment under hydrogen

**H₂ Version for Operation under Hydrogen**
When hydrogen is used as a process gas, the furnace is additionally equipped with the required safety technology. Only certified and industry proven safety sensors are used. The furnace is controlled by a fail-safe PLC control system (S7-300F/safety controller).

- H₂ supply at controlled overpressure of 50 mbar relative
- Certified safety concept
- PLC controls with graphic touch panel H 3700 for data input
- Redundant gas inlet valves for hydrogen
- Monitored pre-pressures of all process gases
- Bypass for safe flushing of furnace chamber with inert gas
- Torch for thermal afterburning of exhaust gases
- Emergency flood container for purging the furnace in case of failure

**IDB Version for Debinding under Non-flammable Protective Gases or for Pyrolysis Processes**
The retort furnaces of the NR and NRA product line are perfectly suited for debinding under non-flammable protective gases or for pyrolysis processes. The IDB version of the furnaces implements a safety concept by controlled purging the furnace chamber with a protective gas. Exhaust gases are burned in an exhaust torch. Both the purging and the torch function are monitored to ensure a safe operation.

- Process control under monitored and controlled overpressure of 50 mbar relative
- PLC controls with graphic touch panel H 1700 for data input
- Monitored gas pre-pressure of the process gas
- Bypass for safe flushing of furnace chamber with inert gas
- Torch for thermal afterburning of exhaust gases

---

**Model** | **Tmax °C** | **Model** | **Tmax °C** | **Work space dimensions in mm** | **Work space in l** | **Electrical connection***<sup>*</sup>  
--- | --- | --- | --- | --- | --- | ---  
NR A 17/.. | 650 or 950 | NR A 17/11 | 1100 | 225 | 350 | 225 | 17 | 3-phase  
NR A 25/.. | 650 or 950 | NR A 25/11 | 1100 | 225 | 500 | 225 | 25 | 3-phase  
NR A 50/.. | 650 or 950 | NR A 50/11 | 1100 | 325 | 475 | 325 | 50 | 3-phase  
NR A 75/.. | 650 or 950 | NR A 75/11 | 1100 | 325 | 700 | 325 | 75 | 3-phase  
NR A 150/.. | 650 or 950 | NR A 150/11 | 1100 | 450 | 1000 | 450 | 150 | 3-phase  
NR A 200/.. | 650 or 950 | NR A 200/11 | 1100 | 450 | 1000 | 450 | 200 | 3-phase  
NR A 300/.. | 650 or 950 | NR A 300/11 | 1100 | 590 | 900 | 590 | 300 | 3-phase  
NR A 400/.. | 650 or 950 | NR A 400/11 | 1100 | 590 | 1250 | 590 | 400 | 3-phase  
NR A 500/.. | 650 or 950 | NR A 500/11 | 1100 | 720 | 1000 | 720 | 500 | 3-phase  
NR A 700/.. | 650 or 950 | NR A 700/11 | 1100 | 720 | 1350 | 720 | 700 | 3-phase  
NR A 1000/.. | 650 or 950 | NR A 1000/11 | 1100 | 870 | 1500 | 870 | 1000 | 3-phase  

*Please see page 61 for more information about supply voltage
The retort furnaces SR and SRA (with gas circulation) are designed for operation with non-flammable or flammable protective or reaction gases. The furnace is loaded from above by crane or other lifting equipment provided by the customer. In this way, even large charge weights can be loaded into the furnace chamber.

Depending on the temperature range in which the furnace be used, the following models are available:

Models SR .../11 with T_max 1100 °C
- Heating from all sides outside the retort
- Temperature uniformity up to +/- 8 °C according to DIN 17052-1 within the work space of 500 °C - 1100 °C see page 60
- Retort made of 1.4841
- Top down multi-zone control of the furnace heating

Models SRA .../09 with T_max 950 °C
Design like models SR.../11 with following differences:
- Atmosphere circulation with powerful fan in the furnace lid provides for temperature uniformity up to +/- 5 °C according to DIN 17052-1 within the work space of 200 °C - 900 °C see page 60
- Single-zone control
- Retort made of 1.4841

Standard Equipment (all models)
Design like standard equipment of models NR and NRA with following differences:
- Charging from above with crane or other lifting equipment from customer
- Hinged lid with opening to the side
- Defined application within the constraints of the operating instructions

Additional equipment, \( \text{H}_2 \) version or IDB version see models NR and NRA

### SRA 17/... - SR 1500

The retort furnaces SR and SRA (with gas circulation) are designed for operation with non-flammable or flammable protective or reaction gases. The furnace is loaded from above by crane or other lifting equipment provided by the customer. In this way, even large charge weights can be loaded into the furnace chamber.

**Models SR .../11 with T_max 1100 °C**
- Heating from all sides outside the retort
- Temperature uniformity up to +/- 8 °C according to DIN 17052-1 within the work space of 500 °C - 1100 °C see page 60
- Retort made of 1.4841
- Top down multi-zone control of the furnace heating

**Models SRA .../09 with T_max 950 °C**
Design like models SR.../11 with following differences:
- Atmosphere circulation with powerful fan in the furnace lid provides for temperature uniformity up to +/- 5 °C according to DIN 17052-1 within the work space of 200 °C - 900 °C see page 60
- Single-zone control
- Retort made of 1.4841

**Standard Equipment (all models)**
Design like standard equipment of models NR and NRA with following differences:
- Charging from above with crane or other lifting equipment from customer
- Hinged lid with opening to the side
- Defined application within the constraints of the operating instructions

Additional equipment, \( \text{H}_2 \) version or IDB version see models NR and NRA

### Model Specifications

<table>
<thead>
<tr>
<th>Model</th>
<th>T_max °C</th>
<th>Inner dimensions of alloy retort</th>
<th>Volume in l</th>
<th>Outer dimensions in mm</th>
<th>Electrical connection</th>
<th>Weight in kg</th>
</tr>
</thead>
<tbody>
<tr>
<td>SR(A)</td>
<td>17/..</td>
<td>250 350</td>
<td>17</td>
<td>1300 1700 1800</td>
<td>3-phase</td>
<td>600</td>
</tr>
<tr>
<td>SR(A)</td>
<td>25/..</td>
<td>250 500</td>
<td>25</td>
<td>1300 1900 1800</td>
<td>3-phase</td>
<td>800</td>
</tr>
<tr>
<td>SR(A)</td>
<td>50/..</td>
<td>400 450</td>
<td>50</td>
<td>1400 2000 1800</td>
<td>3-phase</td>
<td>1300</td>
</tr>
<tr>
<td>SR(A)</td>
<td>100/..</td>
<td>600 800</td>
<td>100</td>
<td>1400 2000 2100</td>
<td>3-phase</td>
<td>1500</td>
</tr>
<tr>
<td>SR(A)</td>
<td>200/..</td>
<td>600 700</td>
<td>200</td>
<td>1600 2200 2200</td>
<td>3-phase</td>
<td>2100</td>
</tr>
<tr>
<td>SR(A)</td>
<td>300/..</td>
<td>600 1000</td>
<td>300</td>
<td>1600 2200 2500</td>
<td>3-phase</td>
<td>2400</td>
</tr>
<tr>
<td>SR(A)</td>
<td>500/..</td>
<td>800 1000</td>
<td>800</td>
<td>1800 2400 2700</td>
<td>3-phase</td>
<td>2800</td>
</tr>
<tr>
<td>SR(A)</td>
<td>600/..</td>
<td>800 1200</td>
<td>600</td>
<td>1800 2400 2900</td>
<td>3-phase</td>
<td>3000</td>
</tr>
<tr>
<td>SR(A)</td>
<td>800/..</td>
<td>800 1200</td>
<td>800</td>
<td>2000 2600 2800</td>
<td>3-phase</td>
<td>3100</td>
</tr>
<tr>
<td>SR(A)</td>
<td>1000/..</td>
<td>1000 1300</td>
<td>1000</td>
<td>2000 2600 3100</td>
<td>3-phase</td>
<td>3300</td>
</tr>
<tr>
<td>SR(A)</td>
<td>1500/..</td>
<td>1200 1300</td>
<td>1500</td>
<td>2200 2800 3300</td>
<td>3-phase</td>
<td>3500</td>
</tr>
</tbody>
</table>

*Please see page 61 for more information about supply voltage
The compact furnaces of the VHT product line are available as electrically heated chamber furnaces with graphite, molybdenum, tungsten or MoSi2 heating. A wide variety of heating designs as well as a complete range of accessories provide for optimal furnace configurations even for sophisticated applications.

The vacuum-tight retort allows heat treatment processes either in protective and reaction gas atmospheres or in a vacuum, subject to the individual furnace specs to 10^{-5} mbar. The basic furnace is suited for operation with non-flammable protective or reactive gases or under vacuum.

The H2 version provides for operation under hydrogen or other flammable gases. Key of the specification up is a certified safety package providing for a safe operation at all times and triggers an appropriate emergency program in case of failure.

If you intend to debind in an inert atmosphere, we recommend the use of a process box. The exhaust gases are vented directly from the box to the exhaust gas torch.

**Alternative Heating Specifications**

The following heating systems are available for the different application temperatures:

**VHT ../GR with Graphite Insulation and Heating**
- Suitable for processes under protective and reaction gases or under vacuum
- Tmax 1800 °C or 2200 °C
- Max. vacuum up to 10^{-4} mbar depending on pump type used
- Graphite felt insulation
**VHT ../MO or ../W with Molybdenum or Tungsten Heating**
- Suitable for high-purity processes under protective and reaction gases or under high vacuum
- Tmax 1200 °C, 1600 °C or 1800 °C (see table)
- Max. vacuum up to 5 x 10⁻¹ mbar depending on pump type used
- Insulation made of Molybdenum steel sheets

**VHT ../KE with Fiber Insulation and Heating through Molybdenum Disilicide Heating Elements**
- Suitable for processes under protective and reaction gases, in air or under vacuum
- Tmax 1800 °C
- Max. vacuum up to 10⁻² mbar (up to 1300 °C) depending on pump type
- Insulation made of high purity aluminum oxide fiber

<table>
<thead>
<tr>
<th>Inert gas</th>
<th>VHT ...-../GR</th>
<th>VHT ...-16/MO</th>
<th>VHT ...-18/W</th>
<th>VHT ...-18/KE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inert gas</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Air</td>
<td>✓</td>
<td></td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Hydrogen</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Rough vacuum and fine vacuum (&gt;10⁻² mbar)</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>High vacuum (&lt;10⁻³ mbar)</td>
<td>-</td>
<td>✓</td>
<td>✓</td>
<td>-</td>
</tr>
<tr>
<td>Oxygen</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>✓</td>
</tr>
</tbody>
</table>

¹up to 1400
²depending on Tmax

**Standard Equipment for all Models**

**Basic version**
- Standard furnace sizes 8, 40 and 100 liters
- A water-cooled stainless steel process reactor sealed with temperature-resistant o-rings
- Frame made of stable steel profiles, easy to service due to easily removable stainless steel panels
- Housing of the VHT 8 model on castors for easy repositioning of furnace
- Cooling water manifold with manual stopcocks in supply and return lines, automatic flowmeter monitoring, openloop cooling water system
- Adjustable cooling water circuits with flowmeter and temperature indicator and overtemperature fuses
- Switchgear and controller integrated in furnace housing
- H 700 PLC control with clearly laid out 7” touchpanel control for program entry and display, 10 programs each with 20 segments
- Over-temperature limiter with manual reset for thermal protection class in accordance with EN 60519-2
- Manual operation of the process gas and vacuum functions
- Manual gas supply for one process gas (N₂ or Ar) with adjustable flow
- Bypass with manual valve for rapid filling or flooding of furnace chamber
- Manual gas outlet with overflow valve (20 mbar relative)
- Single-stage rotary vane pump with ball valve for pre-evacuating and heat treatment in a rough vacuum to 5 mbar
- Pressure gauge for visual pressure monitoring
- Defined application within the constraints of the operating instructions

**Additional equipment**
- Tmax 2400 °C
- Housing, optionally divisible, for passing through narrow door frames (VHT 08)
- Manual gas supply for second process gas (N₂ or Ar) with adjustable flow and bypass
- Inner process box made of molybdenum or CFC, especially recommended for debinding processes. The box is installed in the furnace with direct gas inlet and outlet and provides for better temperature uniformity. Due to a change in gas supply direction after debinding a clean process atmosphere for sintering is achieved.
- Charge thermocouple with display

<table>
<thead>
<tr>
<th>Model</th>
<th>Inner dimensions of retort in mm</th>
<th>Volume in l</th>
</tr>
</thead>
<tbody>
<tr>
<td>VHT 8/..</td>
<td>120</td>
<td>210</td>
</tr>
<tr>
<td>VHT 40/..</td>
<td>280</td>
<td>430</td>
</tr>
<tr>
<td>VHT 100/..</td>
<td>430</td>
<td>530</td>
</tr>
</tbody>
</table>
VHT 40/16MO H₂

Continuation of additional equipment

- Two-stage rotary vane pump with ball valve for pre-evacuating and heat-treating in a vacuum to 10⁻² mbar
- Temperature measurement at 2200 °C models with pyrometer and thermocouple, type S with automatic pull-out device for precise control results in the low temperature range (VHT 40 and larger)
- Turbo molecular pump with slide valve for pre-evacuation and for heat treatment in a vacuum to 10⁻⁵ mbar including electric pressure transducer and booster pump (only VHT.../MO)
- Heat exchanger with closed-loop cooling water circuit
- Automation package with graphic touch panel H 3700
  - 12” graphic touch panel H 3700
  - Input of all process data like temperatures, heating rates, gas injection, vacuum at the touch panel
  - Display of all process-relevant data on a process control diagram
  - Automatic gas supply for one process gas (N₂, argon or forming gas) with adjustable flow
  - Bypass for flooding and filling the chamber with process gas controlled by the program
  - Automatic pre- and post programs, including leak test for safe furnace operation
  - Automatic gas outlet with bellows valve and overflow valve (20 mbar)
  - Transducer for absolute and relative pressure
- MFC flow controller for alternating volume flow and generation of gas mixtures with second process gas (only with automation package)
- Partial pressure operation: protective gas flushing at controlled underpressure (only with automation package)
- PC control via NCC with corresponding optional documentation and connection to customer PC networks
H₂ Version VHT.../MO-H₂ or VHT.../GR-H₂ for Operation with Hydrogen or other Reaction Gases

In the H₂ version the furnaces of the VHT.../MO or VHT.../GR product line can be operated under hydrogen or other reaction gases. For these applications, the systems are additionally equipped with the required safety technology. Only certified and industry proven safety sensors are used. The furnaces are controlled by a fail-safe PLC control system (S7-300F/safety controller).

- Certified safety concept
- Automation package (see additional equipment above)
- Redundant gas inlet valves for hydrogen
- Monitored pre-pressures of all process gases
- Bypass for safe purging of furnace chamber with inert gas
- Pressure-monitored emergency flooding with automated solenoid valve opening
- Electric or gas-heated exhaust gas torch for H₂ post-combustion
- Atmospheric operation: H₂-purging of process reactor starting from room temperature at controlled over pressure (50 mbar relative)

Additional equipment
- Partial pressure operation: H₂ flushing at underpressure in the process reactor starting from 750 °C furnace temperature
- Retort in the process chamber for debinding under hydrogen

Process Box for Debinding in Inert Gas

Certain processes require charges to be debinded in non-flammable protective or reactive gases. For these processes we fundamentally recommend a hot-wall retort furnace (see models NR... or SR...). These furnaces can ensure that the formation of condensation will be avoided as thoroughly as possible.

If there is no way to avoid the escape of small amounts of residual binder during the process, even in the VHT furnace, the furnace should be designed to meet this contingency.

The furnace chamber is equipped with an additional process box that has a direct outlet to the exhaust gas torch through which the exhaust gas can be directly vented. This system enables a substantial reduction in the amount of furnace chamber contamination caused by the exhaust gases generated during debinding.

Depending on the exhaust gas composition the exhaust gas line can be designed to include various options.

- Exhaust gas torch for burning off the exhaust gas
- Condensation trap for separating out binding agents
- Exhaust gas post-treatment, depending on the process, via scrubbers
- Heated exhaust gas outlet to avoid condensation deposits in the exhaust gas line

### VHT gas supply diagram, debinding and sintering

**Model**

<table>
<thead>
<tr>
<th>Model</th>
<th>T max °C</th>
<th>Inner dimensions in mm</th>
<th>Volume in l</th>
<th>Outer dimensions in mm</th>
<th>Connected load kW⁴</th>
<th>Electrical connection⁺</th>
<th>Weight in kg</th>
<th>Material heater/insulation</th>
</tr>
</thead>
<tbody>
<tr>
<td>VHT 8/-MO</td>
<td>1800</td>
<td>170 240 200</td>
<td>8 1250 (800)¹</td>
<td>1100 2000</td>
<td>27</td>
<td>3-phase³</td>
<td>1200</td>
<td>Graphite/graphite felt</td>
</tr>
<tr>
<td>VHT 40/-MO or 300</td>
<td>300 450 300</td>
<td>40 1600</td>
<td>2100 2300</td>
<td>83/103³</td>
<td>3-phase³</td>
<td>2000</td>
<td>Graphite/graphite felt</td>
<td></td>
</tr>
<tr>
<td>VHT 70/-MO</td>
<td>2200 375 500 375</td>
<td>70 1700</td>
<td>2500 2400</td>
<td>105/125³</td>
<td>3-phase³</td>
<td>2400</td>
<td>Graphite/graphite felt</td>
<td></td>
</tr>
<tr>
<td>VHT 100/-MO</td>
<td>1200 170 240 200</td>
<td>8 1250 (800)¹</td>
<td>1100 2700</td>
<td>15/34⁴</td>
<td>3-phase³</td>
<td>1200</td>
<td>Molybdenum</td>
<td></td>
</tr>
<tr>
<td>VHT 8/-MO</td>
<td>1200 170 240 200</td>
<td>8 1250 (800)¹</td>
<td>1100 2700</td>
<td>15/34⁴</td>
<td>3-phase³</td>
<td>1200</td>
<td>Molybdenum</td>
<td></td>
</tr>
<tr>
<td>VHT 40/-MO or 300</td>
<td>300 450 300</td>
<td>40 1600</td>
<td>2600 2300</td>
<td>50/110⁴</td>
<td>3-phase³</td>
<td>3000</td>
<td>Molybdenum</td>
<td></td>
</tr>
<tr>
<td>VHT 70/-MO</td>
<td>1600 375 500 375</td>
<td>70 1700</td>
<td>2800 2400</td>
<td>70/140⁴</td>
<td>3-phase³</td>
<td>3000</td>
<td>Molybdenum</td>
<td></td>
</tr>
<tr>
<td>VHT 100/-MO</td>
<td>1600 375 500 375</td>
<td>70 1700</td>
<td>2800 2400</td>
<td>70/140⁴</td>
<td>3-phase³</td>
<td>3500</td>
<td>Molybdenum</td>
<td></td>
</tr>
<tr>
<td>VHT 100/-MO</td>
<td>1600 375 500 375</td>
<td>70 1700</td>
<td>2800 2400</td>
<td>70/140⁴</td>
<td>3-phase³</td>
<td>3500</td>
<td>Molybdenum</td>
<td></td>
</tr>
<tr>
<td>VHT 100/-MO</td>
<td>1600 375 500 375</td>
<td>70 1700</td>
<td>2800 2400</td>
<td>70/140⁴</td>
<td>3-phase³</td>
<td>3500</td>
<td>Molybdenum</td>
<td></td>
</tr>
<tr>
<td>VHT 100/-MO</td>
<td>1600 375 500 375</td>
<td>70 1700</td>
<td>2800 2400</td>
<td>70/140⁴</td>
<td>3-phase³</td>
<td>3500</td>
<td>Molybdenum</td>
<td></td>
</tr>
<tr>
<td>VHT 100/-MO</td>
<td>1600 375 500 375</td>
<td>70 1700</td>
<td>2800 2400</td>
<td>70/140⁴</td>
<td>3-phase³</td>
<td>3500</td>
<td>Molybdenum</td>
<td></td>
</tr>
<tr>
<td>VHT 100/-MO</td>
<td>1600 375 500 375</td>
<td>70 1700</td>
<td>2800 2400</td>
<td>70/140⁴</td>
<td>3-phase³</td>
<td>3500</td>
<td>Molybdenum</td>
<td></td>
</tr>
<tr>
<td>VHT 100/-MO</td>
<td>1600 375 500 375</td>
<td>70 1700</td>
<td>2800 2400</td>
<td>70/140⁴</td>
<td>3-phase³</td>
<td>3500</td>
<td>Molybdenum</td>
<td></td>
</tr>
<tr>
<td>VHT 100/-MO</td>
<td>1600 375 500 375</td>
<td>70 1700</td>
<td>2800 2400</td>
<td>70/140⁴</td>
<td>3-phase³</td>
<td>3500</td>
<td>Molybdenum</td>
<td></td>
</tr>
<tr>
<td>VHT 100/-MO</td>
<td>1600 375 500 375</td>
<td>70 1700</td>
<td>2800 2400</td>
<td>70/140⁴</td>
<td>3-phase³</td>
<td>3500</td>
<td>Molybdenum</td>
<td></td>
</tr>
<tr>
<td>VHT 100/-MO</td>
<td>1600 375 500 375</td>
<td>70 1700</td>
<td>2800 2400</td>
<td>70/140⁴</td>
<td>3-phase³</td>
<td>3500</td>
<td>Molybdenum</td>
<td></td>
</tr>
</tbody>
</table>

¹With the switching system unit removed
²Heating only between two phases
³1800 °C/2200 °C
⁴For operation under hydrogen a higher power rating has to be considered

*Please see page 61 for more information about supply voltage

1200 °C/1600 °C
The LBVHT product line with lift-bottom specification are especially suitable for production processes which require either protective or reaction gas atmosphere or a vacuum. The basic performance specifications of these models are similar to the VHT models. Their size and design with electro-hydraulically driven table facilitate charging during production. The furnaces are available in various sizes and designs. Similar like the VHT models, these furnaces can be equipped with different heating concepts.

- Standard furnace sizes between 100 and 600 liters
- Designed as lift-bottom retort furnace with electro-hydraulically driven table for easy and well-arranged charging
- Prepared to carry heavy charge weights
- Different heating concepts using
  - Graphite heating chamber up to Tmax 2400 °C
  - Molybdenum heating chamber up to Tmax 1600 °C
  - Tungsten heating chamber up to Tmax 2000 °C
- Frame structure filled with textured stainless steel sheets
- Standard design with gassing system for non-flammable protective or reaction gases
- Automatic gas supply system which also allows for operation with several process gases as additional equipment
- Gas supply systems for operating with hydrogen or other flammable reaction gases incl. safety package as additional equipment
- Switchgear and control box as well as gassing system integrated into the furnace housing
- Defined application within the constraints of the operating instructions
- Further product characteristics of the standard furnace as well as possible additional equipment can be found in the description of the VHT furnaces from Page 52

### LBVHT 100/16 - LBVHT 600/24

The LBVHT product line with lift-bottom specification are especially suitable for production processes which require either protective or reaction gas atmosphere or a vacuum. The basic performance specifications of these models are similar to the VHT models. Their size and design with electro-hydraulically driven table facilitate charging during production. The furnaces are available in various sizes and designs. Similar like the VHT models, these furnaces can be equipped with different heating concepts.

- Standard furnace sizes between 100 and 600 liters
- Designed as lift-bottom retort furnace with electro-hydraulically driven table for easy and well-arranged charging
- Prepared to carry heavy charge weights
- Different heating concepts using
  - Graphite heating chamber up to Tmax 2400 °C
  - Molybdenum heating chamber up to Tmax 1600 °C
  - Tungsten heating chamber up to Tmax 2000 °C
- Frame structure filled with textured stainless steel sheets
- Standard design with gassing system for non-flammable protective or reaction gases
- Automatic gas supply system which also allows for operation with several process gases as additional equipment
- Gas supply systems for operating with hydrogen or other flammable reaction gases incl. safety package as additional equipment
- Switchgear and control box as well as gassing system integrated into the furnace housing
- Defined application within the constraints of the operating instructions
- Further product characteristics of the standard furnace as well as possible additional equipment can be found in the description of the VHT furnaces from Page 52

### LBVHT Models

<table>
<thead>
<tr>
<th>Model</th>
<th>Tmax °C</th>
<th>Model</th>
<th>Tmax °C</th>
<th>Tmax °C</th>
<th>Inner dimensions in mm</th>
<th>Volume in l</th>
<th>Electrical connection</th>
</tr>
</thead>
<tbody>
<tr>
<td>LBVHT 100/16-MO</td>
<td>1600</td>
<td>LBVHT 100/20-WO</td>
<td>2000</td>
<td>LBVHT 100/24-GR</td>
<td>2400</td>
<td>450</td>
<td>700</td>
</tr>
<tr>
<td>LBVHT 250/16-MO</td>
<td>1600</td>
<td>LBVHT 250/20-WO</td>
<td>2000</td>
<td>LBVHT 250/24-GR</td>
<td>2400</td>
<td>600</td>
<td>900</td>
</tr>
<tr>
<td>LBVHT 600/16-MO</td>
<td>1600</td>
<td>LBVHT 600/20-WO</td>
<td>2000</td>
<td>LBVHT 600/24-GR</td>
<td>2400</td>
<td>800</td>
<td>1200</td>
</tr>
</tbody>
</table>

*Please see page 61 for more information about supply voltage
Pit-Type Cold-Wall Retort Furnaces up to 2400 °C or up to 3000 °C

SVHT 2/24-W - SVHT 9/30-GR
Compared with the VHT models (page 52), the furnaces of the SVHT product line offer improved performance data with regard to achievable vacuum and maximum temperature. Due to the design as pit-type furnace with tungsten heating, processes up to max. 2400 °C even in high vacuum can be implemented with models of the SVHT..-W product line. Models of the SVHT..-GR product line with graphite heating, also in pit-type design, can be operated in an inert gas atmosphere even up to max. 3000 °C.

- Standard sizes with a furnace chamber of 2 or 9 liters
- Designed as pit-type furnace, charged from above
- Frame construction with inserted sheets of textured stainless steel
- Dual shell water-cooled stainless steel container
- Manual operation of process gas and vacuum functions
- Manual gas supply for non-flammable process gas
- A step in front of the furnace for an ergonomic charging height
- Retort lid with gas-charged shock absorbers
- Controls and switchgear as well as gas supply integrated in furnace housing
- Defined application within the constraints of the operating instructions
- Further standard product characteristics see description for standard design of VHT models page 52

Heating options

SVHT ..-GR
- Applicable for processes:
  - under protective or reactive gases or in the vacuum up to 2200 °C
  - under inert gases (argon, helium) up to 3000 °C
- Max. vacuum up to 10⁻³ mbar depending on the type of pump used
- Heating: graphite heating elements in cylindrical arrangement
- Insulation: graphite felt insulation
- Temperature measurement by means of an optical pyrometer

SVHT ..-W
- Applicable for processes under protective or reaction gases or in vacuum up to 2400 °C
- Max. vacuum up to 10⁻⁵ mbar depending on the type of pump used
- Heating: cylindrical tungsten heating module
- Insulation: tungsten and molybdenum radiant plates
- Temperature measurement with optical pyrometer

Additional equipment such as automatic process gas control or design for the operation with flammable gases incl. safety system see VHT models page 52.

<table>
<thead>
<tr>
<th>Model</th>
<th>Tmax °C</th>
<th>Work space dimensions Ø x h in mm</th>
<th>Work space in l</th>
<th>Outer dimensions in mm</th>
<th>Connected load KW</th>
<th>Electrical connection*</th>
</tr>
</thead>
<tbody>
<tr>
<td>SVHT 2/24-W</td>
<td>2400</td>
<td>150 x 150</td>
<td>2,5</td>
<td>1400</td>
<td>55</td>
<td>3-phase</td>
</tr>
<tr>
<td>SVHT 9/24-W</td>
<td>2400</td>
<td>230 x 230</td>
<td>9,5</td>
<td>1500</td>
<td>95</td>
<td>3-phase</td>
</tr>
<tr>
<td>SVHT 2/30-GR</td>
<td>3000</td>
<td>150 x 150</td>
<td>2,5</td>
<td>1400</td>
<td>55</td>
<td>3-phase</td>
</tr>
<tr>
<td>SVHT 9/30-GR</td>
<td>3000</td>
<td>230 x 230</td>
<td>9,5</td>
<td>1500</td>
<td>95</td>
<td>3-phase</td>
</tr>
</tbody>
</table>

*Please see page 61 for more information about supply voltage
Float-Glass Test Kiln with Wire Heating

N 40/14
This kiln was designed to test different types of glass plates such as fire protection glass. In addition to the kiln door, there is a second frame which can be swung in front of the work space into which the test plate is placed. This door is fixed with a special mechanism. The kiln chamber is flat and is heated by element coils supported on ceramic tubes mounted only on the back wall so that the heat radiates directly onto the glass surface. The kiln achieves exceptionally short cycle times due to the very small chamber volume and high power input.

<table>
<thead>
<tr>
<th>Model</th>
<th>Tmax °C</th>
<th>Inner dimensions in mm</th>
<th>Volume in l</th>
<th>Outer dimensions in mm</th>
<th>Connected load kW</th>
<th>Electrical connection*</th>
<th>Weight in kg</th>
</tr>
</thead>
<tbody>
<tr>
<td>N 40/14</td>
<td>1400</td>
<td>400 150 600</td>
<td>36</td>
<td>1000 600 1800</td>
<td>36.0</td>
<td>3-phasig</td>
<td>250</td>
</tr>
</tbody>
</table>

*Please see page 61 for more information about supply voltage

Laboratory Melting Furnace SC 8 with SiC Rod Heating

Model SC 8 was specially developed for melting glass in the laboratory. A customer crucible is entered into the furnace from the top. Glass is molten in the crucible. Heating is realized from two sides with powerful SiC rods. With this heating method a maximum furnace temperature of 1500 °C can be achieved. The very effective, multi-layer insulation with long-life lightweight refractory bricks inside the chamber guarantees low outside temperatures even if the furnace is in continuously used.

<table>
<thead>
<tr>
<th>Model</th>
<th>Tmax °C</th>
<th>Inner dimensions in mm</th>
<th>Volume in l</th>
<th>Outer dimensions in mm</th>
<th>Connected load kW</th>
<th>Electrical connection*</th>
<th>Weight in kg</th>
</tr>
</thead>
<tbody>
<tr>
<td>SC 8</td>
<td>1500</td>
<td>200 150 250</td>
<td>8</td>
<td>840 715 730</td>
<td>30</td>
<td>3-phase</td>
<td>290</td>
</tr>
</tbody>
</table>

*Please see page 61 for more information about supply voltage
Fast-Firing Decoring Furnaces with Infrared Heating

**IR 500/90 - IR 1000/90**

These fast-firing decoring furnaces with infrared heating are especially suitable for decal firing of glass or ceramics at working temperatures up to 900 °C. The furnace is equipped with two manually movable tables on castors for easy handling. Both tables and the furnace chamber are insulated with fiber materials. With the fiber insulation in combination with the infrared heating, which provides for a fast surface heating, the furnace achieves particularly short process cycles.

Depending on the charge type the tables may be charged in several layers what allows for an optimal use of the available space. The charge surface with applied decal should face towards the heating elements which are positioned in the roof. While one charged table is positioned in the furnace the other table can already be charged outside the furnace. If the charge permits, the table with still warm charge can be driven out of the furnace and the other table is pushed into the furnace to use the residual energy.

To vent the exhaust gases generated during decor firing, the furnace is equipped with a motor-driven exhaust gas flap which can be activated via the controls. The stainless steel exhaust hood which is positioned above the motor-driven flap will be connected to customer’s ductwork.

- Infrared heating elements in the roof with reflectors installed on each table
- Insulation made of non-classified fiber materials provides for fast process cycles
- Process times of hardly three hours from cold to cold possible, depending on the charge and the working temperature
- Alternating table system on castors, very easy to move
- Motorized exhaust-gas flap on top of the furnace with stainless steel exhaust hood
- Easy-to-operate controls
- Defined application within the constraints of the operating instructions

<table>
<thead>
<tr>
<th>Model</th>
<th>Tmax °C</th>
<th>Inner dimensions in mm</th>
<th>Volume in l</th>
<th>Outer dimensions in mm</th>
<th>Connected load kW</th>
<th>Electrical connection*</th>
<th>Weight in kg</th>
</tr>
</thead>
<tbody>
<tr>
<td>IR 500/90</td>
<td>900</td>
<td>1600 900 350</td>
<td>500</td>
<td>6000 1400 1300</td>
<td>36</td>
<td>3phase 1100</td>
<td>2000</td>
</tr>
<tr>
<td>IR 1000/90</td>
<td>900</td>
<td>3200 900 350</td>
<td>1000</td>
<td>12000 1400 1300</td>
<td>72</td>
<td>3phase 2000</td>
<td></td>
</tr>
</tbody>
</table>

*Please see page 61 for more information about supply voltage.
Temperature Uniformity and System Accuracy

Temperature uniformity is defined as the maximum temperature deviation in the work space of the furnace. There is a general difference between the furnace chamber and the work space. The furnace chamber is the total volume available in the furnace. The work space is smaller than the furnace chamber and describes the volume which can be used for charging.

**Specification of Temperature Uniformity in +/- K in the Standard Furnace**

In the standard design the temperature uniformity is specified in +/- K at a defined set-temperature with the work space of the empty furnace during the dwell time. In order to make a temperature uniformity survey the furnace should be calibrated accordingly. As standard our furnaces are not calibrated upon delivery.

**Calibration of the Temperature Uniformity in +/- K**

If an absolute temperature uniformity at a reference temperature or at a defined reference temperature range is required, the furnace must be calibrated appropriately. If, for example, a temperature uniformity of +/- 5 K at a set temperature of 750 °C is required, it means that measured temperatures may range from a minimum of 745 °C to a maximum of 755 °C in the work space.

**System Accuracy**

Tolerances may occur not only in the work space, they also exist with respect to the thermocouple and in the controls. If an absolute temperature uniformity in +/- K at a defined set temperature or within a defined reference working temperature range is required, the following measures have to be taken:

- Measurement of total temperature deviation of the measurement line from the controls to the thermocouple
- Measurement of temperature uniformity within the work space at the reference temperature or within the reference temperature range
- If necessary, an offset is set at the controls to adjust the displayed temperature at the controller to the real temperature in the furnace
- Documentation of the measurement results in a protocol

**Temperature Uniformity in the Work Space incl. Protocol**

In standard furnaces a temperature uniformity is guaranteed as +/- K without measurement of temperature uniformity. However, as additional feature, a temperature uniformity measurement at a reference temperature in the work space compliant with DIN 17052-1 can be ordered. Depending on the furnace model, a holding frame which is equivalent in size to the charge space is inserted into the furnace. This frame holds thermocouples at defined measurement positions (11 thermocouples with square cross-section, 9 thermocouple with circular cross-section). The temperature uniformity measurement is performed at a reference temperature specified by the customer at a pre-defined dwell time. If necessary, different reference temperatures or a defined reference working temperature range can also be calibrated.

For the configuration of furnace and control system to meet specific industry standards such as AMS 2750 E, CQI-9, or FDA, Nabetherm offers adapted solutions. See our catalog „Thermal Process Technology“
Nabertherm has many years of experience in the design and construction of both standard and custom control systems. All controls are remarkable for their ease of use and even in the basic version have a wide variety of functions.

**Standard Controllers**

Our extensive line of standard controllers satisfies most customer requirements. Based on the specific furnace model, the controller regulates the furnace temperature reliably. The standard controllers are developed and fabricated within the Nabertherm group. When developing controllers, our focus is on ease of use. From a technical standpoint, these devices are custom-fit for each furnace model or the associated application. From the simple controller with an adjustable temperature to the control unit with freely configurable control parameters, stored programs, PID microprocessor control with self-diagnosis system and a computer interface, we have a solution to meet your requirements.

### Assignment of Standard Controllers to Furnace Families

<table>
<thead>
<tr>
<th>Controller</th>
<th>P 300</th>
<th>P 310</th>
<th>R 6</th>
<th>B 130</th>
<th>B 180</th>
<th>B 150</th>
<th>P 330</th>
<th>C 40</th>
<th>C 280</th>
<th>H 700</th>
<th>H 1700</th>
<th>H 3700</th>
</tr>
</thead>
<tbody>
<tr>
<td>Catalog page</td>
<td>4</td>
<td>8</td>
<td>10</td>
<td>12</td>
<td>14</td>
<td>17</td>
<td>18</td>
<td>22</td>
<td>24</td>
<td>26</td>
<td>29</td>
<td>30</td>
</tr>
<tr>
<td>P 300</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>P 310</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>C 40</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>C 280</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>H 700</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>H 1700</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>H 3700</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

### Functionality of the Standard Controllers

<table>
<thead>
<tr>
<th>Feature</th>
<th>P 300</th>
<th>P 310</th>
<th>R 6</th>
<th>B 130</th>
<th>B 180</th>
<th>B 150</th>
<th>P 330</th>
<th>C 40</th>
<th>C 280</th>
<th>H 700</th>
<th>H 1700</th>
<th>H 3700</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of programs</td>
<td>9</td>
<td>9</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>9</td>
<td>9</td>
<td>9</td>
<td>1-50</td>
<td>10</td>
</tr>
<tr>
<td>Segments</td>
<td>40</td>
<td>40</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2-8</td>
</tr>
<tr>
<td>Extra functions (e.g. fan or automatic flaps)</td>
<td>2²</td>
<td>2²</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2-8</td>
</tr>
<tr>
<td>Maximum number of control zones</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Graphic color display</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Status messages in clear text</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Start time configurable (e.g. to use night power rates)</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Operating hour counter</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Auto tune</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Program entry in steps of 1 °C or 1 min.</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Keypad lock</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Skip-button for segment jump</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Drive of manual zone regulation</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Interface for MV software</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>USB extension module for recording of process data on an USB flash drive</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Programmable power outlet</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>kWh meter</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Real-time clock</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Bath control/charge control</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Data entry via touchpanel</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Data input via number pad</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

### Mains Voltages for Nabertherm Furnaces

**1-phase:** all furnaces are available for mains voltages from 110 V - 240 V at 50 or 60 Hz.

**3-phase:** all furnaces are available for mains voltages from 200 V - 240 V or 380 V - 480 V, at 50 or 60 Hz.

The connecting rates in the catalog refer to the standard furnace with 400 V (3/N/PE) respectively 230 V (1/N/PE).
HiProSystems Control and Documentation

This professional control system for single and multi-zone furnaces is based on Siemens hardware and can be adapted and upgraded extensively. HiProSystems control is used when more than two process-dependent functions, such as exhaust air flaps, cooling fans, automatic movements, etc., have to be handled during a cycle, when furnaces with more than one zone have to be controlled, when special documentation of each batch is required and when remote telediagnostic service is required. It is flexible and is easily tailored to your process or documentation needs.

Alternative User Interfaces

Touch panel H 500/H 700
This basic panel accommodates most basic needs and is very easy to use.

Touch panel H 1700
Firing cycle data and the extra functions activated are clearly displayed in a table. Messages appear as text.

Touch panel H 3700
All functions and process data are stored and displayed in easy to read charts. The data can be exported through various interfaces (Ethernet TCP/IP, MPI, Profibus) to a local PC or your company network for further processing. A CF card also gives the opportunity for data storage and transfer to a PC with a card reader.

For Control, Visualisation and Documentation

Nabertherm Control Center NCC
Upgrading the HiProSystems-Control individually into an NCC provides for additional interfaces, operating documentation, and service benefits in particular for controlling furnace groups including charge beyond the furnace itself (quenching tank, cooling station etc.):

- Recommended for heat treatment processes with extensive requirements in respect to documentation e.g. for metals, technical ceramics or in the medicine field
- Software can be used also in accordance with the AMS 2750 E (NADCAP)
- Documentation according to the requirements of Food and Drug Administration (FDA), Part 11, EGV 1642/03 possible
- Charge data can be read in via barcodes
- Interface for connection to existing Enterprise Database systems (e.g. SAP, Oracle)
- Connection to mobile phone network for alarm message transmission via SMS
- Control from various locations over the network
- Calibration of each measuring point for a specific temperature possible
- Extendable for calibration of a polygonal line with up to 18 temperatures per measuring point for use at different temperatures e.g for AMS 2750 E applications

For Documentation

Nabertherm Documentation Center NDC and Data Recording via NTLog
If the process data of the HiProSystems control unit only need to be recorded, this can be done using a personal computer (PC) with the high-performance NDC software. The data are documented, forgery-proof, and can be evaluated both in the form of a table or a chart. Individual charge data can be entered by the customer and are archived together with the process data. A low-cost alternative which can be used is the NTLog package. The data is recorded on a USB stick during the firing. After the heat treatment has been completed, the recorded value can be read out on the PC with the free analysis software.

Temperature Recorder

Besides the documentation via the software which is connected to the controls, Nabertherm offers different temperature recorders which can be used with respect to the application.

<table>
<thead>
<tr>
<th></th>
<th>Model 6100e</th>
<th>Model 6100a</th>
<th>Model 6180a</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data input using touch panel</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Size of colour display in inch</td>
<td>5,5</td>
<td>5,5</td>
<td>12,1</td>
</tr>
<tr>
<td>Number of thermocouple inputs</td>
<td>3</td>
<td>18</td>
<td>48</td>
</tr>
<tr>
<td>Data read-out via USB-stick</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Input of charge data</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Evaluation software included</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Applicable for TUS-measurements acc. to AMS 2750 E</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
</tbody>
</table>
Controltherm MV Software for Control, Visualisation and Documentation

Documentation and reproducibility gain increased attention with steadily rising quality standards. The powerful Nabertherm software Controltherm MV provides for an optimum solution for the control and documentation of one or more furnaces as well as charge data on basis of Nabertherm controllers.

In the basic version one furnace can be connected to the MV-software. The system can be extended to four, eight or even 16 multi-zone controlled furnaces. Up to 400 different heat treatment programs can be stored. The process will be documented and filed. Process data can be read-out graphically or in table format. A data transfer to MS-Excel is also possible.

For furnaces which are not controlled via a Nabertherm controller, the furnace temperature can be documented with the MV-software. We deliver an extension package as optional equipment. With respect to the individual version, three, six or even nine independent thermocouples can be connected. Independent of the control system, the values of each thermocouple will be read-out and evaluated by the MV-software.

Features

- Simple installation without specific knowledge
- Suitable for PC with operating system Microsoft Windows 7 (32 Bit), Vista (32 Bit), XP with SP3, 2000, NT4.0, Me, 98
- All Nabertherm controllers with interface connectable
- Manipulation protected storage of temperature curves of up to one, four, eight or 16 furnaces (also multizone-controlled), depending on the version of MV-software
- Redundant storage on a network server possible
- Programming, archiving and printing of programs and graphics
- Free input of descriptive charge data text with comfortable search function
- Data exportable into Excel format for further evaluation
- Start/stop of the controller from the local PC (only with Nabertherm controllers mit interface)
- Selectable languages: German, English, French, Italian or Spanish
- 400 additional programs storable (only with Nabertherm controllers with interface)

Extension Package II for Connection of one Additional Temperature Measuring Point, Independent of the Controller

- Connection of an independent thermocouple, type K or S with display of the measured temperature on the included controller C 6 D, e.g. for documentation of charge temperature
- Conversion and transmission of measured data to the MV-software
- For data evaluation, please see MV-software features

Extension Package II for Connection Three, Six or Nine Temperature Measuring Points, Independent of the Controller

- Connection of three thermocouples, type K, S, N or B to the supplied connection box
- Extendable to two or three connection boxes for up to nine temperature measuring points
- Conversion and transmission of measured data to the MV-software
- For data evaluation, please see MV-software features
Please visit our website www.nabertherm.com and find out all you want to know about us - and especially about our products.

Besides news and our current calendar of trade fairs, there is also the opportunity to get in touch directly with your local sales office or nearest dealer worldwide.

Professional Solutions for:
- Arts & Crafts
- Glass
- Advanced Materials
- Laboratory
- Dental
- Thermal Process Technology for Metals, Plastics and Surface Finishing
- Foundry

Headquarters:
Nabertherm GmbH
Bahnhofstr. 20
28865 Lilienthal, Germany
contact@nabertherm.de

Sales and Service Subsidiaries:

China
Nabertherm Ltd. (Shanghai)
150 Lane, No. 158 Pingbei Road, Minhang District
201109 Shanghai, China
contact@nabertherm-cn.com

France
Nabertherm SARL
35 Allée des Impressionnistes - BP 44011
95911 Roissy CDG Cedex, France
contact@nabertherm.fr

Italy
Nabertherm Italia
via Trento N° 17
50139 Florence, Italy
contact@nabertherm.it

Spain
Nabertherm España
c/ Martí i Julià, 8 Bajos 7*
08940 Cornellà de Llobregat, Spain
contact@nabertherm.es

USA
Nabertherm Inc.
54 Read’s Way
New Castle, DE 19720, USA
contact@nabertherm.com

All other Countries: Follow
http://www.nabertherm.com/contacts