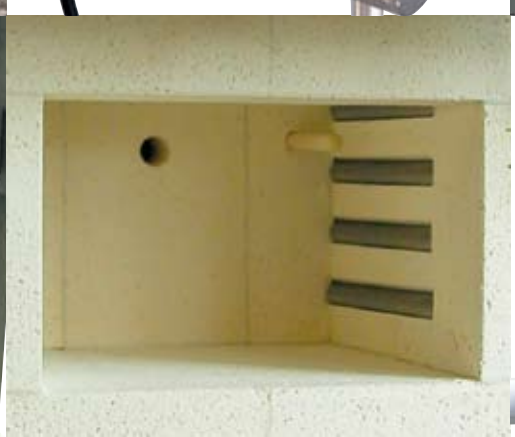
Nabertherm
MORE THAN HEAT 30-3000 °C

# Laboratory








**Muffle Furnaces**
**Preheating Furnaces**
**Ashing Furnaces**
**Tube Furnaces**
**Ovens**
**Air Circulation Furnaces**
**Chamber Furnaces**
**Melting Furnaces**
**High-Temperature Furnaces**
**Sintering Furnaces of Zirconia**
**Vacuum Furnaces**
**Dental Furnaces**

**Made in Germany**

Nabertherm with a staff of more than 300 employees worldwide, have developed and produced furnaces and ovens for laboratory and industrial applications for more than 50 years. 150,000 satisfied customers in 100 countries document our success. Subsidiaries and partners, established for years in all the significant countries of the world guarantee one-on-one customer service and advice on site. Complete fabrication of our furnaces takes place exclusively at facilities in Lilienthal/Bremen. Nabertherm will continue to concentrate its full production in Germany in the future.

**Benchmarks in Quality and Reliability**

Our product line ranges from standard muffle furnaces to technically demanding high-temperature and vacuum furnaces. A variety of accessories is available to adapt standard furnaces to your particular needs. The innovative Nabertherm regulation and automation technology enables precise control, as well as monitoring and documentation of processes.

The depth of our product range guarantees the application flexibility of our furnaces. Applications like ashing and burn-off, heat treatment, drying, or the manufacture of bioceramics are just a few examples of the many uses for our furnaces.

Technical details like the double-wall stainless steel housings on most of our furnaces mean both energy-efficiency and a long service life, ensuring your decisive competitive advantage.

**Time is Money**

We know you need your laboratory furnaces fast in order to be able to perform your experiments or production. And we won't let you down in this important point. That's why many models are warehoused ready to deliver. Even for complex laboratory furnaces, we promise you quick delivery.

**Customer Service and Replacement Parts**

The experts on our customer service team are ready to answer any of your questions. Whether on site, by telephone, or by email, our service technicians will solve your problem. We are particularly proud of our replacement parts service. We send you most replacement parts anywhere in the world in the shortest possible time – and at fair prices, no matter how old your furnace is.

**Experience in many Applications**

Besides furnaces for the laboratory, Nabertherm also provides a range of standard furnances for a variety of other application areas. Many laboratory furnaces are also available in larger versions for your production facilities. Our experienced engineering team views customer-specific solutions as a challenge. We are also happy to provide consulting on custom system solutions.

# Contents



# Professional Furnaces: L 3/11 - LT 40/12 with Folding Door or Lift Door

L 9/11

L 5/12

**L 3/11 - LT 40/12**

Our L 3/11 - LT 40/12 series is the right choice for daily laboratory use. These models stand out for their excellent workmanship, advanced and attractive design, and high level of reliability. The furnaces come equipped with either a folding door or lift door at no extra charge.

- Tmax 1100 °C or 1200 °C
- Ceramic heating plates with integral heating element which is safeguarded against fumes and splashing, and easy to replace
- Highly durable cured vacuum fibre module lining
- Casing made of sheets of textured stainless steel (non-rusting design)
- Double-walled casing for low external temperatures and high stability
- Optional fold-down door (L) which can be used as work platform or lift door (LT) with hot surface facing away from the operator
- Adjustable air inlet integrated in door (see illustration)
- Exhaust air outlet in rear wall of furnace
- Silent solid-state power control relay
- Please see page 44 for a description of various controllers


Over-temperature limit controller

**Additional Equipment**

- Vent, vent with fan or catalytic converter
- Over-temperature limit controller with adjustable cutout temperature for thermal protection class 2 in accordance with EN 60519-2 as temperature limiter to protect the oven and load
- Protective gas connection on the rear wall of furnace
- Manual or automatic gas supply system
- Please see page 13 for more optional equipment

LT 15/12

LT 24/11

| Model fold. door | Tmax °C | Inner dimensions in mm w | d | h | Volume in L | Outer dimensions in mm W | D | H | Power kW | Electrical connection* | Weight in kg | Minutes to Tmax |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| L 3/11 | 1100 | 160 | 140 | 100 | 3 | 380 | 370 | 420 | 1,2 | single-phase | 20 | 60 |
| L 5/11 | 1100 | 200 | 170 | 130 | 5 | 440 | 470 | 520 | 2,4 | single-phase | 35 | 60 |
| L 9/11 | 1100 | 230 | 240 | 170 | 9 | 480 | 550 | 570 | 3,0 | single-phase | 45 | 75 |
| L 15/11 | 1100 | 230 | 340 | 170 | 15 | 480 | 650 | 570 | 3,6 | single-phase | 55 | 90 |
| L 24/11 | 1100 | 280 | 340 | 250 | 24 | 560 | 660 | 650 | 4,5 | 3-phase | 75 | 95 |
| L 40/11 | 1100 | 320 | 490 | 250 | 40 | 600 | 790 | 650 | 6,0 | 3-phase | 95 | 95 |
| L 3/12 | 1200 | 160 | 140 | 100 | 3 | 380 | 370 | 420 | 1,2 | single-phase | 20 | 75 |
| L 5/12 | 1200 | 200 | 170 | 130 | 5 | 440 | 470 | 520 | 2,4 | single-phase | 35 | 75 |
| L 9/12 | 1200 | 230 | 240 | 170 | 9 | 480 | 550 | 570 | 3,0 | single-phase | 45 | 90 |
| L 15/12 | 1200 | 230 | 340 | 170 | 15 | 480 | 650 | 570 | 3,6 | single-phase | 55 | 105 |
| L 24/12 | 1200 | 280 | 340 | 250 | 24 | 560 | 660 | 650 | 4,5 | 3-phase | 75 | 110 |
| L 40/12 | 1200 | 320 | 490 | 250 | 40 | 600 | 790 | 650 | 6,0 | 3-phase | 95 | 110 |

| Model Lift door | Tmax °C | Inner dimensions in mm w | d | h | Volume in L | Outer dimensions in mm W | D | H[1] | Power kW | Electrical connection* | Weight in kg | Minutes to Tmax |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LT 3/11 | 1100 | 160 | 140 | 100 | 3 | 380 | 370 | 420+165 | 1,2 | single-phase | 20 | 60 |
| LT 5/11 | 1100 | 200 | 170 | 130 | 5 | 440 | 470 | 520+220 | 2,4 | single-phase | 35 | 60 |
| LT 9/11 | 1100 | 230 | 240 | 170 | 9 | 480 | 550 | 570+290 | 3,0 | single-phase | 45 | 75 |
| LT 15/11 | 1100 | 230 | 340 | 170 | 15 | 480 | 650 | 570+290 | 3,6 | single-phase | 55 | 90 |
| LT 24/11 | 1100 | 280 | 340 | 250 | 24 | 560 | 660 | 650+335 | 4,5 | 3-phase | 75 | 95 |
| LT 40/11 | 1100 | 320 | 490 | 250 | 40 | 600 | 790 | 650+335 | 6,0 | 3-phase | 95 | 95 |
| LT 3/12 | 1200 | 160 | 140 | 100 | 3 | 380 | 370 | 420+165 | 1,2 | single-phase | 20 | 75 |
| LT 5/12 | 1200 | 200 | 170 | 130 | 5 | 440 | 470 | 520+220 | 2,4 | single-phase | 35 | 75 |
| LT 9/12 | 1200 | 230 | 240 | 170 | 9 | 480 | 550 | 570+290 | 3,0 | single-phase | 45 | 90 |
| LT 15/12 | 1200 | 230 | 340 | 170 | 15 | 480 | 650 | 570+290 | 3,6 | single-phase | 55 | 105 |
| LT 24/12 | 1200 | 280 | 340 | 250 | 24 | 560 | 660 | 650+335 | 4,5 | 3-phase | 75 | 110 |
| LT 40/12 | 1200 | 320 | 490 | 250 | 40 | 600 | 790 | 650+335 | 6,0 | 3-phase | 95 | 110 |

[1]Including opened lift door

*Please see page 44 for more information about mains voltage

Infinetely variable working air inlet sliding valve

# Compact Muffle Furnaces LE 2/11 - LE 14/11


LE 4/11

LE 6/11

**LE 2/11 - LE 14/11**

With their unbeatable price/performance ratio, these compact muffle furnaces are perfect for many applications in the laboratory. Quality features like the double-walled furnace casing of rust-free stainless steel, their compact, lightweight constructions, or the heating elements encased in quartz glass tubes make these models reliable partners for your application.

- Tmax 1100 °C, working temperature 1050 °C
- Heating from two sides from heating elements in quartz glass tubes
- Maintenance-friendly replacement of heating elements and insulation
- Multilayered insulation with fibre plates in the furnace chamber
- Casing made of sheets of textured stainless steel (non-rusting design)
- Double-walled casing for low external temperatures and high stability
- Folding door which can also be used as a work platform
- Exhaust air outlet in rear wall
- Low-noise high-power relay
- Compact dimensions and light weight
- Controller mounted in side space (under the door on the LE 2/11 and LE 4/11 to save space)
- Please see page 44 for a description of various controllers

**Additional Equipment**

- Vent, vent with fan or catalytic converter
- Over-temperature limit controller with adjustable cutout temperature for thermal protection class 2 in accordance with EN 60519-2 as temperature limiter to protect the oven and load
- Protective gas connection on the rear wall of furnace
- Manual gas supply system
- Please see page 13 for more optional equipment


Over-temperature limit controller

| Model | Tmax °C | Inner dimensions in mm w | d | h | Volume in L | Outer dimensions in mm W | D | H | Power kW | Electrical connection* | Weight in kg | Minutes to Tmax |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LE 2/11 | 1100 | 110 | 180 | 110 | 2 | 275 | 380 | 350 | 1,8 | single-phase | 10 | 25 |
| LE 4/11 | 1100 | 170 | 200 | 170 | 4 | 335 | 400 | 410 | 1,8 | single-phase | 15 | 35 |
| LE 6/11 | 1100 | 170 | 200 | 170 | 6 | 510 | 400 | 320 | 1,8 | single-phase | 18 | 35 |
| LE 14/11 | 1100 | 220 | 300 | 220 | 14 | 555 | 500 | 370 | 2,9 | single-phase | 25 | 40 |

*Please see page 44 for more information about mains voltage

# Muffle Furnaces L 3/13 - LT 15/13 with Brick Insulation and Flap Door or Lift Door

LT 15/13

LT 9/13

## L 3/13 - LT 15/13

Heating elements embedded in grooves radiating freely into the furnace chamber give these models particularly short heating times. Thanks to their robust lightweight refractory brick insulation, they can reach a maximum working temperature of 1300 °C. These models thus represent an interesting alternative to the familiar L(T) 3/11 models, when you need particularly short heating times or a higher application temperature.

- Tmax 1300 °C
- Heating elements freely radiating, embedded in grooves for high heating speeds
- Multilayer insulation with robust lightweight refractory bricks in the furnace chamber
- Casing made of sheets of textured stainless steel (non-rusting design)
- Double-walled casing for low external temperatures and stability
- Optional fold-down door (L) which can be used as work platform or lift door (LT) with hot surface facing away from the operator
- Adjustable air inlet in the furnace door
- Exhaust air outlet in rear wall of furnace
- Silent solid-state power control relay
- Please see page 44 for a description of various controllers

## Additional Equipment

- Vent, vent with fan or catalytic converter
- Over-temperature limit controller with adjustable cutout temperature for thermal protection class 2 in accordance with EN 60519-2 as temperature limiter to protect the oven and load
- Protective gas connection on the rear wall of furnace
- Manual or automatic gas supply system
- Please see page 13 for more optional equipment

Furnace interior with high-quality lightweight refractory brick insulation

Over-temperature limit controller

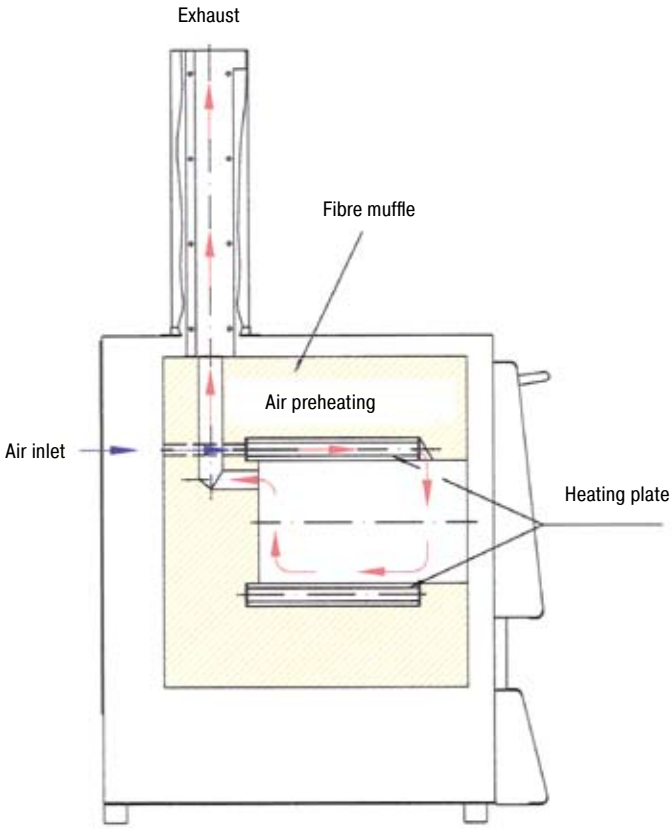
| Model fold. door | Tmax °C | Inner dimensions in mm w | d | h | Volume in L | Outer dimensions in mm W | D | H | Power kW | Electrical connection* | Weight in kg | Minutes to Tmax |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| L 3/13 | 1300 | 160 | 140 | 100 | 3 | 380 | 370 | 420 | 1,6 | single-phase | 25 | 45 |
| L 5/13 | 1300 | 200 | 170 | 130 | 5 | 440 | 470 | 520 | 2,4 | single-phase | 42 | 45 |
| L 9/13 | 1300 | 230 | 240 | 170 | 9 | 480 | 550 | 570 | 3,0 | single-phase | 60 | 50 |
| L 15/13 | 1300 | 230 | 340 | 170 | 15 | 480 | 650 | 570 | 3,6 | single-phase | 70 | 60 |

| Model Lift door | Tmax °C | Inner dimensions in mm w | d | h | Volume in L | Outer dimensions in mm W | D | H[1] | Power kW | Electrical connection* | Weight in kg | Minutes to Tmax |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LT 3/13 | 1300 | 160 | 140 | 100 | 3 | 380 | 370 | 420+165 | 1,6 | single-phase | 25 | 45 |
| LT 5/13 | 1300 | 200 | 170 | 130 | 5 | 440 | 470 | 520+220 | 2,4 | single-phase | 42 | 45 |
| LT 9/13 | 1300 | 230 | 240 | 170 | 9 | 480 | 550 | 570+290 | 3,0 | single-phase | 60 | 50 |
| LT 15/13 | 1300 | 230 | 340 | 170 | 15 | 480 | 650 | 570+290 | 3,6 | single-phase | 70 | 60 |

[1]Including opened lift door

*Please see page 44 for more information about mains voltage

# Ashing Furnaces LV 3/11 - LVT 15/11 with Flap Door or Lift Door




**Air intake and exhaust flow principle**

**LV 3/11**

**LV 3/11 - LVT 15/11**

The models LV 3/11 - LVT 15/11 are especially designed for ashing in the laboratory. A special air intake and exhaust system allows air exchange of more than 6 times per minute. Incoming air is preheated to ensure a good temperature uniformity.

- Tmax 1100 °C
- Ceramic heating plates with integral heating element which is safeguarded against fumes and splashing, and easy to replace
- Highly durable, high-performance cured vacuum fibre module lining
- Casing made of sheets of textured stainless steel (non-rusting design)
- Double-walled casing for low external temperatures and stability
- Optional fold-down door (L) which can be used as work platform or lift door (LT) with hot surface facing away from the operator
- Silent solid-state power control relay
- Air exchanged more than 6 times per minute
- Good temperature uniformity due to preheating of incoming air
- Please see page 44 for a description of the different controllers


LVT 9/11


LVT 15/11

**Additional Equipment**

- Over-temperature limit controller with adjustable cutout temperature for thermal protection class 2 in accordance with EN 60519-2 as temperature limiter to protect the oven and load
- Please see page 13 for more optional equipment

Over-temperature limit controller

| Model fold. door | Tmax °C | Inner dimensions in mm w | d | h | Volume in L | Outer dimensions in mm W | D | H[1] | Supply kW | Electrical connection* | Weight in kg | Minutes to Tmax |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LV 3/11 | 1100 | 160 | 140 | 100 | 3 | 380 | 370 | 750 | 1,2 | single-phase | 20 | 120 |
| LV 5/11 | 1100 | 200 | 170 | 130 | 5 | 440 | 470 | 850 | 2,4 | single-phase | 35 | 120 |
| LV 9/11 | 1100 | 230 | 240 | 170 | 9 | 480 | 550 | 900 | 3,0 | single-phase | 45 | 120 |
| LV 15/11 | 1100 | 230 | 340 | 170 | 15 | 480 | 650 | 900 | 3,6 | single-phase | 55 | 120 |

| Model Lift door | Tmax °C | Inner dimensions in mm w | d | h | Volume in L | Outer dimensions in mm W | D | H[1] | Power kW | Electrical connection* | Weight in kg | Minutes to Tmax |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LVT 3/11 | 1100 | 160 | 140 | 100 | 3 | 380 | 370 | 750 | 1,2 | single-phase | 20 | 120 |
| LVT 5/11 | 1100 | 200 | 170 | 130 | 5 | 440 | 470 | 850 | 2,4 | single-phase | 35 | 120 |
| LVT 9/11 | 1100 | 230 | 240 | 170 | 9 | 480 | 550 | 900 | 3,0 | single-phase | 45 | 120 |
| LVT15/11 | 1100 | 230 | 340 | 170 | 15 | 480 | 650 | 900 | 3,6 | single-phase | 55 | 120 |

[1]Including exhaust tube (Ø 80 mm)

*Please see page 44 for more information on mains voltage

# Muffle Furnaces L 9/11/SKM with embedded Heating Elements in the Ceramic Muffle

L 9/11/SKM

Muffle heated from four sides

Gas supply panel for nonflammable protective gas with shutoff valve and flow meter with regulator valve, piped and ready to connect


Over-temperature limit controller

**L 9/11/SKM**

We particularly recommend the L 9/11/SKM model if your application involves aggressive substances. The furnace has a ceramic muffle with embedded heating from four sides. The furnace thus combines a very good temperature uniformity with excellent protection of the heating elements from aggressive atmospheres. Another aspect is the smooth, nearly dust-free muffle (furnace door made of fibre insulation), an important quality feature for some ashing processes.

- Tmax 1100 °C
- Muffle heated from four sides
- Furnace chamber with embedded ceramic muffle, high resistance to aggressive gasses and vapours
- Casing made of sheets of textured stainless steel (non-rusting design)
- Adjustable working air inlet in the door
- Exhaust air outlet in rear wall of furnace
- Silent solid-state power control relay
- Please see page 44 for a description of the different controllers

**Additional Equipment**

- Vent, vent with fan or catalytic converter
- Over-temperature limit controller with adjustable cutout temperature for thermal protection class 2 in accordance with EN 60519-2 as temperature limiter to protect the oven and load
- Protective gas connection on the rear wall of furnace
- Manual or automation gas supply system
- Please see page 13 for more optional equipment

| Model | Tmax °C | Inner dimensions in mm w | d | h | Volume in L | Outer dimensions in mm W | D | H | Power kW | Electrical connection* | Weight in kg | Minutes to Tmax |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| L 9/11/SKM | 1100 | 230 | 240 | 170 | 9 | 480 | 550 | 570 | 3,0 | single-phase | 50 | 90 |

*Please see page 44 for more information about mains voltage

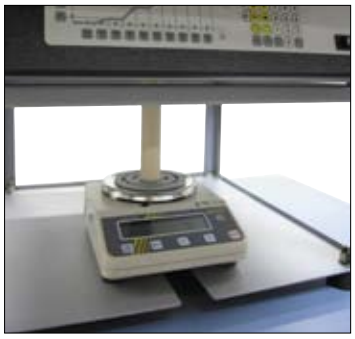
# Furnace Systems with Scale and Software for Determination of Combustion Loss

L 9/11/SW

**L 9/11/SW - LT 9/12/SW**

This complete system, with an furnace, integrated precision scale, and software, was designed especially for combustion loss determination in the laboratory. The determination of combustion loss is necessary, for instance, when analyzing sludges and household garbage, and is also used in a variety of technical processes for the evaluation of results. The difference between the initial total mass and the combustion residue is the combustion loss. During the process, the software included records both the temperature and the weight loss.

- Tmax 1100 °C or 1200 °C
- Ceramic heating plates with integral heating element which is safeguarded against fumes and splashing, and easy to replace
- Highly durable cured vacuum fibre module lining
- Casing made of sheets of structured stainless steel (non-rusting design)
- Adjustable working air inlet in the door
- Exhaust air outlet in rear wall of furnace
- Silent solid-state power control relay
- Delivery includes base, ceramic plunger with base plate in the furnace interior, precision scale and software package
- 3 scales available for different maximum weights and scaling ranges
- Software for documentation of the temperature curve and combustion loss using a PC
- Please see page 44 for a desciption of the different controllers



3 scales available for different maximum weights and scaling areas

**Additional Equipment**

- Vent, vent with fan or catalytic converter
- Over-temperature limit controller with adjustable cutout temperature for thermal protection class 2 in accordance with EN 60519-2 as temperature limiter to protect the oven and load
- Please see page 13 for more optional equipment

Over-temperature limit controller

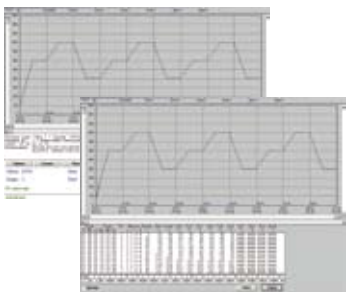
| Model fold. door | Tmax °C | Inner dimensions in mm w | d | h | Volume in L | Outer dimensions in mm W | D | H | Power kW | Electrical connection* | Weight in kg | Minutes to Tmax |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| L 9/11/SW | 1100 | 230 | 240 | 170 | 9 | 480 | 550 | 800 | 3,0 | single-phase | 55 | 75 |
| L 9/12/SW | 1200 | 230 | 240 | 170 | 9 | 480 | 550 | 800 | 3,0 | single-phase | 55 | 90 |

| Model Lift door | Tmax °C | Inner dimensions in mm w | d | h | Volume in L | Outer dimensions in mm W | D | H[1] | Power kW | Electrical connection* | Weight in kg | Minutes to Tmax |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LT 9/11/SW | 1100 | 230 | 240 | 170 | 9 | 480 | 550 | 800+290 | 3,0 | single-phase | 55 | 75 |
| LT 9/12/SW | 1200 | 230 | 240 | 170 | 9 | 480 | 550 | 800+290 | 3,0 | single-phase | 55 | 90 |

[1]Including opened lift door

*Please see page 44 for more information about mains voltage

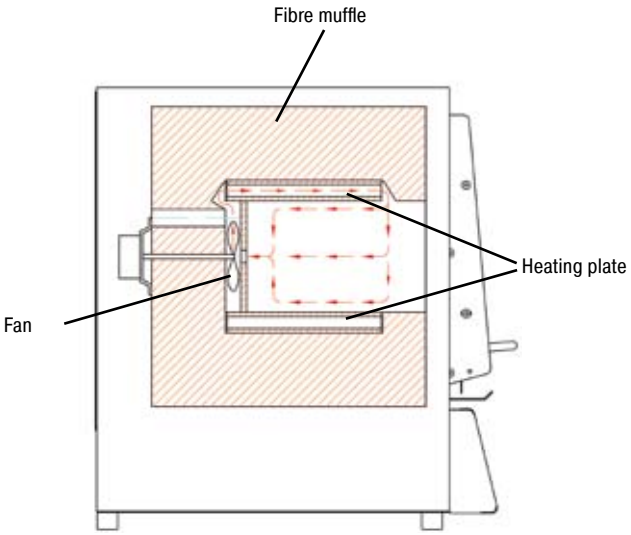
| Scale type | Readability in g | Weight range in g | Weight of plunger in g | Calibration value in g | Minimum load in g |
|---|---|---|---|---|---|
| EW-1500 | 0,01 | 1500 incl. plunger | 850 | 0,1 | 0,5 |
| EW-3000 | 0,01 | 3000 incl. plunger | 850 | 0,1 | 0,5 |
| EW-6000 | 0,10 | 6000 incl. plunger | 850 | 1,0 | 5,0 |



Software for documentation of the temperature curve and combustion loss using a PC

# Muffle Furnaces LT 5/11 HA - LT 15/11 HA with integrated Air Circulation


**LT 5/11HA** with air circulation




**LT 15/11 HA - LT 15/11 HA**

The LT 5/11HA - LT 15/11HA muffle ovens with integrated air circulation provide an optimum temperature uniformity in the furnace chamber and heat transmission to your batch. This advantageous effect not only increases the precision of the results of your work, it is also a true quality factor, particularly when you need good uniformity in the lower temperature range.

Ventilator in rear wall of furnace

- Tmax 1100 °C
- Ceramic heating plates with integral heating element which is safeguarded against splashing, and easy to replace
- Highly durable cured vacuum fibre module lining
- Casing made of sheets of textured stainless steel (non-rusting design)
- Double-walled casing for low external temperatures and stability
- With lift door (LT), whereby the hot side is away from the operator
- Exhaust air outlet in rear wall of furnace
- Silent solid-state power control relay
- Circulation fans for better heat transmission and distribution, particularly during heating and cooling
- Please see page 44 for a description of the different controllers

**Additional Equipment**


Over-temperature limit controller

- Vent, vent with fan or catalytic converter
- Over-temperature limit controller with adjustable cutout temperature for thermal protection class 2 in accordance with EN 60519-2 as temperature limiter to protect the oven and load
- Protective gas connection on the rear wall of furnace
- Please see page 13 for more optional equipment

| Model | Tmax °C | Inner dimensions in mm w | d | h | Volume in L | Outer dimensions in mm W | D | H[1] | Power kW | Electrical connection* | Weight in kg | Minutes to Tmax |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LT 5/11HA | 1100 | 200 | 160 | 130 | 5 | 440 | 470 | 520+220 | 2,4 | single-phase | 36 | 60 |
| LT 9/11HA | 1100 | 230 | 230 | 170 | 9 | 480 | 550 | 570+290 | 3,0 | single-phase | 46 | 60 |
| LT 15/11HA | 1100 | 230 | 330 | 170 | 15 | 480 | 650 | 570+290 | 3,6 | single-phase | 56 | 75 |

[1]Including opened lift door

*Please see page 44 for more information about mains voltage

# Muffle Furnace Accessories

**Vent** for connection to an exhaust pipe.

Article No.: 631000140

**Vent with fan**, to remove exhaust gas from the furnace better. The P 320 controller can be used to control the vent automatically.

Article No.: 631000141

**Catalytic converter with fan** for removal of organic components from the exhaust air. Organic components are catalytically oxidized at about 600 °C, broken into carbon dioxide and water vapour. Irritating odors are thus largely eliminated. The P 320 controller can be used to switch the catalytic converter automatically.

Article No.: 631000166

Select between different **base plates** and **collecting pans** for protection of the furnace and easy loading (for models L, LT, LE, LV and LVT on pages 4 - 12).

**Ceramic ribbed plate**

| for models | Articel No. |
|---|---|
| LE 2 | 691601097 |
| L 3, LT 3, LV, LVT 3 | 691600507 |
| LE 4, LE 6, L 5, LT 5, LV 5, LVT 5 | 691600508 |
| L 9, LT 9, LV 9, LVT 9 | 691600509 |
| LE 14 | 691601098 |
| L 15, LT 15, LV 15, LVT 15 | 691600506 |
| L 24, LT 24 | 691600874 |
| L 40, LT 24 | 691600875 |

**Ceramic collecting pan**

| for models | Articel No. |
|---|---|
| LE 2 | 691601099 |
| L 3, LT 3, LV 3, LVT 3 | 691600510 |
| LE 4, LE 6, L 5, LT 5, LV 5, LVT 5 | 691600511 |
| L 9, LT 9, LV 9, LVT 9 | 691600512 |

**Steel collecting pan**

| for models | Articel No. |
|---|---|
| LE 2 | 691402096 |
| L 3, LT 3, LV 3, LVT 3 | 691400145 |
| LE 4, LE 6, L 5, LT 5, LV 5, LVT 5 | 691400146 |
| L 9, LT 9, LV 9, LVT 9 | 691400147 |
| LE 14 | 691402097 |
| L 15, LT 15, LV 15, LVT 15 | 691400149 |
| L 24, LT 24 | 691400626 |
| L 40, LT 40 | 691400627 |

Heat-resistant **gloves** for protection of the operator when loading or removing hot materials, resistant to 600 °C or 900 °C.

**Gloves, Tmax 600 °C**

Article No.: 493000004

**Gloves, Tmax 900 °C**

Article No.: 491041101

Various **tongs** for easy loading and unloading of the furnace

Article No.: 493000002 (300 mm)
493000003 (500 mm)

# Annealing and Hardening Furnaces N 7/H - N 61/H

**N 7/H** as table-top model

**N 41/H**

**N 7/H - N 61/H**

To withstand harsh use in the laboratory, e.g. when heat-treating metals, robust insulation with light refractory bricks is necessary. The N 7/H - N 61/H models are a perfect fit to solve this problem. The furnaces can be extended with a variety of accessories, like annealing boxes for operation under protective gas, roller guides, or a cooling station with a quenching bath. Even high-performance applications like the annealing of titanium in medical applications can be implemented without the use of expensive and complicated annealing systems.

Working with protective gas boxes for a protective gas atmosphere using a loading carriage

- Tmax 1280 °C
- Three-sided heating from both sides and the floor
- Heating elements embedded in protective grooves
- Floor heating protected by heat-resistant SiC plate
- Multilayer insulation with high-quality lightweight refractory bricks in the furnace chamber
- Exhaust opening in the side of the furnace, or on back wall of furnace in the N 31/H models and higher
- Models N 7/H - N 17/HR are designed as tabletop models
- Stand included with model N 31/H and up
- Parallel swinging door which opens downward, or upward upon request
- Manual or automatic gassing system
- Please see page 44 for a description of various controllers

| Model | Tmax °C | Inner dimensions in mm w | d | h | Volume in L | Outer dimensions in mm W | D | H | Power kW | Electrical connection* | Weight in kg | Minutes to Tmax |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| N 7/H | 1280 | 250 | 250 | 120 | 7 | 720 | 640 | 510 | 3,0 | single-phase | 60 | 180 |
| N 11/H | 1280 | 250 | 350 | 140 | 11 | 720 | 740 | 510 | 3,6 | single-phase | 70 | 180 |
| N 11/HR | 1280 | 250 | 350 | 140 | 11 | 720 | 740 | 510 | 5,5 | 3-phase[1] | 70 | 120 |
| N 17/HR | 1280 | 250 | 500 | 140 | 17 | 720 | 890 | 510 | 6,4 | 3-phase[1] | 90 | 120 |
| N 31/H | 1280 | 350 | 350 | 250 | 31 | 840 | 1010 | 1320 | 15,0 | 3-phase | 210 | 105 |
| N 41/H | 1280 | 350 | 500 | 250 | 41 | 840 | 1160 | 1320 | 15,0 | 3-phase | 260 | 120 |
| N 61/H | 1280 | 350 | 750 | 250 | 61 | 840 | 1410 | 1320 | 20,0 | 3-phase | 400 | 120 |

[1]Heating only between two phases

*Please see page 44 for information on mains voltage

# Hardening Accessories

Our wide selection of annealing and hardening furnaces can be extended with a variety of hardening accessories to suit your application. The accessories shown below represent only a small fraction of the products available. For further details, please see our separate catalogues for heat-treatment furnaces and hardening accessories.

### Hardening and Annealing Boxes

- Hardening and annealing boxes with or without protective gas connectors, up to 1100 °C, also in a tailor-made variant for cold evacuation, for instance for the annealing of small parts and bulk goods

### Annealing Tray with Holder

- Annealing tram with alloy bag and holder with protective gas connection for models N 7/H to N 61/H for annealing and hardening under protective gas and quenching in air

### Hearth Plates

- Hearth plates for up to 1100 °C for protection of the furnace floor for models N 7/H to N 61/H, edged on three sides

### Hardening Tongs

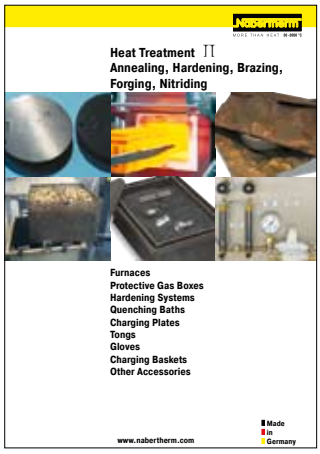
- Hardening tongs in various sizes and forms for use in annealing and hardening

### Heat Treating Foil

- Heat treating foil for wrapping of samples for oxidation-free annealing and hardening of steels up to 1200 °C

### Gloves

- Heat-resistant gloves to 600 °C or 900 °C for protection of operator during loading (see page 13)

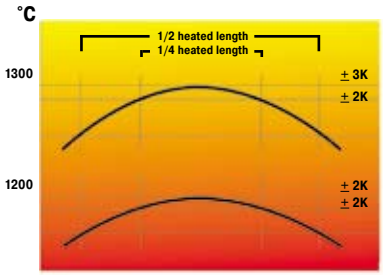




**Please ask for our separate catalogues for hardening furnaces and hardening accessories!**

# Compact Tube Furnaces R


**R 50/250/12** single-zoned


**R 100/750/13** three-zoned




Temperature distribution, single-zoned tube furnaces


Over-temperature limit controller

## R 50/250/12 - R 120/1000/13

These compact tabletop tube furnaces with integrated control systems can be used universally for many processes. Equipped with a standard working tube of C 530 ceramic and two fibre plugs, these furnaces have an unbeatable price/performance ratio.

- Tmax 1200 °C or 1300 °C
- Casing made of textured stainless steel sheets (non-rusting design)
- Outer tube diameter of 50 to 120 mm, heated length from 250 to 1000 mm
- Working tube of C 530 ceramic including two fibre plugs as standard equipment
- Long lasting type S thermocouple
- Silent solid-state power control relays
- Standard working tube see chart on page 27
- Please see page 44 for a description of various controllers

### Additional Equipment

- Over-temperature limit controller with adjustable cutout temperature for thermal protection class 2 in accordance with EN 60519-2 as temperature limiter to protect the oven and load
- Cascade controller for temperature measurement in the working tube and behind the tube
- Working tubes designed for process requirements
- Three-zoned design with HiProSystem control (heated length from 750 mm, for 1300 °C models)
- Alternative working tubes see chart on page 27
- Please see page 24 for optional equipment

| Model | Tmax °C | Outer dimensions in mm W | D | H | Outer tube Ø /mm | Heated length mm | Length constant temperature ΔT 10K | Tube length in mm | Power kW | Electrical connection* | Weight in kg |
|---|---|---|---|---|---|---|---|---|---|---|---|
| R 50/250/12 | 1200 | 400 | 240 | 490 | 50 | 250 | 80 | 450 | 1,2 | single-phase | 20 |
| R 50/500/12 | 1200 | 650 | 240 | 490 | 50 | 500 | 170 | 700 | 1,8 | single-phase | 25 |
| R 100/750/12 | 1200 | 1000 | 360 | 640 | 90 | 750 | 250 | 1070 | 3,6 | single-phase | 80 |
| R 120/1000/12 | 1200 | 1300 | 420 | 730 | 120 | 1000 | 330 | 1400 | 6,0 | 3-phase[2] | 170 |
| R 50/250/13 | 1300 | 400 | 240 | 490 | 50 | 250 | 80 | 450 | 1,3 | single-phase | 35 |
| R 50/500/13 | 1300 | 650 | 240 | 490 | 50 | 500 | 170 | 700 | 1,9 | single-phase | 48 |
| R 100/750/13[1] | 1300 | 1000 | 360 | 640 | 90 | 750 | 250 | 1070 | 4,4 | 3-phase[2] | 120 |
| R 120/1000/13[1] | 1300 | 1300 | 420 | 730 | 120 | 1000 | 330 | 1400 | 6,5 | 3-phase[2] | 230 |

[1]These models also available with 3 zones
[2]Heating only between two phases
*Please see page 44 for information about mains voltage

# Universal Tube Furnaces RT with Stand for horizontal or vertical Operation

RT 50-250/11

RT 50-250/13

**RT 50-250/11 - RT 30-200/15**

These compact tube furnaces are used when laboratory experiments must be performed horizontally, vertically, or at specific angles. The ability to configure the angle of tilt and the working height, and their compact design, also make these furnaces suitable for integration into existing process systems.

- Tmax 1100 °C, 1300 °C, or 1500 °C
- Compact design
- Vertical or horizontal operation freely adjustable
- Working height freely adjustable
- Working tube made of C 530 ceramic
- Long lasting type S thermocouple
- Operation also possible separate from stand if safety guidelines are observed
- Control system built into furnace base
- Please see page 24 for optional equipment
- Please see page 44 for a description of various controllers

| Model | Tmax °C | Outer dimensions in mm W | D | H | Inner tube Ø /mm | Heated length mm | Length constant temperature ΔT 10K | Tube length in mm | Power kW | Electrical connection* | Weight in kg |
|---|---|---|---|---|---|---|---|---|---|---|---|
| RT 50-250/11 | 1100 | 350 | 380 | 740 | 50 | 250 | 80 | 360 | 1,8 | single-phase | 25 |
| RT 50-250/13 | 1300 | 350 | 380 | 740 | 50 | 250 | 80 | 360 | 1,8 | single-phase | 25 |
| RT 30-200/15 | 1500 | 445 | 475 | 740 | 30 | 200 | 70 | 360 | 1,8 | single-phase | 45 |

*Please see page 44 for more information about mains voltage

# Hinged Tube Furnaces RS for horizontal or vertical Operation up to 1300 °C, Gas Atmosphere or Vacuum

**RS 80/300/11** for horizontal operation

**RS 80/300/11** with stand as additional equipment for vertical operation

Gas supply panel for nonflammable protective gas with shutoff valve and flow meter with regulator valve, piped and ready to connect

**RS 80/300/11 - RS 170/1000/13**

The RS tube furnaces can be used for either horizontal or vertical operation. Using a variety of accessories, these professional tube furnaces can be optimally laid out for your process. By using different available gas supply packages, operations can be performed under a protective gas atmosphere, vacuum, or even with flammable gasses.

- Tmax 1100 °C or 1300 °C
- Casing made of sheets of textured stainless steel (non-rusting design)
- Tmax 1100 °C: Type K thermocouple
- Tmax 1300 °C: Wear-free type S thermocouple
- Available in horizontal or vertical designs
- Hinged design for simple insertion of the working tube
- Working tube made of ceramic C 530 for operation in air included in scope of delivery
- Switching and control unit separate from furnace in own wall or standing cabinet
- Standard working tube see chart on page 27
- Please see page 44 for a description of various controllers

| Model | Tmax °C | Exterior dimensions[3] in mm W[2] | D | H | Outer tube Ø /mm | Heated length mm | Length constant temperature ΔT 10K | Tube length in mm | Power kW | Electrical connection* | Weight in kg |
|---|---|---|---|---|---|---|---|---|---|---|---|
| RS 80/300/11 | 1100 | 555 | 475 | 390 | 80 | 300 | 100 | 650 | 1,8 | single-phase | 80 |
| RS 80/500/11 | 1100 | 755 | 475 | 390 | 80 | 500 | 170 | 850 | 3,4 | single-phase | 90 |
| RS 80/750/11 | 1100 | 1005 | 475 | 390 | 80 | 750 | 250 | 1100 | 4,6 | 3-phase[4] | 105 |
| RS 120/500/11 | 1100 | 755 | 525 | 440 | 120 | 500 | 170 | 850 | 4,8 | 3-phase[4] | 95 |
| RS 120/750/11 | 1100 | 1005 | 525 | 440 | 120 | 750 | 250 | 1100 | 6,3 | 3-phase[1] | 110 |
| RS 120/1000/11 | 1100 | 1255 | 525 | 440 | 120 | 1000 | 330 | 1350 | 9,0 | 3-phase[1] | 125 |
| RS 170/750/11 | 1100 | 1005 | 575 | 490 | 170 | 750 | 250 | 1100 | 11,5 | 3-phase[1] | 115 |
| RS 170/1000/11 | 1100 | 1255 | 575 | 490 | 170 | 1000 | 330 | 1350 | 11,5 | 3-phase[1] | 130 |
| RS 80/300/13 | 1300 | 555 | 475 | 390 | 80 | 300 | 100 | 650 | 3,6 | single-phase | 80 |
| RS 80/500/13 | 1300 | 755 | 475 | 390 | 80 | 500 | 170 | 850 | 6,0 | 3-phase[1] | 90 |
| RS 80/750/13 | 1300 | 1005 | 475 | 390 | 80 | 750 | 250 | 1100 | 9,3 | 3-phase[1] | 105 |
| RS 120/500/13 | 1300 | 755 | 525 | 440 | 120 | 500 | 170 | 850 | 7,8 | 3-phase[1] | 95 |
| RS 120/750/13 | 1300 | 1005 | 525 | 440 | 120 | 750 | 250 | 1100 | 12,6 | 3-phase[1] | 110 |
| RS 120/1000/13 | 1300 | 1255 | 525 | 440 | 120 | 1000 | 330 | 1350 | 12,6 | 3-phase[1] | 125 |
| RS 170/750/13 | 1300 | 1005 | 575 | 490 | 170 | 750 | 250 | 1100 | 12,6 | 3-phase[1] | 115 |
| RS 170/1000/13 | 1300 | 1255 | 575 | 490 | 170 | 1000 | 330 | 1350 | 12,6 | 3-phase[1] | 130 |

[1]Heating only between two phases

[2]Without tube

[3]Exterior dimensions for vertical operation upon request

[4]Heating only on one phase

*Please see page 44 for more information about mains voltage

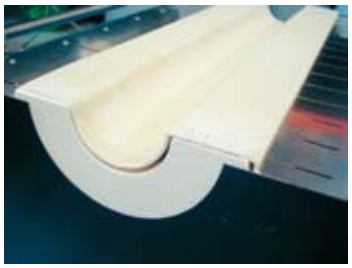

**RS ../13** hinged tubed furnace with special tube of quartz glass and flanges for protective gas operation

The RS tube furnace line can be custom-fit to your needs with a variety of extras. Starting with various working tubes of different materials to protective gas or vacuum operation. For optimum temperature distribution, all RS furnaces are also available as three-zone tube furnaces with modern PLC controls. The heat loss at the ends of the tube is compensated using this three-zoned control, and a longer uniform zone is the result. An overview of the complete line of accessories can be found starting on page 24.

Quartz glass and flanges for protective gas operation as optional equipment

**Additional Equipment**

- Cascade controller with temperature measurement in the working tube and in the oven chamber behind the tube
- Working tubes designed for process requirements
- Different gas supply packages (starting on page 24) for protective gas and vacuum operation
- 3-zone control for optimization of temperature distribution
- Burst protector for heating elements and/or as support surface for the load
- Stand for vertical operation
- Alternative working tubes see chart on page 27
- Please see page 24 for more optional equipment



Burst protectior for heating elements and/or as support surface for the load

Switching and control unit separate from furnace

# Rotary Tube Furnaces RSR

**RSR 80-500/11** with built-in reactor

Gas outlet with gas cooler

**RSR 80-500/11 - RSR 120-750/11**

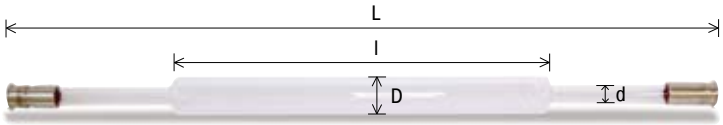
When the retention of the granular characteristics of the material is important, e.g. when drying or calcining, this rotary tube furnace is the optimum solution. The continuous rotary operation of the furnace tube and the option of operating it under protective gas lead to excellent results.

- Design like RS models, see page 18
- Tmax 1100 °C
- Type K thermocouple
- Compact unit, designed as tabletop model
- Optionally supplied with quartz glass process reactor or quartz glass tube
- Easy working tube or process reactor removal through beltless drive and hinged casing
- Infinitely variable drive (approx. 1-20 rpm)
- Good flooding of load with process gas due to inlet on one side and outlet on other side of tube
- For a description of various controllers, see page 44

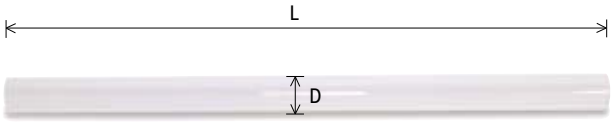
Rotary tube drive

**Additional Equipment**

- Gas-tight rotary feedthrough for connection to gas supply systems (suitable for operation in rough vacuum) upon request
- Tilting device
- Gas supply systems with gas cooler at the outlet
- Three-zone control




Quartz glass reactor with flange KF 40 according to DIN 28403




Quartz glass tube for through-put operation in combination with tilting device

| Model | Tmax °C | Outer dimensions in mm W[2] | D | H | Length constant Temperature ΔT 10K | Tube dimensions in mm L | l | D | d | Supply power/kW | Electrical connection* | Weight in kg |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| RSR 80-500/11 | 1100 | 1075 | 475 | 390 | 170 | 1140 | 500 | 76 | 34 | 3,4 | single-phase | 100 |
| RSR 80-750/11 | 1100 | 1325 | 475 | 390 | 250 | 1390 | 750 | 76 | 34 | 4,6 | 3-phase[1] | 115 |
| RSR 120-500/11 | 1100 | 1075 | 525 | 440 | 170 | 1140 | 500 | 106 | 34 | 4,8 | 3-phase[1] | 105 |
| RSR 120-750/11 | 1100 | 1325 | 525 | 440 | 250 | 1390 | 750 | 106 | 34 | 6,3 | 3-phase | 120 |

[1]Only heating between two phases

[2]Without tube

*Please see page 44 for information on mains voltage

# Universal High-Temperature Tube Furnaces RHTC with Silicon Carbide Rod Heating, Gas Atmosphere or Vacuum


**RHTC 80-230**

**RHTC 80-230 - RHTC 80-710**

These compact tube furnaces with SiC rod heating and integrated control systems can be used universally for many processes. With an easy to replace working tube as well as additional standard equipment options, these furnaces are flexible and can be used for a wide range of applications. The high-quality fiber insulation ensures fast heating and cooling times. The SiC heating rods installed parallel to the working tube ensure excellent temperature distribution. The price-performance ratio for this temperature range is unbeatable.

- Tmax 1500 °C
- Textured stainless steel sheet casing (non-rusting)
- High-quality fiber insulation
- Active cooling of casing for low surface temperatures
- Type S thermocouple with no wear & tear
- Silent semiconductor relay
- Prepared for assembly of working tubes with water-cooled flanges
- Ceramic tube, C 799 quality
- Standard working tube see chart on page 27
- For a description of various controllers, see page 44

SiC rod heating

**Additional Equipment**

- Over-temperature limit controller with adjustable cutout temperature for thermal protection class 2 in accordance with EN 60519-2 as temperature limiter to protect furnace and load
- Fiber plugs
- Working tubes for operation with water-cooled flanges
- Gas panel for non-combustible gases
- Alternative working tubes see chart on page 27
- Controlled switch-on/switch-off of gas supply (for controller P 320 only)

| Model | Tmax °C | Outer dimensions in mm W | D | H | Outer tube Ø /mm | Heated length/mm | Length constant temperature ΔT 10K | Tube length in mm | Supply power/kW | Electrical connection* | Weight in kg |
|---|---|---|---|---|---|---|---|---|---|---|---|
| RHTC 80-230 | 1500 | 600 | 430 | 580 | 80 | 230 | 75 | 480 | 6,3 | 3-phase[2] | 50 |
| RHTC 80-450 | 1500 | 820 | 430 | 580 | 80 | 450 | 150 | 630 | 9,5 | 3-phase[1] | 70 |
| RHTC 80-710 | 1500 | 1070 | 430 | 580 | 80 | 710 | 235 | 1070 | 11,7 | 3-phase[1] | 90 |

[1]Heating only between two phases
[2]Heating only on one phase

*See page 44 for information on supply voltage

# High-temperature Tube Furnaces RHTH for horizontal Operation and RHTV for vertical Operation up to 1800 °C, Gas Atmosphere or Vacuum


Horizontal tube furnace **RHTH 70/300/16** with vacuum flanges as optional equipment

**RHTH 120/150/.. - RHTH 120/600/.., RHTV 120/150/.. - RHTV 120/600/..**

The high-temperature tube furnaces are available in either horizontal (type RHTH) or vertical (type RHTV) designs. High-quality insulation materials made of vacuum-formed fibre plates enable energy-saving operation and a fast heating time due to low heat storage and heat conductivity. By using different gas supply systems, operations can be performed under a protective gas atmosphere, vacuum, or even with flammable gasses.

Gas supply panel for nonflammable protective gas with shutoff valve and flow meter with regulator valve, piped and ready to connect

- Tmax 1600 °C, 1700 °C, or 1800 °C
- $MoSi_2$ heating elements, mounted vertically for easy replacement
- Insulation with vacuum-formed ceramic fibre plates
- Rectangular outer casing with slots for convection cooling
- Casing made of sheets of textured stainless steel (non-rusting design)
- Ceramic working tube including fibre plugs for operation in air, included in delivery
- Type B thermocouple
- Power unit with low-voltage transformer and thyristor controller
- Switching and control unit separate from furnace in own wall or standing cabinet
- Please see page 44 for a description of various controllers

**Additional Equipment**

- Over-temperature limit controller with adjustable cutout temperature for thermal protection class 2 in accordance with EN 60519-2 as temperature limiter to protect the oven and load
- Cascade controller with temperature measurement in the working tube and in the oven chamber behind the tube
- Working tubes designed for process requirements
- Gas-tight flanges for protective gas and vacuum operation
- Manual or automatic gas supply system
- 3-zone control for optimization of temperature distribution
- Stand for vertical operation
- Please see page 24 for more optional equipment


Over-temperature limit controller

**RHTV 120-300/17** vertical tube furnace with stand as optional equipment

Choice of various working tubes

Vacuum pump stand for operation up to $10^{-5}$ mbar (see pages 24 and following)

**RHTH 80-1000/16-5** with 5-zone temperature control, used as gradiant furnace

| Model Horizontal design | Tmax °C | Outer dimensions in mm W | D | H | Outer tube Ø /mm | Heated length mm | Length constant temperature ΔT 10K | Tube length in mm | Power kW | Electrical connection* | Weight in kg |
|---|---|---|---|---|---|---|---|---|---|---|---|
| RHTH 120/150/.. | 1600 or | 470 | 550 | 640 | 120 | 150 | 50 | 470 | 3,8 | 3-phase[1] | 70 |
| RHTH 120/300/.. | 1700 or | 620 | 550 | 640 | 120 | 300 | 100 | 620 | 8,3 | 3-phase[1] | 90 |
| RHTH 120/600/.. | 1800 | 920 | 550 | 640 | 120 | 600 | 200 | 920 | 10,8 | 3-phase[1] | 110 |

| Model Vertical design | Tmax °C | Outer dimensions in mm W | D | H[2] | Outer tube Ø /mm | Heated length mm | Length constant temperature ΔT 10K | Tube length in mm | Power kW | Electrical connection* | Weight in kg |
|---|---|---|---|---|---|---|---|---|---|---|---|
| RHTV 120/150/.. | 1600 or | 580 | 580 | 480 | 120 | 150 | 30 | 480 | 5,4 | 3-phase[1] | 70 |
| RHTV 120/300/.. | 1700 or | 580 | 580 | 630 | 120 | 300 | 80 | 630 | 7,1 | 3-phase[1] | 90 |
| RHTV 120/600/.. | 1800 | 580 | 580 | 880 | 120 | 600 | 170 | 880 | 12,6 | 3-phase[1] | 110 |

[1]Heating only between two phases
[2]Without tube

*Please see page 44 for information on mains voltage

# Gas Supply Systems/Vacuum Operation for Tube Furnaces RS, RHTC, RHTH and RHTV

When equipped with various equipment packages, the tube furnace series RS, RHTH, and RHTV can be adapted for operation with nonflammable or flammable gasses or for vacuum operation. The different equipment packages can be delivered together with the furnace, or later as needed.

**Gas supply system 1:**
Fibre plugs with protective gas connection, suitable for many laboratory applications

## **Gas Supply System 1** for simple protective gas applications (no vacuum operation)

This package represents a basic version sufficient for many applications, for operation with nonflammable protective gasses. The standard working tube made of ceramic C 530 delivered with the furnace can still be used.

- Working tube of ceramic C 530 can be used
- 2 plugs of ceramic fibre with protective gas connections
- Gas supply system for nonflammable protective gas (Ar, $N_2$, forming gas) with shutoff valve and flow meter with control valve (volume 50-500 l/hr), piped and ready to connect (gas intake pressure at 300 mbar to be provided by customer)

**Additional Equipment**

- Extension of gas supply system with a second or third nonflammable type of gas
- Bottle pressure regulator for use with bottled gas
- Automatically controlled gas supply with solenoid valves on the gas supply panel, which can be switched on and off through a controller with programmable extra functions (e.g. P 320)

Gas supply panel for nonflammable protective gas with shutoff valve and flow meter with regulator valve, piped and ready to connect

## **Gas Supply System 2** for gas-tight operation with nonflammable gasses/vacuum operation

For increased atmospheric purity requirements in the working tube, we recommend this gas supply system. The standard working tube is replaced by a dense working tube of ceramic C 610 or C 799 in a gas-tight design. Besides the longer working tube, the scope of delivery also includes gas-tight flanges and a corresponding bracket system in the furnace. The system can also be equipped for vacuum operation.

- Longer, gas-tight working tube of ceramic C 610 for furnaces to 1300 °C or of C 799 for temperatures above 1300 °C
- 2 vacuum-tight, water-cooled stainless steel flanges with fittings on the outlet side (cooling water supply with NW9 hose connector to be provided by the customer)
- Mounting system on furnace for the flanges
- Gas supply system for nonflammable protective gas (Ar, $N_2$, forming gas) with shutoff valve and flow meter with control valve (volume 50-500 l/hr), piped and ready to connect (gas intake pressure at 300 mbar to be provided by customer)

**Additional Equipment**

- Extension of gas supply system with a second or third nonflammable type of gas
- Bottle pressure regulator for use with bottled gas
- Automatically controlled gas supply with solenoid valves on the gas supply panel, which can be switched on and off through a controller with programmable extra functions (e.g. P 320)
- Water-cooled end flange with quick connectors
- Cooling unit for closed loop water circuit

**Vacuum Operation**

- Vacuum package for evacuation of the working tube, consisting of a tee for the gas outlet, 2 ball valves, manometer, 1-stage manually operated rotary vane vacuum pump with corrugated stainless steel hose connected to the gas outlet, max. attainable end pressure in working tube about $10^{-3}$ mbar
- Alternative pumps for max. final pressure of up to $10^{-5}$ mbar on request (see page 25)

## **Gas Supply System 3** for gas-tight operation with hydrogen, introduced above 800 °C/vacuum operation

Adding gas supply system 3 to the tube furnace allows operation under a hydrogen atmosphere. The built-in safety system allows the introduction of hydrogen into the working tube, when heated to at least 800 °C. The furnace and control system are designed to provide the highest possible degree of safety for the furnace, operator, and surroundings.

- Longer, gas-tight working tube of ceramic C 630 for furnaces to 1300 °C, or of C 799 for temperatures above 1300 °C
- 2 vacuum-tight, water-cooled stainless steel flanges with fittings on the outlet side with cooling water supply (to be provided by the customer) and NW9 hose connector
- Mounting system on furnace for the flanges
- Safety system for gassing with flammable protective gases starting at 800 °C
- Exhaust gas torch, propane-powered for customer-installed propane gas supply at 30 mbar
- Gas supply system for $H_2$ and $N_2$. The customer provides an $H_2$ supply at 300 mbar and a $N_2$ supply at 10 bar
- $N_2$ emergency purge container
- PLC-controlled regulation with operation via HiProSystem touchscreen, locking procedures, and safety matrix programmed into the software

Tube furnace **RHTH 70/600/18** with gas supply system 4

**Additional Equipment**

- Extension of gas supply system with a second or third nonflammable type of gas
- Bottle pressure regulator for use with bottled gas
- Cooling unit for closed loop water circuit

**Vacuum Operation**

- Vacuum package for pre-evacuation of the working tube, consisting of a tee for the gas outlet, 2 ball valves, manometer, 1-stage manually operated rotary vane vacuum pump with corrugated stainless steel hose connected to the gas outlet, max. attainable end pressure in working tube about $10^{-3}$ mbar
- Vacuum package with adapted pumps for a max. end pressure down to $10^{-5}$ mbar upon request (see below)

Gas-tight design with water-cooled flanges

## **Gas Supply System 4** for gas-tight operation with hydrogen, introduced at room temperature/vacuum operation

Adding gas supply system 4 to the tube furnace allows operation under a hydrogen atmosphere. The built-in safety system allows the introduction of hydrogen into the working tube at room temperature. The furnace and control system are designed to provide the highest possible degree of safety for the furnace, operator, and surroundings.

- Equipment as for gassing package 3, but with extended safety system for operation with hydrogen at room temperature.

## Vacuum Pumps

With respect to the final pressure different pumps are available (see also page 40):

- Single-step rotary piston pump for a max. final pressure of approx. 20 mbar.
- Two-step rotary piston pump for a max. final pressure of approx. $10^{-2}$ mbar.
- Pump system PT70 Dry (rotary vane pump with following turbomolecular pump for a max. final pressure of $10^{-5}$ mbar.

**Information:**

For protection of the vacuum pump only cold stage evacuation is allowed. The reduction of working tube strengthness limits the max. possible working temperature under vacuum (see page 26).

Vacuum pump stand for operation up to $10^{-5}$ mbar

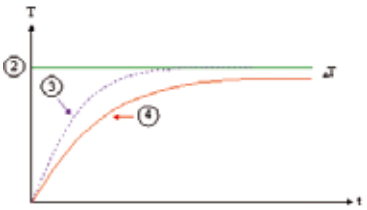
# Control Alternatives and Working Tubes

## Control Alternatives for Tube Furnaces

**Furnace Chamber Control**

with temperature measurement in furnace chamber outside the working tube.

- Advantages: Thermocouple protected against damage and aggressive load, very even control, attractive price
- Disadvantage: Process-dependent temperature difference between displayed temperature on the controller and inside the tube

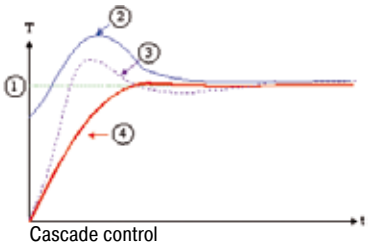


Furnace control

**Charge Control**

with temperature measurement of load in the working tube.

- Advantages: Precise control inside of tube without temperature deviation
- Disadvantages: Slow control with danger of temperature overshoot, control parameters must eventually be adjusted to correspond to the process. At high application temperatures, the over-temperature limit controller can activate to protect the heating elements.



Cascade control

**Cascade Control**

with temperature measurement both in the furnace chamber outside the working tube as well as in the working tube.

- Advantages: Very precise and rapid control adjustment
- Disadvantage: Costs (only available for models with external switchgear panel)

1. Charge setpoint value
2. Furnace setpoint value
3. Actual value furnace chamber
4. Actual value load/bath/muffle/retort

## Furnace Chamber vs. Cascade Controller Comparison

**Furnace Chamber Control**

Only the furnace chamber temperature is measured and controlled. Regulation is carried out slowly to avoid out-of-range values. Because the charge temperature is not measured during this process, the furnace chamber temperature deviates from the charge temperature by several degrees.

**Cascade Control**

If the cascade is switched on, both the charge temperature and furnace chamber temperature are measured. By setting different parameters the heat-up and cooling processes can be individually adapted. This results in a more precise temperature control at the charge.

## Working Tubes


Various working tubes as option

There are various working tubes available, depending on application and temperatures. The technical characteristics of the different working tubes are presented in the following table:

| Material | Tmax in air °C | Tmax in vacuum operation °C | Gas-tight |
|---|---|---|---|
| C 530 (Sillimantin) | 1300 | not possible | no |
| C 610 (Pytagoras) | 1400 | 1200 | yes |
| C 799 (99.7 % $Al_2O_3$) | 1800 | 1400 | yes |
| Quartz glass | 1100 | 950 | yes |
| CrFeAl-Alloy | 1300 | 1100 | yes |

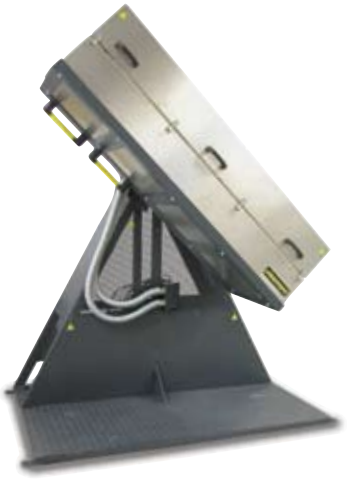
# Available Working Tubes: Standard (✓) and Options (●)

| Working tube outer Ø x inner Ø x length | Article No. | Model | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | R | | | | RS | | | | | | | | | RHTC | | | RHTH | | | RHTV | | |
| | | 50-250 | 50-500 | 100-750 | 120-1000 | 80-300 | 80-500 | 80-750 | 120-500 | 120-750 | 120-1000 | 170-500 | 170-750 | 170-1000 | 80-230 | 80-450 | 80-710 | 120-150 | 120-300 | 120-600 | 120-150 | 120-300 | 120-600 |
| C 530 | | | | | | | | | | | | | | | | | | | | | | | |
| 40 x 30 x 450 mm | 692070274 | ● | | | | | | | | | | | | | | | | | | | | | |
| 40 x 30 x 700 mm | 692070276 | | ● | | | ● | | | | | | | | | | | | | | | | | |
| 50 x 40 x 450 mm | 692070275 | ✓ | | | | | | | | | | | | | | | | | | | | | |
| 50 x 40 x 700 mm | 692070277 | | ✓ | | | | | | | | | | | | | | | | | | | | |
| 60 x 50 x 650 mm | 692070106 | | | | | ● | | | | | | | | | | | | | | | | | |
| 60 x 50 x 850 mm | 692070305 | | | | | | ● | | ● | | | ● | | | | | | | | | | | |
| 60 x 50 x 1100 mm | 692070101 | | | ● | | | | ● | | ● | | | ● | | | | | | | | | | |
| 70 x 60 x 1070 mm | 692070048 | | | ● | | | | ● | | ● | | | ● | | | | | | | | | | |
| 80 x 70 x 650 mm | 692070036 | | | | | ✓ | | | | | | | | | | | | | | | | | |
| 80 x 70 x 850 mm | 692070108 | | | | | | ✓ | | ● | | | ● | | | | | | | | | | | |
| 80 x 70 x 1100 mm | 692070109 | | | ● | | | | ✓ | | ● | | | ● | | | | | | | | | | |
| 95 x 80 x 1070 mm | 692070049 | | | ✓ | | | | | | ● | | | ● | | | | | | | | | | |
| 120 x 100 x 850 mm | 692070110 | | | | | | | | ✓ | | | ● | | | | | | | | | | | |
| 120 x 100 x 1100 mm | 692070111 | | | | | | | | | ✓ | | | ● | | | | | | | | | | |
| 120 x 100 x 1350 mm | 692070131 | | | | | | | | | | ✓ | | | ● | | | | | | | | | |
| 120 x 100 x 1400 mm | 692070279 | | | | ✓ | | | | | | | | | | | | | | | | | | |
| 170 x 150 x 850 mm | 692071658 | | | | | | | | | | | ✓ | | | | | | | | | | | |
| 170 x 150 x 1100 mm | 692071659 | | | | | | | | | | | | ✓ | | | | | | | | | | |
| 170 x 150 x 1350 mm | 692071660 | | | | | | | | | | | | | ✓ | | | | | | | | | |
| Vacuum tube[1] C 610 | | | | | | | | | | | | | | | | | | | | | | | |
| 60 x 50 x 1030 mm | 601435137 | | | | | ● | | | | | | | | | | | | | | | | | |
| 60 x 50 x 1230 mm | 601435138 | | | | | | ● | | ● | | | ● | | | | | | | | | | | |
| 60 x 50 x 1480 mm | 601435139 | | | | | | | ● | | ● | | | ● | | | | | | | | | | |
| 80 x 70 x 1230 mm | 601435111 | | | | | | ● | | ● | | | ● | | | | | | | | | | | |
| 80 x 70 x 1480 mm | 601435112 | | | | | | | ● | | ● | | | ● | | | | | | | | | | |
| 120 x 100 x 1230 mm | 601435114 | | | | | | | | ● | | | ● | | | | | | | | | | | |
| 120 x 100 x 1480 mm | 601435113 | | | | | | | | | ● | | | ● | | | | | | | | | | |
| 120 x 100 x 1730 mm | 601435140 | | | | | | | | | | ● | | | ● | | | | | | | | | |
| 170 x 150 x 1230 mm | 601435191 | | | | | | | | | | | ● | | | | | | | | | | | |
| 170 x 150 x 1480 mm | 601435192 | | | | | | | | | | | | ● | | | | | | | | | | |
| 170 x 150 x 1730 mm | 601435193 | | | | | | | | | | | | | ● | | | | | | | | | |
| C 799 | | | | | | | | | | | | | | | | | | | | | | | |
| 50 x 40 x 470 mm | 692070470 | | | | | | | | | | | | | | | | | ● | | | | | |
| 50 x 40 x 520 mm | 692071664 | | | | | | | | | | | | | | | | | | | | ● | | |
| 50 x 40 x 620 mm | 692070159 | | | | | | | | | | | | | | | | | | ● | | | | |
| 50 x 40 x 670 mm | 692071665 | | | | | ● | | | | | | | | | | | | | | | | ● | |
| 50 x 40 x 920 mm | 692071666 | | | | | | ● | | ● | | | | | | | | | | | ● | | | ● |
| 50 x 40 x 1400 mm | 692071621 | | | | | | | | | | ● | | | | | | | | | | | | |
| 80 x 70 x 470 mm | 692071667 | | | | | | | | | | | | | | | | | ● | | | | | |
| 80 x 70 x 520 mm | 692071668 | | | | | | | | | | | | | | | | | | | | ● | | |
| 80 x 70 x 600 mm | 692070600 | | | | | | | | | | | | | | ✓ | | | | | | | | |
| 80 x 70 x 620 mm | 692071642 | | | | | | | | | | | | | | | | | | ● | | | | |
| 80 x 70 x 670 mm | 692071669 | | | | | ● | | | | | | | | | | | | | | | | ● | |
| 80 x 70 x 820 mm | 692071670 | | | | | | | | | | | | | | | ✓ | | | | | | | |
| 80 x 70 x 920 mm | 692071671 | | | | | | ● | | ● | | | | | | | | | | | ● | | | ● |
| 80 x 70 x 1080 mm | 692071647 | | | | | | | ● | | ● | | | | | | | ✓ | | | | | | |
| 80 x 70 x 1370 mm | 692071620 | | | | | | | | | | ● | | | | | | | | | | | | |
| 120 x 100 x 470 mm | 692071672 | | | | | | | | | | | | | | | | | ✓ | | | | | |
| 120 x 100 x 520 mm | 692071673 | | | | | | | | | | | | | | | | | | | | ✓ | | |
| 120 x 100 x 620 mm | 692071674 | | | | | | | | | | | | | | | | | | ✓ | | | | |
| 120 x 100 x 670 mm | 692071675 | | | | | | | | | | | | | | | | | | | | | ✓ | |
| 120 x 100 x 920 mm | 692071676 | | | | | | | | ● | | | | | | | | | | | ✓ | | | ✓ |
| 120 x 100 x 1100 mm | 692071625 | | | | | | | | | ● | | | | | | | | | | | | | |
| 120 x 100 x 1400 mm | 692071626 | | | | | | | | | | ● | | | | | | | | | | | | |
| Vacuum tube[1] C 799 | | | | | | | | | | | | | | | | | | | | | | | |
| 50 x 40 x 950 mm | 601435141 | | | | | | | | | | | | | | | | | ● | | | ● | | |
| 50 x 40 x 1100 mm | 601435149 | | | | | | | | | | | | | | | | | | | ● | | | ● |
| 50 x 40 x 1400 mm | 601435169 | | | | | | | | | | | | | | | | | | ● | | | ● | |
| 80 x 70 x 950 mm | 601435143 | | | | | | | | | | | | | | | | | | | ● | | | ● |
| 80 x 70 x 990 mm | 601435144 | | | | | | | | | | | | | | | | | ● | | | ● | | |
| 80 x 70 x 1100 mm | 601435171 | | | | | | | | | | | | | | ● | | | | | | | | |
| 80 x 70 x 1210 mm | 601435145 | | | | | | | | | | | | | | | | | | ● | | | ● | |
| 80 x 70 x 1470 mm | 601435170 | | | | | | | | | | | | | | | ● | | | | | | | |
| 80 x 70 x 1400 mm | 601435142 | | | | | | | | | | | | | | | | ● | | | | | | |
| 120 x 100 x 950 mm | 601435146 | | | | | | | | | | | | | | | | | | | ● | | | ● |
| 120 x 100 x 1100 mm | 601435147 | | | | | | | | | | | | | | | | | ● | | | ● | | |
| 120 x 100 x 1400 mm | 601435148 | | | | | | | | | | | | | | | | | | ● | | | ● | |

✓ Standard working tube
● Working tube available as an option

[1]Incl. sticked sealing rings for operation with water-cooled flanges

## Customized Tube Furnaces



Besides our extensive selection of standard tube furnaces, we can also provide you with a tube furnace custom-designed for your application. Some examples of tube furnace systems we have supplied to other customers are listed below. From modified standard furnaces to fully-customized tube furnace systems – we will find a solution for your needs!

- RS 100/1500/13S tube furnace for integration in the customer's production plant
- Operates horizontally, vertically, or at a defined angle
- Tmax 1300 °C
- Heated length: 1500 mm
- Tube interior diameter: 100 mm
- 3-zoned control system for optimization of temperature distribution

- R 100/1000/11S tube furnace for vacuum operation for annealing of metals under vacuum or protective gas atmospheres
- Working tube closed on one side made of highly heat-resistant 1.4841 (314) alloy
- Load carrier made of 1.4841 (314) alloy
- 1-stage rotary vane pump for vacuum down to $10^{-1}$ mbar
- Tmax 1100 °C
- Heated length: 1000 mm
- Tube interior diameter: 100 mm

- Dual tube ceramic furnace system with 2 RS 50/300/13 furnaces for working with different temperatures in one working tube
- Furnaces hinged for simple insertion of the working tube
- Each furnace has its own controller
- Gas-tight flanges, water-cooled for working under protective gas
- Tmax 1300 °C
- Overall tube length: 800 mm
- Heated length: 2 x 300 mm
- Tube interior diameter: 50 mm

- RS 200/2500/13S production tube furnace with hinged lid
- Simple insertion of working tube from above by opening the furnace lid
- Lid to be opened using a crane
- Tmax 1300 °C
- Heated length: 2500 mm
- Tube interior diameter: 200 mm

- RS 100/1000/11 hinged tube furnace for debinding under protective gas atmospheres
- Gas-tight flanges, water-cooled for working under protective gas
- Binder cold trap with condensate separator on the right side of the tube
- Tmax 1100 °C
- Heated length: 1000 mm
- Tube interior diameter: 100 mm

# Compact Chamber Furnaces N 40 E - N 100 E

**N 40 E**
as table-top model


**N 60 E**
with stand (optional)

**N 40 E - N 100 E**

We offer compact chamber furnaces as an alternative to the pit furnaces described, which can also handle a large number of simple processes.

- Heating from both sides with high-quality heating elements, embedded in protective grooves
- Multilayered insulation with light refractory bricks in the furnace interior and special backup insulation for low power consumption
- Double-walled door with low exterior temperature
- Casing made of sheets of textured stainless steel (non-rusting design)
- Quiet operation of heating with solid state relays
- High-quality types PtRh-Pt thermocouple
- Freely adjustable air intake for good ventilation and short cooling times
- Exhaust air outlet in roof
- Precise temperature characteristic due to fast clocking of switching processes
- Standard tabletop design
- Stand available optionally
- Door contact switch for safety shutoff
- Please see page 44 for a description of the different controllers

| Model | Tmax | Inner dimensions in mm | | | Volume | Outer dimensions in mm | | | Power | Electrical | Weight |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | °C | w | d | h | in L | W | D | H | kW | connection* | in kg |
| N 40 E | 1300 | 360 | 400 | 320 | 40 | 560 | 690 | 570 | 2,9 | single-phase | 70 |
| N 60 LE | 1200 | 360 | 400 | 440 | 60 | 560 | 690 | 690 | 2,9 | single-phase | 90 |
| N 60 E | 1300 | 360 | 400 | 440 | 60 | 560 | 690 | 690 | 3,6 | single-phase | 90 |
| N 100 E | 1300 | 360 | 610 | 440 | 400 | 560 | 1035 | 690 | 5,5 | 3-phase[1] | 115 |

[1]Heating only on one phase

*Please see page 44 for more information about mains voltage

# Professional Chamber Furnaces with Brick Insulation LH or Fibre Insulation LF

**LH 15/12**
with brick insulation

**LH 60/12**
with brick insulation

Interior of low heat storage fibre material for fast cooling times in LF models

Cooling fan connected to automatic vent flap for shorter cooling time

**LH 15/12 - LF 120/14**

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 fibre 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
- 5-sided heating for very good temperature uniformity
- Heating elements on support tubes ensure free heat radiation and a long service life
- Protection of floor heating and flat stacking surface provided by embedded SiC plate in the floor
- LH models: multilayered, fibre-free insulation of light refractory bricks and special backup insulation
- LF models: high-quality fibre 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
- Please see page 44 for a description of the different controllers

**LF 120/12** with fibre insulation

**LH 120/12S** with gas supply system and sight port in the door

**Additional Equipment**

- Parallel swinging door, pivots away from operator, for opening when hot
- Separate wall-mounting or floor standing cabinet for switchgear
- Automatic vent flap
- Cooling fan for shorter cycle times
- Protective gas connector, sealed casing
- Manual or automatic gas supply system

| Model | Tmax | Inner dimensions in mm | | | Volume | Outer dimensions in mm | | | Power | Electrical | Weight |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | °C | w | d | h | in L | W | D | H | kW | connection* | in kg |
| LH 15/12 | 1200 | 250 | 250 | 250 | 15 | 570 | 790 | 1170 | 5,0 | 3-phase[1] | 150 |
| LH 30/12 | 1200 | 320 | 320 | 320 | 30 | 640 | 860 | 1240 | 7,0 | 3-phase[1] | 170 |
| LH 60/12 | 1200 | 400 | 400 | 400 | 60 | 720 | 1010 | 1320 | 8,0 | 3-phase | 260 |
| LH 120/12 | 1200 | 500 | 500 | 500 | 120 | 820 | 1110 | 1420 | 12,0 | 3-phase | 340 |
| LH 15/13 | 1300 | 250 | 250 | 250 | 15 | 570 | 790 | 1170 | 7,0 | 3-phase[1] | 150 |
| LH 30/13 | 1300 | 320 | 320 | 320 | 30 | 640 | 860 | 1240 | 8,0 | 3-phase[1] | 170 |
| LH 60/13 | 1300 | 400 | 400 | 400 | 60 | 720 | 1010 | 1320 | 11,0 | 3-phase | 260 |
| LH 120/13 | 1300 | 500 | 500 | 500 | 120 | 820 | 1110 | 1420 | 15,0 | 3-phase | 340 |
| LH 15/14 | 1400 | 250 | 250 | 250 | 15 | 570 | 790 | 1170 | 8,0 | 3-phase[1] | 150 |
| LH 30/14 | 1400 | 320 | 320 | 320 | 30 | 640 | 860 | 1240 | 10,0 | 3-phase[1] | 170 |
| LH 60/14 | 1400 | 400 | 400 | 400 | 60 | 720 | 1010 | 1320 | 12,0 | 3-phase | 260 |
| LH 120/14 | 1400 | 500 | 500 | 500 | 120 | 820 | 1110 | 1420 | 18,0 | 3-phase | 340 |

Parallel swinging door for opening when hot

| Model | Tmax | Inner dimensions in mm | | | Volume | Outer dimensions in mm | | | Power | Electrical | Weight |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | °C | w | d | h | in L | W | D | H | kW | connection* | in kg |
| LF 15/13 | 1300 | 250 | 250 | 250 | 15 | 570 | 790 | 1170 | 7,0 | 3-phase[1] | 130 |
| LF 30/13 | 1300 | 320 | 320 | 320 | 30 | 640 | 860 | 1240 | 8,0 | 3-phase[1] | 150 |
| LF 60/13 | 1300 | 400 | 400 | 400 | 60 | 720 | 1010 | 1320 | 11,0 | 3-phase | 230 |
| LF 120/13 | 1300 | 500 | 500 | 500 | 120 | 820 | 1110 | 1420 | 15,0 | 3-phase | 300 |
| LF 15/14 | 1400 | 250 | 250 | 250 | 15 | 570 | 790 | 1170 | 8,0 | 3-phase[1] | 130 |
| LF 30/14 | 1400 | 320 | 320 | 320 | 30 | 640 | 860 | 1240 | 10,0 | 3-phase[1] | 150 |
| LF 60/14 | 1400 | 400 | 400 | 400 | 60 | 720 | 1010 | 1320 | 12,0 | 3-phase | 230 |
| LF 120/14 | 1400 | 500 | 500 | 500 | 120 | 820 | 1110 | 1420 | 18,0 | 3-phase | 300 |

Gas panel

[1]Heating only between two phases

*Please see page 44 for information on mains voltage

# Ovens TR 60 - TR 1050 up to 300 °C

**TR 240/S**
with view window

**TR 1050**
with double door

**TR 60**

**TR 60 - TR 1050**

Usable to a maximum of 300 °C, these ovens offer optimum temperature uniformity over their entire useable volume. Horizontal air circulation ensures high drying power and a fast heating time. Maximum temperature uniformity is achieved even for closely packed charges. Multiple tray supports enable loading on multiple layers.

- Tmax 300 °C
- Compact design as tabletop model (TR 420 and TR 1050 as free standing model)
- Horizontal air circulation for temperature uniformity better than ΔT 8K in the usable space
- Stacking in multiple layers possible using removeable trays
- Furnace chamber of stainless steel, material 1.4301 (304)
- Double door for model TR 1050
- View window upon request
- Please see page 44 for a description of various controllers

Exhaust air opening in the rear wall to vent the exhaust gasses generated during drying

| Model | Tmax | Inner dimensions in mm | | | Volume | Outer dimensions in mm | | | Power | Electrical | Weight | Trays in- | Trays | Max. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | °C | w | d | h | in L | W | D | H | kW | connection* | in kg | cluded | max. | total load[1] |
| TR 60 | 300 | 490 | 360 | 340 | 60 | 650 | 550 | 640 | 2,1 | single-phase | 45 | 1 | 4 | 120 |
| TR 120 | 300 | 600 | 360 | 480 | 105 | 750 | 550 | 780 | 2,1 | single-phase | 70 | 2 | 7 | 150 |
| TR 240 | 300 | 700 | 550 | 640 | 240 | 860 | 730 | 940 | 3,1 | single-phase | 100 | 2 | 9 | 150 |
| TR 420 | 300 | 710 | 550 | 1080 | 420 | 860 | 830 | 1370 | 4,0 | 3-phase | 120 | 3 | 17 | 150 |
| TR 1050 | 300 | 1240 | 570 | 1510 | 1050 | 1430 | 860 | 1920 | 9,3 | 3-phase | 380 | 4 | 22 | 170 |

[1]Max load per layer 30 kg

*Please see page 44 for information on mains voltage

# High-Temperature Ovens, Air Circulation Furnaces up to 850 °C

N 60/65HA

N 560/45HA

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

If very good temperature uniformity is necessary for your heat treatment, our air circulation furnaces with horizontal air circulation are the right solution for you. Due to their solid industrial design, they can be used for many processes, like ageing, preheating, drying, hardening, tempering and annealing.

- Tmax 450 °C, 650 °C, or 850 °C
- Furnace plenum made of stainless steel (N 15/65HA without plenum)
- Model with 15 liters designed as tabletop model, other models freestanding with stand
- Solid industrial design
- Optimum temperature distribution per DIN 17052-1 to ΔT 6K in useable space
- Loading of multiple layers possible using removeable trays. For models N 30/.. - N 560/.. one tray is included in scope of delivery
- Please see page 44 for a description of various controllers

N 15/65HA

| Model | Tmax °C | Inner dimensions in mm w | d | h | Volume in L | Outer dimensions in mm W | D | H | Power kW | Electrical connection* | Weight in kg |
|---|---|---|---|---|---|---|---|---|---|---|---|
| N 30/45HA | 450 | 290 | 420 | 260 | 30 | 607+255 | 1175 | 1315 | 3,0 | single-phase | 195 |
| N 60/45HA | 450 | 350 | 500 | 350 | 60 | 667+255 | 1250 | 1400 | 6,0 | 3-phase | 240 |
| N 120/45HA | 450 | 450 | 600 | 450 | 120 | 767+255 | 1350 | 1500 | 9,0 | 3-phase | 310 |
| N 250/45HA | 450 | 600 | 750 | 600 | 250 | 1002+255 | 1636 | 1860 | 19,0 | 3-phase | 610 |
| N 560/45HA | 450 | 750 | 1000 | 750 | 560 | 1190+255 | 1800 | 1190 | 19,0 | 3-phase | 730 |
| N 15/65HA[1] | 650 | 295 | 340 | 170 | 15 | 470 | 875 | 460 | 2,4 | single-phase | 55 |
| N 30/65HA | 650 | 290 | 420 | 260 | 30 | 607+255 | 1175 | 1315 | 5,5 | 3-phase[2] | 195 |
| N 60/65HA | 650 | 350 | 500 | 350 | 60 | 667+255 | 1250 | 1400 | 9,0 | 3-phase | 240 |
| N 120/65HA | 650 | 450 | 600 | 450 | 120 | 767+255 | 1350 | 1500 | 13,0 | 3-phase | 310 |
| N 250/65HA | 650 | 600 | 750 | 600 | 250 | 1002+255 | 1636 | 1860 | 21,0 | 3-phase | 610 |
| N 500/65HA | 650 | 750 | 1000 | 750 | 500 | 1152+255 | 1886 | 2010 | 31,0 | 3-phase | 1030 |
| N 30/85HA | 850 | 290 | 420 | 260 | 30 | 607+255 | 1175 | 1315 | 6,1 | 3-phase[2] | 195 |
| N 60/85HA | 850 | 350 | 500 | 350 | 60 | 667+255 | 1250 | 1400 | 9,6 | 3-phase | 240 |
| N 120/85HA | 850 | 450 | 600 | 450 | 120 | 767+255 | 1350 | 1500 | 13,6 | 3-phase | 310 |
| N 250/85HA | 850 | 600 | 750 | 600 | 250 | 1002+255 | 1636 | 1860 | 21,0 | 3-phase | 610 |
| N 500/85HA | 850 | 750 | 1000 | 750 | 500 | 1152+255 | 1886 | 2010 | 31,0 | 3-phase | 1030 |

[1]Tabletop model
[2]Heating only between two phases

*Please see page 44 for more information on mains voltage

# High-Temperature Furnaces HTC with SiC Rod Heating as Table-Top Model

HTC 03/14


HTC 08/15

**HTC 03/14 - HTC 08/16**

These powerful laboratory muffle furnaces are available for temperatures up to 1400 °C, 1500 °C, or 1600 °C. The durability of the SiC rods in periodic use, in combination with their high heating speed, make these furnaces to all-rounders in the laboratory. Heating times of 40 minutes to 1400 °C can be achieved, depending on the furnace model and the conditions of use.

Furnace chamber with high-quality fibre material and SiC heating rods in the sides of the furnace

- Tmax 1400 °C, 1500 °C, or 1600 °C
- Easy replacement of heating rods
- High-quality fibre material, selected for the working temperature
- Casing made of sheets of textured stainless steel (non-rusting design)
- Double-walled casing for low external temperatures and high stability
- Optional fold-down door which can be used as work platform or lift door with hot surface facing away from the operator
- Adjustable air intake opening in the furnace door, exhaust air opening in the back wall
- Switching system with semiconductor relay, power tuned to the SiC rods
- Please see page 44 for a description of the different controllers

**Additional Equipment**

- Over-temperature limit controller with adjustable cutout temperature for thermal protection class 2 in accordance with EN 60519-2 as temperature limiter to protect the oven and load


Over-temperature limit controller

| Model | Tmax °C | Inner dimensions in mm w | d | h | Volume in L | Outer dimensions in mm W | D | H | Power kW | Electrical connection* | Weight in kg | Minutes to Tmax |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| HTC 03/14 | 1400 | 120 | 210 | 120 | 3 | 400 | 535 | 530 | 4,5 | 3-phase | 30 | 40 |
| HTC 08/14 | 1400 | 170 | 290 | 170 | 8 | 450 | 620 | 570 | 8,0 | 3-phase | 40 | 40 |
| HTC 03/15 | 1500 | 120 | 210 | 120 | 3 | 400 | 535 | 530 | 4,5 | 3-phase | 30 | 50 |
| HTC 08/15 | 1500 | 170 | 290 | 170 | 8 | 450 | 620 | 570 | 8,0 | 3-phase | 40 | 50 |
| HTC 03/16 | 1600 | 120 | 210 | 120 | 3 | 400 | 535 | 530 | 4,5 | 3-phase | 30 | 60 |
| HTC 08/16 | 1600 | 170 | 290 | 170 | 8 | 450 | 620 | 570 | 8,0 | 3-phase | 40 | 60 |

*Please see page 44 for more information about mains voltage

# High-Temperature Furnaces LHT with $MoSi_2$ Heating Elements as Table-Top Model

LHT 02/17

LHT 04/17

**LHT 02/16 - LHT 08/18**

Designed as tabletop models, these compact high-temperature furnaces have a variety of advantages. The first-class workmanship using high-quality materials, combined with ease of operation, make these furnaces all-rounders in research and the laboratory. These furnaces are also perfectly suited for the sintering of technical ceramics, such as zirconium oxide dental bridges.

- Tmax 1600 °C, 1750 °C, or 1800 °C
- High-quality molybdenum disilicide heating elements
- Furnace chamber lined with first-class, durable fibre material
- Casing made of sheets of textured stainless steel (non-rusting design)
- Double-walled casing with additional cooling using fans, for low exterior temperature
- Furnace sizes of 2, 4, or 8 liters
- With lift door, whereby the hot side is away from the operator
- Exhaust air opening in the roof
- Type B thermocouple
- Switching system with phase-angle firing thyristors (SCRs)
- Please see page 44 for a description of the different controllers

**Additional Equipment**

- Over-temperature limit controller with adjustable cutout temperature for thermal protection class 2 in accordance with EN 60519-2 as temperature limiter to protect the oven and load
- Protective gas connector in rear wall of furnace
- Manual or automatic gas supply system

Over-temperature limit controller

| Model | Tmax | Inner dimensions in mm | | | Volume | Outer dimensions in mm | | | Power | Electrical | Weight | Minutes |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | °C | w | d | h | in L | W | D | H | kW | connection* | in kg | to Tmax |
| LHT 02/16 | 1600 | 90 | 150 | 150 | 2 | 470 | 700 | 750+350 | 3,0 | single-phase | 75 | 30 |
| LHT 04/16 | 1600 | 150 | 150 | 150 | 4 | 470 | 700 | 750+350 | 5,2 | 3-phase[1] | 85 | 25 |
| LHT 08/16 | 1600 | 150 | 300 | 150 | 8 | 470 | 850 | 750+350 | 8,0 | 3-phase[1] | 100 | 25 |
| LHT 02/17 | 1750 | 90 | 150 | 150 | 2 | 470 | 700 | 750+350 | 3,0 | single-phase | 75 | 60 |
| LHT 04/17 | 1750 | 150 | 150 | 150 | 4 | 470 | 700 | 750+350 | 5,2 | 3-phase[1] | 85 | 40 |
| LHT 08/17 | 1750 | 150 | 300 | 150 | 8 | 470 | 850 | 750+350 | 8,0 | 3-phase[1] | 100 | 40 |
| LHT 02/18 | 1800 | 90 | 150 | 150 | 2 | 470 | 700 | 750+350 | 3,6 | single-phase | 75 | 75 |
| LHT 04/18 | 1800 | 150 | 150 | 150 | 4 | 470 | 700 | 750+350 | 5,2 | 3-phase[1] | 85 | 60 |
| LHT 08/18 | 1800 | 150 | 300 | 150 | 8 | 470 | 850 | 750+350 | 9,0 | 3-phase[1] | 100 | 60 |

[1]Heating only between two phases

*Please see page 44 for more information about mains voltage

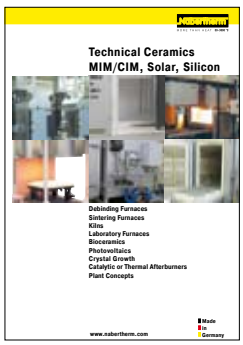
# High-Temperature Furnaces HT with $MoSi_2$ Heating Elements as Floor Models

**HT 04/16** with gas panel

**HT 32/17** with automatic vapour vent flap and fresh air fan with dimmer

Gas supply panel for nonflammable protective gas with shutoff valve and flow meter with regulator valve, piped and ready to connect

Automatic vent flap




**Ask for our "Ceramics" catalog for more information on our high-temperature furnaces!**

## HT 04/16 - HT 16/18

Due to their solid construction and compact stand-alone design, these high-temperature furnaces are perfect for processes in the laboratory where the highest precision is needed. Oustanding temperature uniformity and practical details set unbeatable quality benchmarks. For configuration for your processes, these furnaces can be extended with extras from our extensive option list.

- Tmax 1600 °C, 1750 °C, or 1800 °C
- High-quality molybdenum disilicide ($MoSi_2$) heating elements
- Furnace chamber lined with first-class, durable fibre material
- Parallel swinging doors, chain-guided, allowing safe opening and closing without destruction of the fibre insulation. Positive closing of the door with a cam latch
- Type B thermocouple
- Furnace sizes from 4 to 450 liters, special sizes on request
- Over-temperature limit controller as standard equipment for protection of material
- Please see page 44 for a description of the different controllers

### Additional Equipment

- Floor reinforcement for support of heavy loads
- Exhaust air flap controlled manually or automatically for better ventilation of furnace chamber
- Fan for better ventilation of combustion chamber and for fast cooling of the furnace
- Protective gas connector and seal of furnace casing to allow flushing of furnace with protective gasses
- Manual or automatic gas supply system

| Model | Tmax °C | Inner dimensions in mm w | d | h | Volume in L | Outer dimensions in mm W | D | H | Power kW | Electrical connection* | Weight in kg | Minutes to Tmax |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| HT 04/16 | 1600 | 150 | 150 | 150 | 4 | 610 | 470 | 1400 | 5,2 | 3-phase[1] | 150 | 25 |
| HT 08/16 | 1600 | 150 | 300 | 150 | 8 | 610 | 610 | 1400 | 8,0 | 3-phase[1] | 200 | 25 |
| HT 16/16 | 1600 | 200 | 300 | 260 | 16 | 710 | 650 | 1500 | 12,0 | 3-phase[1] | 270 | 25 |
| HT 04/17 | 1750 | 150 | 150 | 150 | 4 | 610 | 470 | 1400 | 5,2 | 3-phase[1] | 150 | 40 |
| HT 08/17 | 1750 | 150 | 300 | 150 | 8 | 610 | 610 | 1400 | 8,0 | 3-phase[1] | 200 | 40 |
| HT 16/17 | 1750 | 200 | 300 | 260 | 16 | 710 | 650 | 1500 | 12,0 | 3-phase[1] | 270 | 40 |
| HT 04/18 | 1800 | 150 | 150 | 150 | 4 | 610 | 470 | 1400 | 5,2 | 3-phase[1] | 150 | 40 |
| HT 08/18 | 1800 | 150 | 300 | 150 | 8 | 610 | 610 | 1400 | 9,0 | 3-phase[1] | 200 | 40 |
| HT 16/18 | 1800 | 200 | 300 | 260 | 16 | 710 | 650 | 1500 | 12,0 | 3-phase[1] | 270 | 40 |

[1]Heating only between two phases

*Please see page 44 for more information about mains voltage

# High-Temperature Furnaces HFL as floor Models with Brick Insulation for Melting Experiments

HFL 16/16

**HFL 295/13** with lift door and transformer in stand, with customer-specific design

## HFL 16/16 - HFL 160/17

The HFL 16/16 - HFL 160/17 series is particularly characterized by their special cladding with light refractory bricks. This insulation is necessary when aggressive gasses (such as vapourized glass) or acids may be produced in the process.

- Tmax 1600 °C or 1700 °C
- High-quality molybdenum disilicide ($MoSi_2$) heating elements
- Insulation with light refractory bricks and special backup insulation
- Type B thermocouple
- Furnace sizes of 16 to 160 liters
- For the release of vapours, a 30 mm large exhaust hole is integrated into the roof of the furnace
- Over-temperature limit controller for protection of material
- Please see page 44 for a description of the different controllers

Protective screen in front of heating elements for protection against mechanical damage

### Additional Equipment

- Exhaust air flap controlled manually or automatically for better ventilation of furnace chamber
- Fan for better ventilation of combustion chamber and for fast cooling of the furnace
- Protective gas connector and seal of furnace casing to allow flushing of furnace with protective gasses
- Manual or automatic gas supply system

| Model | Tmax | Inner dimensions in mm | | | Volume | Outer dimensions in mm | | | Power | Electrical | Weight |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | °C | w | d | h | in L | W | D | H | kW | connection* | in kg |
| HFL 16/16 | 1600 | 200 | 300 | 260 | 16 | 720 | 900 | 1520 | 12 | 3-phase[1] | 500 |
| HFL 40/16 | 1600 | 300 | 350 | 350 | 40 | 820 | 950 | 1620 | 12 | 3-phase | 660 |
| HFL 64/16 | 1600 | 400 | 400 | 400 | 64 | 920 | 1000 | 1670 | 18 | 3-phase | 880 |
| HFL 160/16 | 1600 | 500 | 550 | 550 | 160 | 1020 | 1150 | 1820 | 21 | 3-phase | 1140 |
| HFL 16/17 | 1700 | 200 | 300 | 260 | 16 | 720 | 900 | 1520 | 12 | 3-phase[1] | 530 |
| HFL 40/17 | 1700 | 300 | 350 | 350 | 40 | 820 | 950 | 1620 | 12 | 3-phase | 690 |
| HFL 64/17 | 1700 | 400 | 400 | 400 | 64 | 920 | 1000 | 1670 | 18 | 3-phase | 920 |
| HFL 160/17 | 1700 | 500 | 550 | 550 | 160 | 1020 | 1150 | 1820 | 21 | 3-phase | 1190 |

[1]Heating only between two phases

*Please see page 44 for more information about mains voltage

# High-Temperature Vacuum Furnaces VHT with Graphite, Molybdenum or $MoSi_2$ Heating

**VHT 8/22-GR** with graphite heating

**VHT 8/22-KE** with ceramic fiber heating

The compact furnaces of the VHT line are available as electrically heated chamber furnaces with graphite, molybdenum or $MoSi_2$ heating. A wide variety of heating designs as well as a complete range of accessories allow optimal furnace configuration for technically demanding customer processes.

The vacuum-tight retort enables heat treatment processes either in protective and reaction gas atmospheres or in a vacuum, depending on the application, all the way to $10^{-5}$ mbar.

With the appropriate safety technology, the furnaces are also suitable for operation with hydrogen.

## Heating Concepts

**Graphite – VHT ../GR**

- Suitable for processes under protective and reaction gases or under vacuum
- Tmax 1800 °C and 2200 °C
- Graphite felt insulation
- Temperature measurement using type B thermocouple (version to 1800 °C)
- Temperature measurement using optical pyrometer (version to 2200 °C)

**Molybdenum – VHT ../MO**

- Suitable for processes under highly pure protective and reaction gases or under a high vacuum up as much as $10^{-5}$ mbar
- Tmax 1600°C
- Insulation made of Molybdenum steel sheets

**$MoSi_2$ – VHT ../KE**

- Suitable for processes under protective and reaction gases, under vacuum or in air
- Tmax 1800°C
- Insulation made of high purity aluminum oxide fiber

## **Basic Version VHT** (All Heating Concepts)

- 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, powder-coated and easy to service due to removable stainless steel panels
- Casing 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, open-loop cooling water system
- Adjustable cooling water circuits with flowmeter and temperature indicator and overtemperature fuses
- Switching system integrated within casing to save space
- H 700 PLC control with clearly laid out 5.7" touchpanel control for program entry and display, 10 programs each with 20 segments
- Over-temperature limit controller with adjustable cutout temperature for thermal protection class 2 in accordance with EN 60519-2
- Manual operation of the process gas and vacuum functions
- Manual gas supply for one process gas ($N_2$ 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)
- Single-stage rotary vane pump with ball valve for pre-evacuating and heat treatment in a rough vacuum to 20 mbar
- Pressure gauge for visual pressure monitoring


Graphite heating chamber


Molybdenum heating chamber

### Additional Equipment

- Optionally separable frame for passing through narrow door openings
- Manual gas supply for second process gas ($N_2$ or Ar) with adjustable flow and bypass
- Molybdenum or carbon-fiber-carbon retort with direct gas supply for clean atmosphere and improved temperature distribution in the furnace chamber
- Charge thermocouple with display
- Two-stage rotary vane pump with ball valve for pre-evacuating and heat-treating in a vacuum to $10^{-2}$ mbar
- Cooling unit with closed-loop cooling water circuit

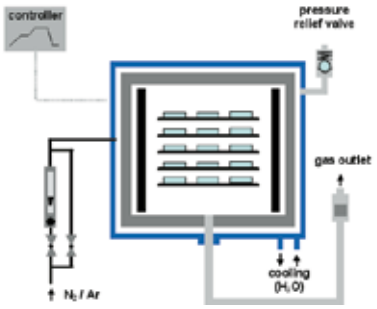

Chamber made of ceramic fiber

| | VHT ...-18/GR | VHT ...-16/MO | VHT ...-18/KE |
|---|---|---|---|
| Inert gas | ✓ | ✓ | ✓ |
| Air | to 500 °C | - | ✓ |
| Hydrogen | ✓ | ✓ | - |
| Rough vacuum and fine vacuum (>$10^{-3}$ mbar) | ✓ | ✓ | ✓ |
| High vacuum (<$10^{-3}$ mbar) | - | ✓ | - |

| Model | Tmax °C | Inner dimensions in mm W | D | H | Volume in l | Outer dimensions in mm W | D | H | Supply power/kW | Electrical connection* | Weight in kg | Material heater/ insulation |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| VHT 8/18-GR | 1800 | 170 | 240 | 200 | 8 | 1250 (800)[1] | 1100 | 2000 | 27,0 | three-phase | 1200 | Graphite/graphite felt |
| VHT 40/18-GR | 1800 | 300 | 450 | 300 | 40 | 1500 | 2000 | 2300 | 83,0 | three-phase | 2000 | Graphite/graphite felt |
| VHT 100/18-GR | 1800 | 450 | 550 | 450 | 100 | 1750 | 2200 | 2600 | on request | three-phase | 2800 | Graphite/graphite felt |
| VHT 8/22-GR | 2200 | 170 | 240 | 200 | 8 | 1250 (800)[1] | 1100 | 2000 | 27,0 | three-phase | 1200 | Graphite/graphite felt |
| VHT 40/22-GR | 2200 | 300 | 450 | 300 | 40 | 1500 | 2000 | 2300 | 83,0 | three-phase | 2000 | Graphite/graphite felt |
| VHT 100/22-GR | 2200 | 450 | 550 | 450 | 100 | 1750 | 2200 | 2600 | on request | three-phase | 2800 | Graphite/graphite felt |
| VHT 8/16-MO | 1600 | 170 | 240 | 200 | 8 | 1250 (800)[1] | 1100 | 2000 | 34,0 | three-phase | 1200 | Molybdenum |
| VHT 40/16-MO | 1600 | 300 | 450 | 300 | 40 | 1500 | 2000 | 2300 | 122,0 | three-phase | 2000 | Molybdenum |
| VHT 100/16-MO | 1600 | 450 | 550 | 450 | 100 | 1750 | 2200 | 2600 | on request | three-phase | 2800 | Molybdenum |
| VHT 8/18-KE | 1800 | 170 | 240 | 200 | 8 | 1250 (800)[1] | 1100 | 2000 | 12,5 | three-phase | 1200 | $MoSi_2$/ceramic fiber |
| VHT 40/18-KE | 1800 | 300 | 450 | 300 | 40 | 1500 | 2000 | 2300 | 45,0 | three-phase | 2000 | $MoSi_2$/ceramic fiber |
| VHT 100/18-KE | 1800 | 450 | 550 | 450 | 100 | 1750 | 2200 | 2600 | on request | three-phase | 2800 | $MoSi_2$/ceramic fiber |

[1]With the switching system unit removed

*See page 44 for information about supply voltage.



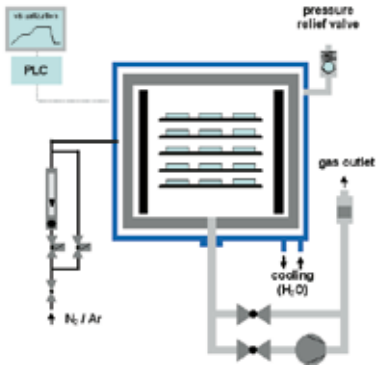

VHT gas supply diagram, manual operation

The use of automatic valves for process gas or exhaust air management and the powerful H3700 controller allow the entire heat treatment process to be run fully automatically. The entry of all process data (temperatures, ramps, gas supply and vacuum) is easily controllable from a large, 12" graphic control panel. System status with all process-related data are clearly shown on a process control diagram. All valves and the vacuum pump can also be operated manually from here as well.

The system has an automatic pre-program and post-program for purging the furnace chamber and also features automated leak testing.

## Automatic Version VHT without Hydrogen Operation

- Features the same as basic version of VHT, plus:
- Automatic gas supply for one process gas ($N_2$ or Ar) with adjustable flow
- Bypass for rapid filling or flooding of furnace chamber
- Automatic gas outlet with check valve and pressure relief valve (20 mbar)
- Single-stage rotary vane pump with check valve for pre-evacuating and heat treatment in a rough vacuum to 20 mbar
- Transducer for absolute and relative pressure measurements
- H3700 controller (10 programs with 20 segments each)
- Operation with 12“ graphical control panel (touchpanel)




VHT gas supply diagram, automatic operation

**Additional Equipment**

- Mass flow controller for varying flow volumes and generating gas mixtures (with second process gas)
- Furnace pressure control with position-controlled exhaust valve (partial pressure control)
- Electric or gas-heated exhaust gas torch for process gas post-combustion
- Water-cooled exhaust gas cooler
- Condensate traps for separation of large amounts of binder
- Two-stage rotary vane pump with check valve for pre-evacuating and heat treatment in a vacuum to $10^{-2}$ mbar
- Pump stand with turbo-molecular pump and slide valve for pre-evacuating and for heat treatment in a vacuum to $10^{-5}$ mbar (only for molybdenum model) including electric pressure transducer and booster pump
- PC control via NCC with enhanced optional documentation and possible connection to customer LAN

Single-stage rotary vane pump for heat treatment in a rough vacuum to 20 mbar

Two-stage rotary vane pump for heat treatment in a vacuum to $10^{-2}$ mbar

Turbo-molecular pump with booster pump for heat treatment in a vacuum to $10^{-5}$ mbar

## Extension Package – Hydrogen in VHT-MO

When hydrogen is used as a process gas, our systems come equipped with additional safety technology. Only certified and industry proven safety sensors are used. The furnaces are always controlled using a fail-safe controller (S7-300F/safety controller). The controller and documentation are carried out using Nabertherm Control Center NCC (see page 45).

**VHT 8/16-MO** with molybdenum heating element

**Two Temperature-Dependent Concepts Available for Safe Operation with Hydrogen:**

- Partial pressure operation: $H_2$ infeed under controlled negative pressure (partial pressure) in the process reactor starting from 750 °C furnace chamber temperature
- Atmospheric operation: $H_2$ overpressure infeed in process reactor starting from room temperature

**Automatic Version VHT for Operation with Hydrogen**

- Features as found with automatic version of the VHT without hydrogen operation, plus
- Redundant process gas valves for hydrogen
- Monitored pre-pressures of all process gases
- Bypass for safe flushing of furnace chamber with inert gas
- Pressure-monitored emergency flooding with automated solenoid valve opening
- Electric or gas-heated exhaust gas torch for $H_2$ post-combustion

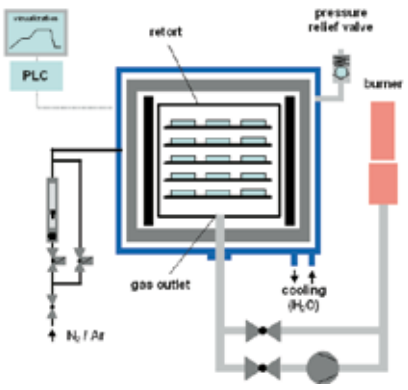
## Extension Package – Debinding and Sintering

The "Debinding and Sintering" extension package allows VHT furnaces with molybdenum heating to be used for processes causing process-related contamination during heat treatment. The furnace is equipped with an additional retort with direct gas inlet and outlet and exhaust gas torch.
Special gas plumbing prevents contamination of the furnace insulation and the heater due to the thermal process. The furnace can also optionally be equipped with a heated gas exhaust, a partial pressure debinding system, and a binding agent trap. The control system corresponds to that of the "Automatic" extension package.


Graphical control panel H 3700 for automatic version (touchpanel model)

**Automatic Version VHT-MO for Debinding/Sintering**

- Features such as the automatic version of the VHT without hydrogen, plus:
- Additional molybdenum retorts in the furnace chamber with direct gas inlet and outlet for protecting the furnace insulation
- Exhaust gas torch for post-combustion of gases produced by process
- Exhaust gas cooler




VHT gas supply diagram, debinding and sintering

**Additional Equipment**

- Heated gas outlet
- Binding agent trap with condensate separation for processes with a large proportion of binding agents
- Cooling unit for closed-loop water circuit

# Melting Furnaces K 1/10 - K 4/13, KC Models

K 1/10

KC 1/15

**K 1/10 - K 4/13, KC 1/15 + KC 2/15**

These compact melting furnaces for the melting of non-ferrous metals and alloys are one of a kind and have a number of technical advantages. Designed as tabletop models, they can be used for many laboratory applications. The practical counter balanced hinge with shock absorbers and the pouring groove on the front of the furnace make exact dosing easy when pouring the melt. The furnaces are available for furnace chamber temperatures of 1000, 1300, or 1500 °C. This corresponds to melt temperatures of about 80-110 °C lower.

- Tmax 1000 °C, 1300 °C, or 1500 °C, with melt temperature about 80 - 110 °C lower
- Crucible sizes of 1, 2, or 4 liters
- Crucible with integrated pouring spout of iso-graphite included with delivery
- Pouring groove on furnace for exact dosing
- Compact table design, simple emptying of crucible by tipping mechanism with hydraulic support
- Crucible for heating of furnace insulated with a hinged lid, lid opened when pouring
- Please see page 44 for a description of the different controllers

**Additional Equipment**

- Other crucible types available, e.g. steel or SiC
- Over-temperature limiter with adjustable cutout temperature for thermal protection class 2 in accordance with EN 60519-2 as temperature limiter to protect the oven and melt The furnace shuts off upon overtemperature and switches back on when the temperature falls below the critical level.


Over-temperature limiter

| Model | Tmax °C | Crucible | Volume in L | Outer dimensions in mm W | D | H | Supply power/kW | Electrical connection* | Weight in kg |
|---|---|---|---|---|---|---|---|---|---|
| K 1/10 | 1000 | A 6 | 1,0 | 520 | 680 | 660 | 3,0 | single-phase | 85 |
| K 2/10 | 1000 | A10 | 2,0 | 520 | 680 | 660 | 3,0 | single-phase | 90 |
| K 4/10 | 1000 | A25 | 4,0 | 570 | 755 | 705 | 3,6 | single-phase | 110 |
| K 1/13[2] | 1300 | A 6 | 1,0 | 520 | 680 | 660 | 3,0 | single-phase | 120 |
| K 2/13[2] | 1300 | A10 | 2,0 | 520 | 680 | 660 | 3,0 | single-phase | 125 |
| K 4/13[2] | 1300 | A25 | 4,0 | 570 | 755 | 705 | 5,5 | 3-phase[1] | 170 |
| KC 1/15[2] | 1500 | A6 | 1,0 | 580 | 630 | 580 | 10,5 | 3-phase | 170 |
| KC 2/15[2] | 1500 | A10 | 2,0 | 580 | 630 | 580 | 10,5 | 3-phase | 170 |

[1]Heating only between two phases

*Please see page 44 for information on mains voltage

[2]External dimensions of furnace, transformer in separate housing (500 x 570 x 300 mm)

# Assay Furnace N 110/HS

N 110/HS

**N 110/HS** with manual lift door and integrated control cabinet

**N 110/HS**

The N 110/HS furnace is especially used for the assay of precious metals where the insulation and heating must be protected from emerging gasses and vapours. The furnace chamber forms a ceramic muffle which can easily be replaced. In the standard design, the muffle is closed with a firebrick plug. A lift door can be installed instead upon request.

- Tmax 1300 °C
- Muffle heated from four sides
- Heating elements and insulation protected by ceramic muffle
- Simple replacement of muffle
- Operation also possible with open furnace if brick stopper is removed
- Tool holder on furnace
- Stainless steel exhaust chimney above the door opening for connection of an exhaust system
- Work platform with embedded ceramic plate in front of the muffle opening to place load
- Front side with large service door for easy access to the furnace chamber behind the muffle
- Switching and control unit separate from furnace
- Please see page 44 for a description of the different controllers

Customized pit furnace **S 73/HS** for the assay of large charges in crucibles

**Additional Equipment**

- Lift door, manually operated with counterweight or electrically operated, for easy opening and closing
- Electrical lift door drive with 2-hand button operation
- Second work platform with embedded ceramic plate below the standard platform
- Double-walled casing with fan cooling to reduce exterior temperatures

Work platform in front of muffle to place load

| Model | Tmax | Interior dimensions in mm | | | Volume | Outer dimensions in mm | | | Power | Electrical | Weight |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | °C | w | d | h | in L | W | D | H | kW | connection* | in kg |
| N 110/HS | 1300 | 260 | 340 | 95 | 8 | 760 | 790 | 1435 | 22 | 3-phase | 510 |

*Please see page 44 for more information about mains voltage

# Measurement and Control Systems

B 170

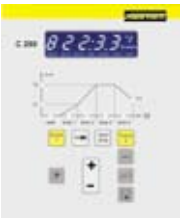
P 320

B 150

C 290

C 295

B 130



C 280

Nabertherm has many years of experience in the design and construction of both standard and custom control system. All controls are remarkable for their ease of use and even in the basic version have a wide variety of functions.

### Standard Controller

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, and a computer interface, we have a solution to meet your requirements.

### Assignment of Standard Controllers to Furnace Families

| | L 3 - LT 40 | LE 2/11 + LE 4/11 | LE 6/11 + LE 14/11 | LV 3/11 - LVT 15/11 | L 9/11/SKM | L(T) 9/../SW | N 7/H - N 61/H | R | RT 50-250/11 - RT 50-250/13 | RT 30-200/15 | RS | RSR | RHTC | RHTH/RHTV | TR 60 - TR 1050 | N 15/../HA | N 30/../HA - N 560/../HA | Top | N 40E - N 100 E | LH 15/12 - LF 120/14 | HTC 03/14 - HTC 08/16 | LHT 02/16 - LHT 08/18 | HT 04/16 - HT 16/18 | HFL 16/16 - HFL 160/17 | VHT | K 1/10 - K 4/13, KC | N 110/HS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Catalog page | 4,7,12 | 6 | 6 | 8 | 10 | 11 | 14 | 16 | 17 | 17 | 18 | 20 | 21 | 22 | 28 | 29 | 29 | 30 | 31 | 32 | 34 | 35 | 36 | 37 | 38 | 42 | 43 |
| Controller | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| B 170 | ✓ | | | ✓ | ✓ | ✓ | | ✓ | | | | ✓ | | | ✓ | ✓ | | | | | ✓ | | | | | | |
| P 320 | ● | | | ● | ● | ● | | ● | | | | ● | | | ● | ● | | | | | ● | | | | | | |
| R 6 | | ● | | | | | | | | | | | | | | | | | | | | | | | | | |
| C 6 | | | | | | | | | ✓ | | | | | | | | | | | | | | | | | ✓ | |
| 2416 | | | | | | | | | | ✓ | | | | | | | | | | | | | | | | | |
| B 150 | | | ✓ | | | | ✓ | | | | ✓ | | ✓ | | | | ✓ | | | ✓ | | | | | | | |
| C 290 | | | ● | | | | ● | | | | ● | | ● | | | | ● | | | ● | | | | | | | ✓ |
| C 295 | | | | | | | | | | | | | | ✓ | | | | | | | | ✓ | ✓ | ✓ | | | |
| B 130 | | | | | | | | | | | | | | | | | | ✓ | ✓ | | | | | | | | |
| C 280 | | | | | | | | | | | | | | | | | | ● | ● | | | | | | | | |
| HiProSystems | | | | | | | | ● | | | ● | | | ● | | | | | | | | | ● | ● | ✓ | | |

### Functionality of the Standard Controllers

| | B 170 | P 320 | R 6 | B 150 | C 290 | C 295 | B 130 | C 280 |
|---|---|---|---|---|---|---|---|---|
| Number of programs | 1 | 9 | 1 | 1 | 9 | 9 | 2 | 9 |
| Steps per program[1] | 2 | 8 | 1 | 2 | 40 | 16 | 3 | 3 |
| Extra functions (e.g. fan or autom. flaps) | | 2 | | | 2 | 2 | | 2 |
| Skip-button for segment jump | | | | | ✓ | | | |
| Clear, blue-white LCD display | ✓ | ✓ | | ✓ | ✓ | ✓ | ✓ | ✓ |
| Status messages in clear text | ✓ | ✓ | | ✓ | ✓ | ✓ | ✓ | ✓ |
| Start time configurable (e.g. to use night power rates) | ✓ | ✓ | | ✓ | ✓ | ✓ | ✓ | ✓ |
| Power usage measurement | ✓ | ✓ | | ✓ | ✓ | ✓ | ✓ | ✓ |
| Operating hour counter | ✓ | ✓ | | ✓ | ✓ | ✓ | ✓ | ✓ |
| Auto tune | ✓ | ✓ | | ✓ | ✓ | ✓ | ✓ | ✓ |
| Program entry in steps of 1 °C or 1 min. | ✓ | ✓ | | ✓ | ✓ | ✓ | ✓ | ✓ |
| Keypad lock | | | | ✓ | ✓ | | ✓ | ✓ |
| Interface for MV software | ● | ✓ | | ● | ● | ● | ● | ● |
| Programmable power outlet | | ✓* | | | | | | |

[1]2 steps equal to one ramp-soak pair
*not for model L(T)15..

✓ Standard
● Option

## Mains Voltages for Nabertherm Furnaces

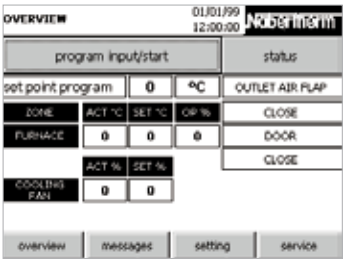
Single-phase: all furnaces are available for mains voltages from 110 V - 240 V at 50 or 60 Hz.

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

# Alternatives for High-Performance Control and Documentation

**HiProSystems Control and Documentation**

This professional control system for single and multi-zone furnaces is based on Siemens hardware and can be upgraded extensively. HiProSystems control is used in the following situations:
When more than two process-dependent functions, such as exhaust dampers, 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 necessary. The system is also perfectly suited for controlling multiple furnaces or furnace groups. It is flexible and is easily tailored to your process or documentation needs.




**H 1700** with monochrome presentation of data in table format

## Alternative User Interfaces

**Touch Panel H 700**

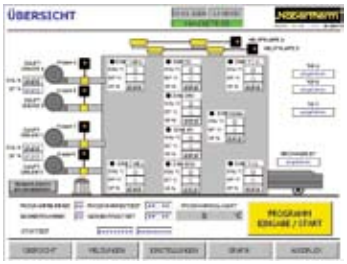
This basic panel accommodates most basic needs and is very easy to use.

**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 (RS 232, RS 422/485, USB, Ethernet TCI/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.




**H 3700** with colored graphic presentation of data

**Nabertherm Control Center NCC (PC-based)**

Upgrading the HiProSystems-Control 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.):

- Charge data can be read in via barcodes
- Interface for connection to existing Enterprise Database systems (e.g. SAP, Oracle)
- Internet connection for remote operation and monitoring
- Connection to mobile phone network for alarm message transmission via SMS
- Control from various locations over the network
- Documentation according to ISO 9000, etc.
- Maximum operator convenience: full keyboard, large screen
- Ideal for controlling furnace groups and documentation

Control Center NCC user interface displayed on a PC

**Controltherm MV Software for Monitoring, Documentation and Control with Standard Controllers**

Documentation and reproducibility are more important with the quality standards certain industries demand. Here, the powerful Nabertherm software, Controltherm MV provides an optimum solution for the control and documentation of one or more furnaces (furnace data only).


Program documentation with MV Software

**Features**

- Parallel control/monitoring and documentation of up to 16 furnaces
- Programming, archiving and printing of programs and graphics
- Documentation of furnace data according to ISO 9000 etc.
- Free input of descriptive charge data text
- Data exportable into Excel format for further evaluation
- Start/stop of the Controller from the local PC

**Temperature Recorder**

Reliable documentation method with a dot printer or continuous pen and up to six measuring points, also available with various digital storage systems (e.g. disk, CF card).

Temperature recorder

Thank you for reading this data sheet.

For pricing or for further information, please contact us at our UK Office, using the details below.

**UK Office**
**Keison Products,**
**P.O. Box 2124, Chelmsford, Essex, CM1 3UP, England.**
**Tel: +44 (0)330 088 0560**
**Fax: +44 (0)1245 808399**
**Email: sales@keison.co.uk**