Nabertherm

MORE THAN HEAT 30-3000 °C

Advanced Materials






Furnaces for

Powder Metallurgy
Technical Ceramics
Bio Ceramics
Metal Injection Molding – MIM
Ceramic Injection Molding – CIM
Enamelling
Battery Production
Fuel Cells
Wafer Technology
Photovoltaics
Crystal Growth
Energy Efficiency Technology

www.nabertherm.com

Made in Germany

Made in Germany

Nabertherm with 350 employees worldwide have been developing and producing industrial furnaces for many different applications for over 60 years. As a manufacturer, Nabertherm offers the widest and deepest range of furnaces worldwide. 150,000 satisfied customers in more than 100 countries offer proof of our commitment to excellent disign, quality and cost efficiency. Short delivery times are ensured due to our complete inhouse production and our wide variety of standard furnaces.

Setting Standards in Quality and Reliability

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

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

Global Sales and Service Network – Close to you

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

Large Test Center for Customers

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

Customer Service and Spare Parts

Our professional service engineers are available for you world-wide. Due to our complete inhouse production, we can despatch most spare parts from stock over night or produce with short delivery time.

Experience in Many Fields of Thermal Processing

In addition to furnaces for Advanced Materials, Nabertherm offers a wide range of standard furnaces and systems for many other thermal processing applications. The modular design of our products provides for customized solutions to your individual needs without expensive modifications.

Content

Which Furnace for Which Process?

Debinding, Drying, Vaporizing, Dewaxing

Catalytic

- Chamber retort furnaces, NRA .. CDB, page 46

Thermal

in Air

- Air circulation chamber furnaces, N .. HACDB, page 8
- Air circulation bogie hearth furnaces, W .. HACDB, page 9
- Air circulation chamber furnaces according to EN 1539, N .. HACLS, page 10
- Ovens TR .. and KTR .., page 11
- Electrically heated dewaxing furnaces, N .. WAX, page 12
- Gas-heated dewaxing furnaces, NB .. WAX, page 12

Pyrolysis

under Protective Gas, Reaction Gas or Vacuum

- Bogie hearth furnaces with gas feed boxes, W .. IDB, page 14
- Chamber retort furnaces, NR and NRA .. IDB, page 38
- Pit-type retort furnaces, SR and SRA .. IDB, page 41
- Vacuum high-temperature chamber furnaces, VHT .., page 42

Debinding + Sintering

in Air

- Chamber furnaces with fresh air preheating, N .. HDB, page 20
- Bogie hearth furnaces with fresh air preheating, W .. HDB, page 14
- Lift-top furnaces with fresh air preheating, H .. HDB, page 18
- High-temperature chamber furnaces with fresh air preheating, HT .. DB, page 30
- HT lift-top furnaces with fresh air preheating, HT .. LTDB, page 26
- HT lift-bottom furnaces with fresh air preheating, HT .. LBDB, page 26

Debinding in Air, Sintering under Protective Gas

- Chamber furnaces with fresh air preheating, N .. HDB, page 20

Retort furnace with safety technology, models NRA .. for sintering under hydrogen atmosphere, see page 38

Combi chamber furnace N 650/HDB for debinding and sintering in air, see page 20

Sintering, Calcinating, Drying, Preheating

in Air

- Chamber furnaces, N .., page 22
- Bogie hearth furnaces, W .., page 14
- Lift-top and lift-bottom furnaces, H .., page 18
- Pit-type and chest furnaces, S .., page 17
- Gas-heated chamber furnaces, NB .., page 24
- Gas-heated bogie hearth furnaces, WB .., page 25
- High-temperature chamber furnaces, HT .., page 30
- High-temperature lift-bottom furnaces, HT .. LB, page 26
- High-temperature lift-top furnaces, HT ..LT, page 26
- High-temperature chamber furnaces, stone-insulated, HFL .., page 33
- High-temperature chamber furnaces, gas-heated, HTB .., page 34
- Continuous furnace, D .., page 37
- Rotary hearth furnaces, DH .., page 36

under Protective Gas, Reaction Gas or in Vacuum

- Sealed chamber furnaces, N .., page 22
- Bogie hearth furnaces with gas boxes, W .., page 14
- Sealed lift-top and lift-bottom furnaces, H .., page 18
- Sealed high-temperature furnaces, HT .., page 30
- Chamber retort furnaces, NR .. and NRA .., page 40
- Pit-type retort furnaces, SR .. and SRA, page 41
- High-temperature chamber retort furnaces, VHT .., page 42

Laboratory Furnaces

- Tube furnaces, R .., page 54
- Chamber furnaces, LH .., page 48
- Gradient furnace, GR .., page 47
- Fast firing furnaces, LS .., page 47
- High-temperature furnaces for TGA tests, LHT/SW, page 53
- High-temperature chamber furnaces, LHT .., page 51
- High-temperature lift-bottom furnaces, LHT .. LB(R), page 52
- High-temperature chamber furnace, SiC, HTC .., page 50

Exhaust Cleaning

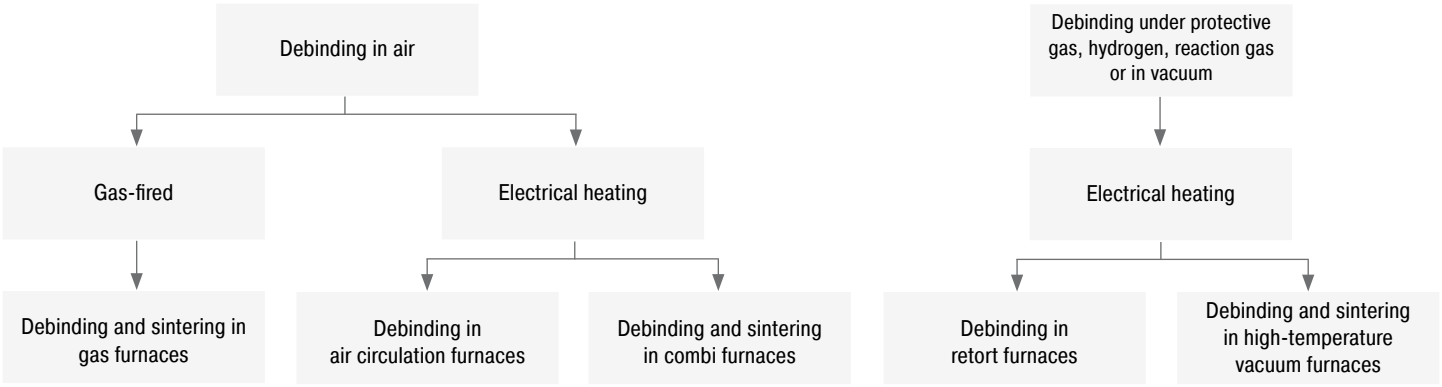
- Catalytic afterburning, page 35
- Thermal afterburning, page 35

Tube furnace for hydrogen operation, see page 65

Matrix Debinding Technology

Debinding of technical ceramics is both a critical process due to the released hydrocarbons and a technical challenge due to the necessary precise temperature control. Nabertherm offers professional solutions for the different debinding methods.

Debinding Methods



I. Debinding in Air

1. Debinding (and Sintering) in Directly Gas-Heated Furnaces

Compared with electrically heated furnaces, gas-heated furnaces have the advantage that the released hydrocarbons are almost completely burned immediately during the firing process. Therefore, gas-heated furnaces are especially used when the vaporization process is difficult to manage e.g. due to high vaporization dynamics. Hence, unavoidable erratic releases of hydrocarbons do not necessitate any elaborate process control or long process times. If, on the other hand, the debinding process requires precise temperature control or a good temperature uniformity, in particular at low temperatures, this challenge can be met only with the employment of electrically heated debinding furnaces.

2. Debinding (and Sintering) in Electrically Heated Furnaces

For debinding in air with electrical heating, Nabertherm offers different debinding packages for different process requirements. All debinding packages comprise a professional, integrated safety technology. Depending on the process a passive or active safety concept can be chosen.

a) Passive Safety Concept

Basically, all Nabertherm debinding furnaces are equipped with a passive safety concept. The electrically heated furnaces operate according to the dilution principle by means of fresh air injection, in order to reduce the gas emissions from the load to a noncombustible atmosphere in the furnace. It is the customer's responsibility to ensure that the maximum permissible vaporization rate is not exceeded, i.e. that the furnace is not overloaded with organic substances and the executable thermal profiles are appropriately defined. The monitoring of all safety-related process parameters, e.g. volume flow, and a corresponding emergency program in case of failure ensures a safe operation. In practice the passive safety concept has prevailed based on the good cost/performance ratio. Subject to process requirements, there are two different debinding packages available as described below.

Debinding Package I

This package represents the basic version for safe debinding and is ideally suited for recurring processes with defined vaporization rates. The furnace is equipped with a fresh air fan and an exhaust gas fan. Both units are firmly mounted on the furnace and factory-adjusted so that the volume of fresh air required for the debinding process is injected in a controlled mode to assure a certain underpressure in the furnace chamber, so that the exhaust gases are discharged exclusively through the exhaust gas outlet and not into the production hall. The fresh air required for the process is indirectly preheated via inlet channels. Monitoring of the furnace underpressure ensures a safe operation.

In addition, an independent ramp monitor is installed, where the customer sets the maximum permissible heating gradient during the debinding process. If in case of faulty operation or a control failure this gradient is exceeded or another safety-related fault is detected, an emergency program ensures that the furnace is transferred into a safe mode. As additional equipment, Debinding Package I can be expanded with active fresh air preheating and/or controlled cooling.

Debinding Package II

Debinding Package II is the convenient solution for the variable ceramics production, since there is ample flexibility to accommodate different or frequently changing debinding processes. The basic differences and advantages compared with Debinding Package I are:

- Program adjustable fresh air volume depending on the vaporization rate of the product
- Fresh air preheating with separate air preheater. The fresh air temperature (up to max. 500 °C) is controlled as additional heat source depending on the furnace temperature. This results in a very good heat transfer and improved temperature uniformity.
- Automatic control of the exhaust gas fan depending on the preselected fresh air volume provides for advantages in temperature control (temperature uniformity) and adapted discharge of the exhaust gases
- Differentiated emergency program: Depending on the fault different emergency programs are automatically executed
- Perforated injection tubes in the furnace chamber depening on furnace model for uniform distribution of the preheated fresh air through the horizontal charging layers
- Display at the furnace for underpressure and volume flow
- PLC controls with touch panel H 1700 (see also page 70)
- Controlled cooling as standard

b) Active Safety Concept

Alternatively, an active safety concept is also available as additional equipment on request. The actually vaporized organic volume in the furnace chamber is monitored by means of the flame-thermal analysis (FTA). The fresh air and exhaust gas fans are automatically reconciled accordingly. In case of unsafe condition in the furnace e.g. from overloading, a heating gradient that is too fast or inadequate fresh air supply, the necessary emergency program is immediately initiated depending on the process step.

2.1. Debinding in Air Circulation Furnaces

Air circulation furnaces are generally the right choice when debinding is the only process. Depending on the raw materials or temperature requirements, the green compacts can also be presintered. Air circulation furnaces convince by their good temperature uniformity even with dense loads, their accelerated heat transfer and their better charge penetration. Debinding and sintering in two process steps is always advisable if a better capacity utilization of the different furnaces and a reduced overall investment volume can be achieved.

2.2. Debinding and Sintering in Combi Furnaces

Combi furnaces provide for debinding and subsequent sintering in just one furnace system. Debinding and sintering or pre-sintering in one process step offer the following advantages:

- Shortened process times: cooling, transfer, no second heating process required
- Energetic advantages
- Reduced scrap risk

The use of combi furnaces is always advisable when charging takes a longer a period of time or if the debindered green/brown compacts are sensitive to cooling and transfer due to their material properties or parts geometry. Nabertherm combi furnaces have successfully proven their reliability in the market for years. Equipped with mature system modules, these furnaces are the right choice for sophisticated processes. For example, the controlled air-preheating provides – besides the conventional furnace heating – for an optimum heat distribution up to 500 °C and, therefore, for excellent quality results.

II. Debinding under Protective Gas, Hydrogen, Reaction Gas or in Vacuum

Besides debinding in air, debinding processes in technical ceramics or powder metallurgy are also executed under protective gas, hydrogen, reaction gas or in vacuum to achieve other process or quality requirements. Also, for these applications Nabertherm offers standard as well as customized furnace solutions, explained in detail on following catalog pages. The safety technology varies subject to the specific process requirements.

Heat Recovery Systems for Energy Savings Purposes

With rising energy costs, but also for environmental reasons, the integration of heat recovery systems is paying off more and more. Depending on the furnace size and process, there is always a certain potential for energy recovery through heat exchangers from the released process exhaust gases or warm disposal air of the furnace system. Especially for large furnace systems or long process times the achieven energy savings will pay back the additional investment in just a short time. We would be glad to advise you on whether an additional heat recovery module would be a useful addition to your furnace system.

Air Circulation Chamber Furnaces for Debinding in Air up to 650 °C

Debinding line with integrated heat recovery system for utilizing the exhaust heat for fresh air preheating

N 250/65HACDB with debinding package I

N 120/65 HACDB - N 500/65 HACDB

The air circulation chamber furnaces N 120/65 HACDB - N 500/65 HACDB are perfectly suited for debinding processes that require a good temperature uniformity due to the parts geometry or characteristics of the binder. The powerful, horizontal air circulation with high air flow rate provides for full utilization of the furnace in different charging layers. Uniform process results are ensured even for small components, such as CIM manufactured parts. On request, the furnaces can be equipped with catalytic or thermal afterburning to clean the exhaust gases. Following the debinding the components are transferred to the sintering furnace.

- Tmax 650 °C
- Powerful, horizontal air circulation provides for a temperature uniformity of ΔT 8 K according to DIN 17052
- Debinding Package I with passive safety package and monitoring of the underpressure in the furnace chamber, exhaust gas fan, fresh air fan, preset underpressure in the furnace chamber, controlled by Nabertherm controller P 300, see page 6
- Connection port for further piping behind the exhaust fan
- Welded inside housing of the furnace made of stainless steel 1.4301
- Holders for removable trays for charging in multiple layers
- 3 removable trays included with delivery
- Heating switched with low-wear semiconductor relay
- Over-temperature limit controller with manual reset for thermal protection class 2 in accordance with EN 60519-2 as temperature limiter to protect the furnace and load

Extricable charging trays for debinding on different layers

Additional equipment

- Additional trays
- Controlled cooling including PLC control of the heating and cooling air fan
- Fresh air preheating and controlled fan cooling, including PLC control of the furnace heating as well as the fresh air preheating as a second heat source
- Debinding Package II with passive safety concept, see page 7
- Thermal or catalytic exhaust cleaning systems, see page 35
- Heat recovery systems, see page 7
- Emergency purging with nitrogen
- Commissioning of the furnace with test firing and temperature uniformity measurement (also with load) for the purpose of process optimization
- Process documentation and control with Controltherm MV software package for the basic furnace or Nabertherm Control Center (NCC) for monitoring, documentation and control in combination with Debinding Package II, see page 70

Air Circulation Bogie Hearth Furnaces for Debinding in Air up to 600 °C

Bogie hearth furnace system for debinding with cross sliding device

W 1000/60 HACDB - W 8100/60 HACDB

The air circulation bogie hearth furnaces W 1000/60 HACDB - W 8100/60 HACDB are designed for debinding large volumes of material. The functionality corresponds to air circulation chamber furnaces for debinding. These powerful production furnaces are equipped with a passive safety package providing for a reliable process control. On request the furnaces can be equipped with catalytic or thermal afterburning to clean the exhaust gases.

- Tmax 600 °C
- Powerful, horizontal air circulation provides for a temperature uniformity of ΔT 8 K according to DIN 17052
- Debinding Package I with passive safety package and monitoring underpressure in the furnace chamber, exhaust gas fan, fresh air fan, preset underpressure in the furnace chamber, controlled by Nabertherm controller P 300, see page 6
- Connection port for further piping behind the exhaust fan
- Inside sheets of the furnace made of stainless steel 1.4301 fully cover the insulation
- Heating switched with low-wear semiconductor relay
- Over-temperature limit controller with manual reset for thermal protection class 2 in accordance with EN 60519-2 as temperature limiter to protect the furnace and load

Furnace chamber with air baffle plates

Additional equipment

- Controlled cooling including PLC control of the heating and cooling air fan
- Fresh air preheating and controlled fan cooling, including PLC control of the furnace heating as well as the fresh air preheating as a second heat source
- Debinding Package II with passive safety concept, see page 7
- Thermal or catalytic exhaust cleaning systems, see page 35
- Heat recovery systems, see page 7
- Emergency purging with nitrogen
- Additional bogie, rail operation, cross-traversal system, see pages 14 ff.
- Commissioning of the furnace with test firing and temperature uniformity measurement (also with load) for the purpose of process optimization
- Process documentation and control with Controltherm MV software package for the basic furnace or Nabertherm Control Center (NCC) for monitoring, documentation and control for use of Debinding Package II, see page 70

Air Circulation Chamber Furnaces/Ovens with Safety Technology for Solvent-Containing Charges according to EN 1539 or NFPA 86

Ship-lock type furnace N 560/ 6HACLS with safety technology, front charging and rear unloading

Drying oven KTR 1500 for drying of foundry cores with an alcohol-based binder

Safety Technology for Air Circulation Chamber Furnaces

Certain processes release and vaporize solvents or other flammable vapors. The concentration of these vapors must be kept below a certain limit to prevent ignition. European Norm EN 1539 and NFPA 86 in the USA prescribe the required safety equipment for these processes.

Exhaust port and powerful exhaust fan mounted on the furnace

For these applications and processes, all air circirculation furnaces of the KTR and N ..HACLS product lines are suited with safety technology for protection of a potentional ignition in the furnace chamber.

To avoid an ignition in the furnace, flammable vapors must be diluted with air. Special care must be taken so high concentrations of flammable materials do not accumulate in “dead” areas within the furnace. For this purpose, the furnaces are equipped with an exhaust gas fan providing for a defined suction flow. A measurement system monitors this flow, while fresh air is simultaneously resupplied. In parallel, the furnace atmosphere is diluted by the inflow of fresh air. The air circulation is also monitored by the measurement system. Furnaces with a capacity greater than 1000 liters are additionally equipped with an explosion pressure relief.

- Furnace sizes between 120 and 10,000 liters
- Powerful exhaust fan capable of maintaining negative furnace pressure
- Defined and monitored air circulation flow and exhaust air
- Visual and audible emergency signals
- Overtemperature selection limiter with adjustable cutout temperature for thermal protection class 2 in accordance with EN 60519-2 as temperature limiter for the furnace and the product
- Description of the control system see page 70

Special door sealing with circular sealing lip

Max. amount of solvent at°C in grams per charge	N 560/..	N 1000/..	N 1500/..	N 2000/..	N 2010/..	N 3920/..	N 4000/..	N 4010/..	N 4500/..	N 5600/..	N 6750/..	N 7200/..	N 10000/..
150 °C	37	71	76	92	92	162	162	162	172	183	225	235	263
200 °C	26	50	57	69	99	121	121	121	132	139	171	180	203
250 °C	21	39	45	55	55	96	96	96	98	112	137	145	165

Ovens up to 300 °C

TR 1050 with double door

KTR 1500

TR 60 - TR 1050 and KTR 1500 - KTR 10000

With their maximum working temperature of up to 300 °C and forced air circulation, the ovens achieve a perfect temperature uniformity. They can be used for various applications such as e.g. drying, sterilizing or warm storing. The stainless steel interior chamber is easy to clean and rust-resistant. For larger charges up to 10000 liters, the KTR product line is the right choice.

TR 240

- Tmax KTR 260 °C and TR 300 °C
- Operating range, room temperature + 5 °C to 300 °C
- Models TR 60 - TR 240 designed as tabletop models
- Models TR 420 - TR 1050 and KTR designed as free standing models
- Horizontal, forced air circulation results in temperature uniformity better than ΔT 8 K
- Stainless steel chamber, alloy 304 (AISI)/(DIN material no. 1.4301), rust-resistant and easy to clean
- Large handle for opening and closing the door
- Charging in multiple layers possible using removeable trays (number of removeable trays included, see table below)
- Large, wide-opening swing door, hinged on the right with quick release for models TR 60 - TR 420
- Door hinge for models TR 60 - TR 420 can be simply changed from the right to the left side
- Double swing door with quick release for TR 1050
- Infinitely adjustable exhaust at the rear wall with operation from the front (only TR line)
- PID microprocessor control with self-diagnosis system
- Solid state relays provide for lownoise operation
- Description of the control system see page 70

Infinitely adjustable fan speed of the aircirculation as additional equipment

Additional equipment

- Over-temperature limit controller with manual reset for thermal protection class 2 in accordance with EN 60519-2 as temperature limiter to protect the furnace and load
- Infinitely adjustable fan speed of the air circulation fan
- Window for charge observing
- Further removable trays with rails

Extricable metal trays to load the oven in different layers

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	Trays incl.	Trays max.	Max. total load[1]
TR 60	300	450	380	350	60	700	650	690	2.1	single-phase	90	1	4	120
TR 120	300	650	380	500	120	900	650	840	2.1	single-phase	150	2	7	150
TR 240	300	750	550	600	240	1000	820	940	3.1	single-phase	190	2	8	150
TR 420	300	710	550	1080	420	860	830	1370	6.3	three-phase	120	3	17	150
TR 1050	300	1240	570	1510	1050	1430	860	1920	9.3	three-phase	380	4	22	170

KTR 1500 - KTR 10000 Please ask for separate quote.

[1]Max. load per layer 30 kg

*Please see page 70 for more information about mains voltage

Dewaxing Furnaces, Electrically Heated or Directly Gas-Fired

N 150/WAX

N 660/WAX

Grid bottom

N 100/WAX - N 2200/WAX with Electrical Heating

The N and NB chamber furnaces are especially designed for dewaxing and subsequent firing of the ceramic form. The electrically heated models are operated below the ignition point of the wax during dewaxing. The furnaces have a heated stainless steel drain in the bottom of the furnace chamber, formed as a funnel with the discharge near the center of the furnace. The drainage is made of stainless steel. The stainless steel grids in the bottom can be removed for cleaning . To prevent draining wax from ignition, there is a tight stainless steel container under the furnace with a removable drawer for wax collection as a safety feature. After the dewaxing process is finished the furnace continues heating in order to sinter the molds.

Drain pan in floor

Standard equipment N/WAX, electrically heated

- Chamber furnace with wide-opening swinging door
- Tmax 850 °C
- Four side heating with freely radiating heating elements on ceramic carrier tubes
- Heated drainage in floor, controlled by a separate controller up to a maximum of 00 °C, to reliably prevent freezing of the draining wax - Release of furnace heating only possible after drain temperature is reached, to prevent clogging
- Stainless steel floor pan with grid bottom for level loading
- Rugged self-supporting, vaulted arch construction
- Exhaust gas vent in furnace ceiling for connection with ductwork (starting with N 440 manual exhaust flap)
- Air inlet openings for reliable air exchange
- Double-walled furnace housing for low exterior temperatures
- Removable base included in delivery (fixed base for models N 440 and larger)
- First over-temperature limit controller which must be set below the ignition point of the wax and prevents the wax from igniting during dewaxing. It is customers responsibility to set the required time interwal for dewaxing. After this time has elapsed the over-temperature limit controller will be deactivated to make sure that the furnace can continue with the sintering process.
- Second over-temperature limit controller with manual reset for thermal protection class 2 in accordance with EN 60519-2 as temperature limiter to protect the furnace and load

Gas-fired NB 660/WAX

NB 660/WAX - NB 1000/WAX with Directly Gas-Fired

These furnaces can be operated above the flash point of wax without further safety equipment. They are used if large amounts of wax have to be molten or the wax flash point is unknown. The molten wax drains off in a stainless steel container through an outlet in the furnace bottom. Additionally, a part of the wax is already vaporized inside the furnace.

Drawer for collection of liquid wax

Standard equipment NB/WAX, directly gas-fired

- Features like N../WAX, except:
- Furnace volumes 660 liters and 1000 liters
- Directly gas-fired using fan burners with fully automatic temperature regulation
- Gas fittings with safety system
- Automatic ignition with monitor
- Gas types: city gas, natural gas, or propane gas
- Special positioning of the gas burner for optimum temperature uniformity
- Exhaust hood with exit connection 150 mm

Additional equipment for N and NB

- Catalytic or thermal afterburning systems, see page 35

Model	Tmax	Inner dimensions in mm			Volume	Outer dimensions in mm			Max. drain-off volume	Power	Electrical	Weight
	°C	w	d	h	in l	W	D	H	in l	kW	connection*	in kg
NB 660/WAX	850	550	700	780	300	860	1340	1750	20	36.0	-	430
NB 1000/WAX	850	600	1100	1000	650	1000	1820	1820	25	105.0	three-phase	850
N 100/WAX	850	400	530	460	100	660	1045	1430	5	7.5	three-phase	340
N 150/WAX	850	450	530	590	150	710	1045	1560	8	9.5	three-phase	360
N 200/WAX	850	500	530	720	200	760	1045	1690	10	11.5	three-phase	440
N 300/WAX	850	550	700	780	300	810	1215	1750	15	15.5	three-phase	480
N 440/WAX	850	600	750	1000	450	1010	1440	1815	17	20.5	three-phase	885
N 660/WAX	850	700	850	1100	650	1120	1540	1925	20	26.5	three-phase	1000
N 1000/WAX	850	800	1000	1250	1000	1290	1730	1830	25	40.5	three-phase	1870
N 1500/WAX	850	900	1200	1400	1500	1390	1930	1990	35	57.5	three-phase	2570
N 2200/WAX	850	1000	1400	1600	2200	1490	2130	2190	50	75.5	three-phase	3170

*Please see page 70 for more information about mains voltage

Bogie Hearth Furnaces up to 1400 °C, also as Combi Furnaces for Debinding and Sintering in one Process

W 1500/H

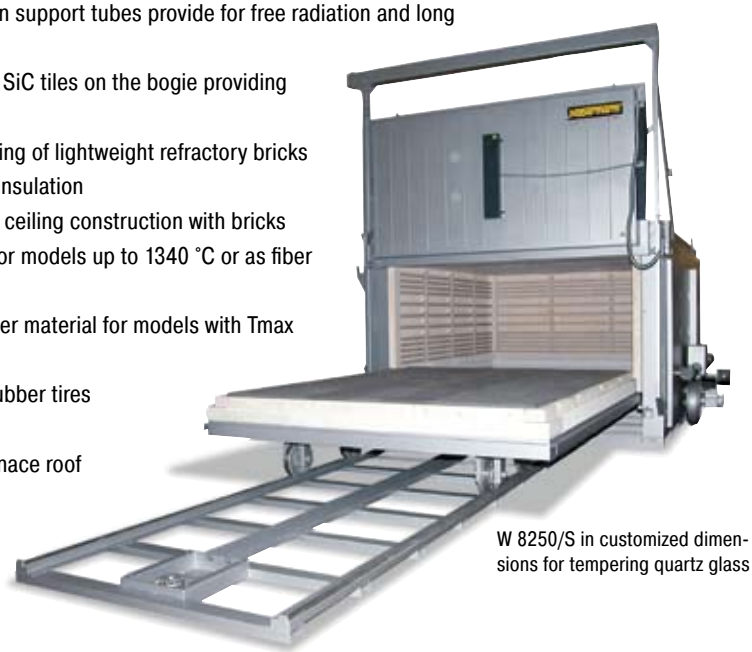
Bogie hearth furnace W 2060/S, customized without bogie heating for preheating fusion molds

W 1000 - W 10000/14, W 1000/DB - W 10000/14DB

Bogie hearth furnaces offer a whole series of advantages in firing, sintering and tempering in production. The bogie can be loaded outside the furnace. If multiple bogies are used, one bogie can be loaded while the other is in use in the furnace. Useful accessories like multi-zone control to optimize the temperature uniformity, controlled cooling systems to shorten process times to the fully automatic system with motorized bogies and bogie exchange provide for the perfect adaptation of these furnaces to production process. A combi furnace version with debinding package for debinding and sintering in a single process is also possible.

- Tmax 1280 °C, 1340 °C or 1400 °C
- Double-walled housing with rear ventilation, provides low shell temperatures
- Swing door hinged on the right side
- Heating from five sides (four sides and bogie) provides for a good temperature uniformity
- Bogie heating receives power via blade contacts when driven in
- Heating elements mounted on support tubes provide for free radiation and long service life
- Bottom heating protected by SiC tiles on the bogie providing level stacking surface
- Multi-layer insulation consisting of lightweight refractory bricks backed by microporus silica insulation
- Self-supporting and long-life ceiling construction with bricks laid in arched construction, for models up to 1340 °C or as fiber insulation
- Roof made of high-quality fiber material for models with Tmax 1400 °C
- Bogies freely movable with rubber tires
- Adjustable air inlet damper
- Manual vapor vent on the furnace roof

Bogie hearth furnace W 3300 for glazing melting crucibles for the solar industry



W 8250/S in customized dimensions for tempering quartz glass

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

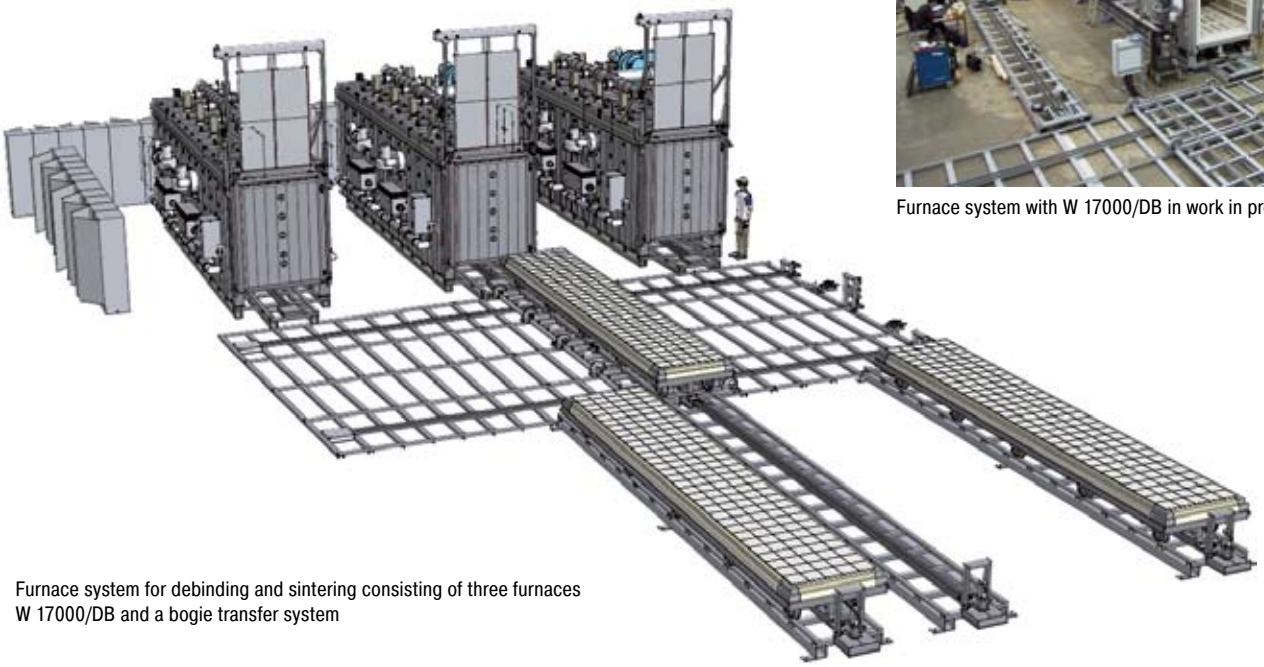
Additional equipment

- Customized dimensions
- Fiber insulation for short heating time requirements
- Bogies with flanged wheels running on rails for easy and precise movement of high loads or complex kiln furniture
- Electric chain-driven bogie in combination with rail operation for smooth movement of heavy loads
- Bogie running on steel wheels with gear rack drive, no rails in front of the furnace necessary
- Different possibilities for an extension to a bogie hearth furnace system:
  - Additional bogies
  - Bogie transfer system with parking rails to exchange bogies running on rails or to connect multiples furnaces
  - Motor-driven bogies and cross-traversal system
  - Fully automatic control of the bogie exchange
- Electro-hydraulic lift door
- Customized kiln furniture
- Motor-driven exhaust air flap, switchable via the program
- Controlled cooling system with frequency-controlled cooling fan and motorized exhaust air flap
- Multi-zone control adapted to the particular furnace provides model for optimal the temperature uniformity
- Commissioning of the furnace with test firing and temperature uniformity measurement (also with load) for the purpose of process optimization
- Debinding packages with passive safety concept, see page 7
- Thermal or catalytic exhaust cleaning systems, see page 35
- Process documentation and control with Controltherm MV software package for the basic furnace or Nabertherm Control Center (NCC) for monitoring, documentation and control for use of Debinding Package II, see page 70

Bogie running on steel wheels with gear rack drive, no rails necessary

Bogie hearth furnace W 2200 DB with Debinding Package II

Furnace system with W 17000/DB in work in progress



Furnace system for debinding and sintering consisting of three furnaces W 17000/DB and a bogie transfer system

Bogie Hearth Furnaces up to 1400 °C, also as Combi Furnaces for Debinding and Sintering in one Process

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

Bogie hearth furnace with gas box for debinding and sintering under protective gas

Model	Tmax	Inner dimensions in mm			Volume	Outer dimensions in mm			Supply	Electrical	Weight
	°C	w	d	h	in l	W	D	H	power/kW	connection*	in kg
W 1000	1280	800	1600	800	1000	1470	2400	1820	57	three-phase	3000
W 1500	1280	900	1900	900	1500	1570	2700	2010	75	three-phase	3500
W 2200	1280	1000	2200	1000	2200	1670	3000	2120	110	three-phase	4500
W 3300	1280	1000	2800	1200	3300	1670	3600	2320	140	three-phase	5300
W 5000	1280	1000	3600	1400	5000	1670	4400	2520	185	three-phase	7300
W 7500	1280	1000	5400	1400	7500	1670	6200	2520	235	three-phase	10300
W 10000	1280	1000	7100	1400	10000	1670	7900	2520	300	three-phase	12500
W 1000/H	1340	800	1600	800	1000	1470	2400	1820	75	three-phase	3500
W 1500/H	1340	900	1900	900	1500	1570	2700	2010	110	three-phase	4000
W 2200/H	1340	1000	2200	1000	2200	1670	3000	2120	140	three-phase	5000
W 3300/H	1340	1000	2800	1200	3300	1670	3600	2320	185	three-phase	6000
W 5000/H	1340	1000	3600	1400	5000	1670	4400	2520	235	three-phase	8000
W 7500/H	1340	1000	5400	1400	7500	1670	6200	2520	370	three-phase	11300
W 10000/H	1340	1000	7100	1400	10000	1670	7900	2520	440	three-phase	13800
W 1000/14	1400	800	1600	800	1000	1470	2400	1820	75	three-phase	3300
W 1500/14	1400	900	1900	900	1500	1570	2700	2010	110	three-phase	3800
W 2200/14	1400	1000	2200	1000	2200	1670	3000	2120	140	three-phase	4800
W 3300/14	1400	1000	2800	1200	3300	1670	3600	2320	185	three-phase	5700
W 5000/14	1400	1000	3600	1400	5000	1670	4400	2520	235	three-phase	7700
W 7500/14	1400	1000	5400	1400	7500	1670	6200	2520	370	three-phase	10900
W 10000/14	1400	1000	7100	1400	10000	1670	7900	2520	440	three-phase	13300

*Please see page 70 for more information about mains voltage

Pit-Type and Top-Loading Furnaces up to 1400 °C

S 5120/GS1 with individual customized dimensions, furnace chamber divided in two sections, split cover

Our top-loading furnaces are perfectly suited for firing, sintering or tempering of long, heavy products. Charging is mostly carried out with the help of an overhead crane. Heating from all sides and from the bottom provides for an good temperature uniformity. Tailor-made dimensions are designed and manufactured in accordance with the size and weight of components.

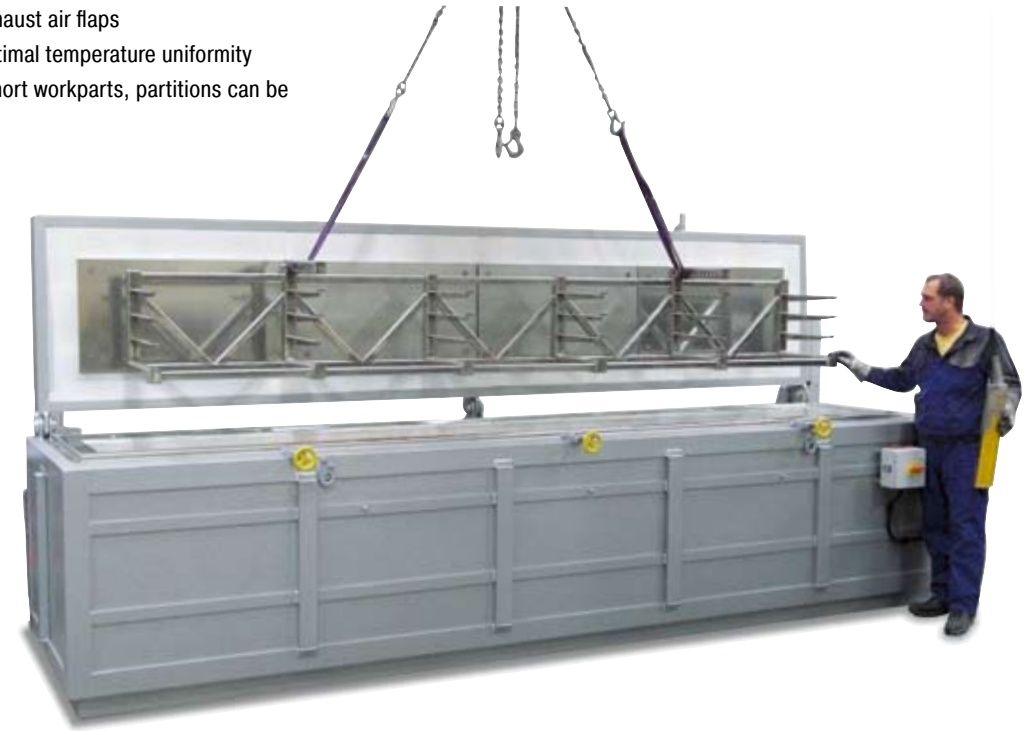
- Tmax 900 °C, 1280 °C, 1340 °C or 1400 °C
- Five-side heating from the sides and the bottom
- Heating elements on supporting tubes provide for long service life
- SiC-bottom plates provide for level stack charging surface
- Bottom heating protected by SiC plates
- Multiple layer insulation with lightweight refractory bricks and special backing isolation
- Lid insulation consists of fiber material with a special fastening
- Electrohydraulic opening system of the lid with two-hand operation
- Closable air supply vents in the lower area of the furnace chamber
- Closable exhaust air vents in the lid
- Over-temperature limit controller with manual reset for thermal protection class 2 in accordance with EN 60519-2 as temperature limiter to protect the furnace and load

Furnace chamber S 5120/GS with receptacle for an insulating plate in order to devide the furnace chamber

Additional equipment

- Automatic exhaust air flaps for faster cooling
- Controlled fan cooling with electrically driven exhaust air flaps
- Multi-zone control of the heating provides for optimal temperature uniformity
- Furnace chamber can be devided in length for short workparts, partitions can be controlled separately
- Customized dimensions
- Customized charging racks

S 4100/S with customized dimensions for sintering of high parts



S 1512/85HAS with customized charging rack

Lift-Top or Lift-Bottom Furnaces up to 1400 °C, also as Combi Furnaces for Debinding and Sintering in One Process

H 1000/S

Lift-bottom furnace H 1710 LBS with debinding package II for debinding and sintering in one process

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

In production lift-top and lift-bottom furnaces have the advantage in comparison with chamber furnaces that even complex charge loads can be clearly arranged. The basic furnace is equipped with a table fixed in place under the hood. The system can be expanded to include one or more changeable tables, either manually or motor driven. Depending on process conditions, a lift-top- or lift-bottom version is advisable. Further additional equipment like a multi-zone control to optimize the temperature uniformity or controlled cooling systems for shorter processes provide for customized solution with respect to the process requirements. A combi furnace version with Debinding Package I or II for debinding and sintering in a single process is also available. The furnaces are moreover perfectly suited for special applications like sintering fuel cells, in which auxiliary fittings must be introduced in the furnace from below or above.

- Tmax 1280 °C
- Double-walled housing with rear ventilation for low shell temperatures
- Electrohydraulically driven hood with fixed table
- Five-sided heating from all four sides and from the table provides for a good temperature uniformity
- Heating elements mounted on support tubes provide for free radiation and long service life of the heating wire
- Bottom heating protected by SiC tiles which provide for a level stacking surface
- Multilayer insulation consisting of lightweight refractory bricks backed by special insulation
- Long-life ceiling design with fiber insulation
- Manual exhaust air flap on the furnace roof
- Over-temperature limit controller with manual reset for thermal protection class 2 in accordance with EN 60519-2 as temperature limiter to protect the furnace and load

Lift-top furnace H 3630/LTHDB for debinding and sintering

Lift-top system H 245/LTS customized with cooling station and table changing system

Additional equipment

- Customized dimensions
- Tmax to 1400 °C
- Lift-bottom furnace version with driven table and fixed hood
- Controlled cooling system with frequency-controlled cooling fan and motor-driven exhaust air flap
- Protective gas connection as well as sealing of the furnace housing for purging the furnace with protective gases
- Manual or automatic gas supply systems
- Multi-zone control adapted to the particular furnace provides model for optimal the temperature uniformity
- Commissioning of the furnace with test firing and temperature uniformity measurement (also with load) for the purpose of process optimization
- Additional tables, table changing system, also automatically driven
- Motor-driven exhaust air flap, switchable via the program
- Debinding Package I with passive safety package and monitoring of the underpressure in the furnace chamber, exhaust gas fan, fresh air fan, preset underpressure in the furnace chamber, controlled by Nabertherm controller P 300, see page 6
- Debinding Package II with passive safety concept, see page 7
- Exhaust air and exhaust gas piping
- Thermal or catalytic exhaust cleaning systems, see page 35
- Heat recovery systems, see page 7
- Emergency purging with nitrogen
- Process documentation and control with Controltherm MV software package for the basic furnace or Nabertherm Control Center (NCC) for monitoring, documentation and control in combination with Debinding Package II, see page 70

Measurement setup for determination of temperature uniformity in the useful dimensions of the furnace

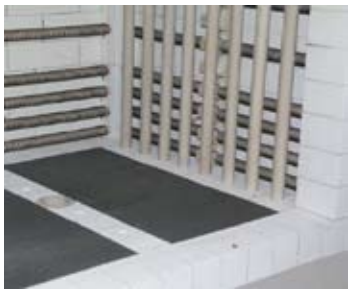
Model	Tmax	Inner dimensions in mm			Volume	Outer dimensions in mm			Supply	Electrical	Weight
	°C	w	d	h	in l	W	D	H	power/kW	connection*	in kg
H 125/LB, LT	1280	800	400	400	125	1330	1280	1900	12	three-phase	1250
H 250/LB, LT	1280	1000	500	500	250	1530	1380	2100	18	three-phase	1400
H 500/LB, LT	1280	1200	600	600	500	1730	1480	2300	36	three-phase	1800
H 1000/LB, LT	1280	1600	800	800	1000	2130	1680	2700	48	three-phase	2800
H 1350/LB, LT	1280	2800	620	780	1360	3690	1700	2750	75	three-phase	3500
H 3000/LB, LT	1280	3000	1000	1000	3000	4000	2100	3200	140	three-phase	6200

*Please see page 70 for more information about mains voltage

Combi Chamber Furnaces up to 1400 °C for Debinding and Sintering in one Process

N 200/HDB

N 650/HDBS



Injection of preheated air through perforated ceramic tubes

N 200/DB - N 1000/HDB

The combi chamber furnaces N 200/DB - N 650/HDB are specially developed for debinding and sintering in one process. The furnaces have a fresh air supply providing for dilution of the exhaust gases produced during debinding, for safe prevention of an inflammable atmosphere in the furnace chamber. The standard version of the furnaces includes Debinding Package I, with fresh air injected at room temperature in the furnace and with a factory pre-set volume flow with respect to the organic volume to be vaporized. In addition, the furnaces have an exhaust gas fan that is also factory pre-set and provides for a safe underpressure in the furnace. This system prevents exhaust gases from escaping into the production area. The passive safety package immediately intervenes when the underpressure in the furnace chamber drops. This system is recommended for reproducible processes in which the load does not change.

Pressure and flow rate displayed as part of Debinding Package II

If the furnace is to be used flexibly with changing loads, we recommend Debinding Package II. The furnace then includes fresh air preheating with variable fan speed and injection of the warm fresh air through air distribution tubes. The exhaust gas fan also operates at variable speed. The PLC control system automatically adjusts the underpressure in the furnace chamber.

- Tmax 1280 °C, 1340 °C or 1400 °C
- Five-sided heating from all four sides and from the floor for a good temperature uniformity
- Heating elements mounted on support tubes provide for free radiation and long service life of the heating wire
- Bottom heating protected by SiC tiles on the table to provide a level stacking surface
- Multilayer insulation consisting of lightweight refractory bricks backed by special insulation
- Self-supporting and long-life ceiling construction, with bricks laid in arched construction
- Motorized exhaust air flap on the furnace roof

- Debinding Package I with passive safety package and monitoring of the underpressure in the furnace chamber, exhaust gas fan, fresh air fan, preset underpressure in the furnace chamber, controlled by Nabertherm controller P 300, see page 6
- Over-temperature limit controller with manual reset for thermal protection class 2 in accordance with EN 60519-2 as temperature limiter to protect the furnace and load

Additional equipment

- Customized dimensions
- Multi-zone control adapted to the particular furnace model for optimizing the temperature uniformity
- Commissioning of the furnace with test firing and temperature uniformity measurement (also with load) for the purpose of process optimization
- Debinding Package II with passive safety concept, see page 7
- Exhaust air and exhaust gas tubing
- Thermal or catalytic exhaust cleaning systems, see page 35
- Emergency purging with nitrogen
- Process documentation and control with Controltherm MV software package for the basic furnace or Nabertherm Control Center (NCC) for monitoring, documentation and control in combination with Debinding Package II, see page 70

N 697/HDS with Debinding Package II for debinding and sintering of standing filter products

Model	Tmax	Inner dimensions in mm			Volume	Outer dimensions in mm			Supply	Electrical	Weight
	°C	w	d	h	in l	W	D	H	power/kW	connection*	in kg
N 200/DB	1280	370	530	720	140	760	1045	1690	26	three-phase	370
N 300/DB	1280	420	700	780	230	810	1215	1750	36	three-phase	410
N 450/DB	1280	470	750	1000	350	1010	1440	1815	43	three-phase	815
N 650/DB	1280	650	850	1100	610	1600	1750	2650	68	three-phase	1350
N 1000/DB	1280	750	1000	1250	940	1900	2250	2400	94	three-phase	2100
N 200/HDB	1340	370	530	720	140	760	1045	1690	31	three-phase	420
N 300/HDB	1340	420	700	780	230	810	1215	1750	43	three-phase	500
N 450/HDB	1340	470	750	1000	350	1010	1440	1815	53	three-phase	1040
N 650/HDB	1340	650	850	1100	610	1600	1750	2650	68	three-phase	1550
N 1000/HDB	1340	750	1000	1250	940	1900	2250	2400	94	three-phase	2500
N 200/14HDB	1400	370	530	720	140	760	1045	1690	33	three-phase	450
N 300/14HDB	1400	420	700	780	230	810	1215	1750	46	three-phase	550
N 450/14HDB	1400	470	750	1000	350	1010	1440	1815	53	three-phase	1320
N 650/14HDB	1400	650	850	1100	610	1600	1750	2650	68	three-phase	1750
N 1000/14HDB	1400	750	1000	1250	940	1900	2250	2400	94	three-phase	2700

*Please see page 70 for more information about mains voltage

Production system consisting of five combi chamber furnaces N 300/HDB with Debinding Package II with catalytic afterburning

Chamber Furnaces up to 1400 °C

N 100/G

N 660/G

N 100 - N 2200/14

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

Chamber furnace with fiber insulation for shorter cycle times

- Tmax 1300 °C, 1340 °C or 1400 °C
- Five-side heating provide for good temperature uniformity
- Heating elements on support tubes provide for free heat radiation and long service life
- Vapour vent in the middle of the roof (excellent ventilation)
- Smoothly adjustable and easy-to-operate air inlet flap or sliding damper
- Self-supporting and long-life ceiling construction, with bricks laid in arched construction
- Special door lock for easy handling
- Multi-layer insulation consisting of lightweight refractory bricks and backed by special fibre insulation
- Models up to N 300/.. with removable stand
- Bottom heating elements protected by SiC tiles for level stacking surface
- Over-temperature limit controller with manual reset for thermal protection class 2 in accordance with EN 60519-2 as temperature limiter to protect the furnace and load
- Description of the control system, see page 70

Gas supply system for protective gas

Chamber furnaces N 200/14 for sintering semiconductors

N 1680/S with customized dimensions for long parts

Additional equipment

- Motor-driven exhaust gas flap
- Fan system for faster cooling with manual or automatic control
- Protective gas connection as well as sealing of the furnace housing for purging the furnace with protective gases
- Manual or automatic gas supply systems
- Fiber-insulation for shorter cycle times, especially cooling periods
- Multi-zone control for optimal temperature uniformity in the useful chamber

Model	Tmax	Inner dimensions in mm			Volume	Outer dimensions in mm			Supply	Electrical	Weight
	°C	w	d	h	in l	W	D	H	power/kW	connection*	in kg
N 100	1300	400	530	460	100	710	1150	1430	9	three-phase	270
N 150	1300	450	530	590	150	760	1150	1560	11	three-phase	305
N 200	1300	500	530	720	200	810	1150	1690	15	three-phase	345
N 300	1300	550	700	780	300	860	1340	1750	20	three-phase	430
N 440	1300	600	750	1000	450	1000	1450	1820	30	three-phase	700
N 660	1300	600	1100	1000	660	1000	1800	1820	40	three-phase	850
N 1000	1300	800	1000	1250	1000	1450	1850	2000	57	three-phase	1800
N 1500	1300	900	1200	1400	1500	1550	2050	2160	75	three-phase	2500
N 2200	1300	1000	1400	1600	2200	1650	2250	2360	110	three-phase	3100
N 100/H	1340	400	530	460	100	710	1150	1430	11	three-phase	315
N 150/H	1340	450	530	590	150	760	1150	1560	15	three-phase	350
N 200/H	1340	500	530	720	200	810	1150	1690	20	three-phase	420
N 300/H	1340	550	700	780	300	860	1340	1750	27	three-phase	500
N 440/H	1340	600	750	1000	450	1000	1450	1820	40	three-phase	1040
N 660/H	1340	600	1100	1000	660	1000	1800	1820	57	three-phase	1260
N 1000/H	1340	800	1000	1250	1000	1450	1850	2000	75	three-phase	2320
N 1500/H	1340	900	1200	1400	1500	1550	2050	2160	110	three-phase	2700
N 2200/H	1340	1000	1400	1600	2200	1650	2250	2360	140	three-phase	3600
N 100/14	1400	400	530	460	100	710	1150	1430	15	three-phase	345
N 150/14	1400	450	530	590	150	760	1150	1560	20	three-phase	400
N 200/14	1400	500	530	720	200	810	1150	1690	22	three-phase	450
N 300/14	1400	550	700	780	300	860	1340	1750	30	three-phase	550
N 440/14	1400	600	750	1000	450	1000	1450	1820	40	three-phase	1320
N 660/14	1400	600	1100	1000	660	1000	1800	1820	57	three-phase	1560
N 1000/14	1400	800	1000	1250	1000	1450	1850	2000	75	three-phase	2500
N 1500/14	1400	900	1200	1400	1500	1550	2050	2160	110	three-phase	3000
N 2200/14	1400	1000	1400	1600	2200	1650	2250	2360	140	three-phase	3900

*Please see page 70 for more information about mains voltage

N 4260/S in customized dimensions

Gas-Fired Chamber Furnaces up to 1400 °C, also as Combi Furnaces for Debinding and Sintering in one Process

NB 660

NB 4330/S

NB 300 - NB 600

Certain firing or sintering processes require a gas-fired chamber furnace. Short heating times due to the high power are a convincing argument. The chamber furnaces with powerful gas burners cover a wide variety of these processes. In the basic version the burners are manually ignited once at the start of the process. The automatic control system then takes over control of the temperature curve. At program end, the burners are automatically switched off. Depending on the process, the furnaces can be equipped with automatically controlled fan burners and safety technology for debinding. Especially in case of larger binder concentrations, gas furnaces have the advantage that the exhaust quantity can be significantly reduced as the binders are burnt off in the furnace, providing for downsizing of the exhaust cleaning.

- Tmax 1300 °C
- Powerful, atmospheric burners for operation with liquified gas or natural gas
- Special positioning of the gas burners with flame guide top-down provides for good temperature uniformity
- Fully automatic temperature control
- Gas fittings with flame control and safety valve in accordance with DVGW (German Technical and Scientific Association for Gas and Water)
- Multi-layer, reduction-proof insulation with light-weight refractory bricks and special back-up insulation result in low gas consumption
- Self-supporting and rugged ceiling, bricks laid in arched construction or as fiber insulation
- Double-walled housing, side panels made of stainless steel (NB 300), for low outside temperatures
- Solid, double-walled door
- Exhaust hood with 150 mm (NB 300) and 00 mm (NB 440, NB 600) diameter connection
- Over-temperature limit controller with manual reset for thermal protection class 2 in accordance with EN 60519-2 as temperature limiter to protect the furnace and load

Chamber furnace NB 4330/S with gas supply system

Additional equipment

- Customized furnace dimensions
- Fan burner with fully automatic control and ignition
- Debinding technology, see page 7
- Exhaust air and exhaust gas piping
- Thermal or catalytic exhaust cleaning systems, see page 35
- Process documentation and control with Controltherm MV software package for the basic furnace or Nabertherm Control Center (NCC) for monitoring, documentation and control for use of Debinding Package II, see page 70

Gas-Fired Bogie Hearth Furnaces up to 1400 °C for Firing or Sintering or as Combi Furnace for Debinding and Sintering in one Process

Bogie hearth furnace WB 14880S

Gas-fired bogie hearth furnaces distinguish by their dimensions and efficiency. The use of high-speed burners allows for short heating times. The burners are arranged according to the furnace geometry providing for a good temperature uniformity. Depending on the furnace dimensions, the burners can alternatively be equipped with recuperator technology to save energy. The high-quality, long-life fiber insulation with storage capacity provides for short heating and cooling times.

- Tmax 1300 °C
- Powerful, sturdy high-speed burner with pulse control and special flame control in the furnace chamber provide for good temperature uniformity
- Operation with city gas, natural gas or liquified gas
- Fully automatic PLC control of the temperature, including monitoring of the burner function
- Gas fittings according to DVGW (German Technical and Scientific Association for Gas and Water) with flame monitoring and safety valve
- Reduction-resistant fiber insulation with low heat storage provides for short heating and cooling times
- Double-walled housing provides for low outside temperatures
- Exhaust hood with fittings for further discharge of the exhaust gases
- Over-temperature limit controller with manual reset for thermal protection class 2 in accordance with EN 60519-2 as temperature limiter to protect the furnace and load

Gas supply system at a bogie hearth furnace

Additional equipment

- Customized furnace dimensions
- Automatic lambda control to set the furnace atmosphere
- Debinding package for debinding and sintering with corresponding safety technology, see page 6
- Exhaust air and exhaust gas piping
- Recuperator burners utilizing part of the waste heat in the exhaust tract to preheat the combustion air and considerably contribute to energy saving
- Thermal or catalytic exhaust cleaning systems, see page 35
- Process documentation via Nabertherm Control Center (NCC) for monitoring, documentation and control in the use of Debinding Package II, see page 70
- Other additional equipment for bogie hearth furnaces, see pages 14 ff.

Furnace chamber with eight high-speed burners

Lift-Top and Lift-Bottom Furnaces up to 1800 °C

HT 680/17 LTS2 with table exchange system

HT 64/17 LT

HTC 64/14 LB or LT - HT 1440/17 LB

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

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

All-round heating of the hood by means of molybdenum disilicide heating elements

- Tmax 1400 °C or 1500 °C (HTC models with SiC rod heating)
- Tmax 1600 °C, 1750 °C or 1800 °C (HT models with molybdenum disilicide heating elements)
- Double-walled housing with fan cooling provides for low shell temperatures
- Designed as lift-top furnace with driven hood (LT) or lift-bottom furnace
- Gently running, low-vibration spindle drive or electrohydraulic drive for larger models
- Safe and tight closing of the furnace due to labyrinth seal and sand cup
- Heating from all four sides provides for good temperature uniformity
- High-quality fiber insulation backed by special insulation
- Side insulation constructed with tongue and groove blocks provides for low heat dissipation to the outside
- Long-life roof insulation with special suspension
- Furnace table with special bottom reinforcement to accommodate high charge weights
- Motor-driven exhaust air flap in the furnace roof, switchable at the program
- PLC controls with state-of-the-art touch panel as user interface, see page 70
- Over-temperature limit controller with manual reset for thermal protection class 2 in accordance with EN 60519-2 as temperature limiter to protect the furnace and load

Additional equipment

- Customized dimensions
- Controlled cooling system with frequency-controlled cooling fan
- Commissioning of the furnace with test firing and temperature uniformity measurement (also with load) for the purpose of process optimization
- Temperature measurement with thermocouples, types B and type S with automatic pull-out device for precise control results in the low temperature range
- Protective gas connection as well as sealing of the furnace housing to purge with protective gases
- Manual or automatic gas supply systems
- Gas supply system in the furnace chamber with ceramic bell jar, protective gas inlet and outlet from below for better sealing when operating with protective gases and/or to prevent from chemical interactions between the load and the insulation or the heating elements
- Alternative table changing systems
- Debinding Package I with passive safety package and monitoring of the underpressure in the furnace chamber, exhaust gas fan, fresh air fan, preset underpressure in the furnace chamber, controlled by Nabertherm controller P 300, see page 6
- Debinding Package II with passive safety concept, see page 7
- Emergency purging with nitrogen
- Exhaust air and exhaust gas piping
- Automatic changing system for thermocouple type S/B for precise measurement and control quality at lowes temperatures, e.g. in combination with a debinding package
- Thermal or catalytic exhaust cleaning systems, see page 35
- Process documentation, display and control via HiproSystems control system, see page 70

HT 276/18 LTS with two ceramic retorts for sintering under protective gas

Gas supply system for protective gas

HT 276/17 LT HDB with manual table changing system and Debinding Package II

Lift-Top and Lift-Bottom Furnaces up to 1800 °C

Model	Tmax	Inner dimensions in mm			Volume	Outer dimensions in mm			Supply	Electrical	Weight
	°C	w	d	h	in l	W	D	H	power/kW	connection*	in kg
HT 64/16 LB, LT	1600	400	400	400	64	950	1100	2350	36	three-phase	480
HT 166/16 LB, LT	1600	550	550	550	166	1100	1250	2500	42	three-phase	1100
HT 276/16 LB, LT	1600	1000	500	550	276	2000	1400	2500	50	three-phase	1200
HT 400/16 LB, LT	1600	1200	600	550	400	2200	1500	2500	72	three-phase	1300
HT 1000/16 LB, LT	1600	1000	1000	1000	1000	1600	2100	2800	146	three-phase	1500
HT 1010/16 LB, LT	1600	2150	600	800	1032	3200	1300	3400	156	three-phase	2000
HT 1440/16 LB, LT	1600									three-phase	
HT 64/17 LB, LT	1750	400	400	400	64	950	1100	2350	36	three-phase	480
HT 166/17 LB, LT	1750	550	550	550	166	1100	1250	2500	42	three-phase	1100
HT 276/17 LB, LT	1750	1000	500	550	276	2000	1400	2500	50	three-phase	1200
HT 400/17 LB, LT	1750	1200	600	550	400	2200	1500	2500	72	three-phase	1300
HT 1000/17 LB, LT	1750	1000	1000	1000	1000	1600	2100	2800	146	three-phase	1500
HT 1010/17 LB, LT	1750	2150	600	800	1032	3200	1300	3400	156	three-phase	2000
HT 1440/17 LB, LT	1750									three-phase	
HT 64/18 LB, LT	1800	400	400	400	64	950	1100	2350	on request	three-phase	480
HT 166/18 LB, LT	1800	550	550	550	166	1100	1250	2500	on request	three-phase	1100
HT 276/18 LB, LT	1800	1000	500	550	276	2000	1400	2500	on request	three-phase	1200
HT 400/18 LB, LT	1800	1200	600	550	400	2200	1500	2500	on request	three-phase	1300
HT 1000/18 LB, LT	1800	1000	1000	1000	1000	1600	2100	2800	on request	three-phase	1500
HT 1010/18 LB, LT	1800	2150	600	800	1032	3200	1300	3400	on request	three-phase	2000
HT 1440/18 LB, LT	1800	1800	800	1000	1440	2300	2900	3700	280	three-phase	2500

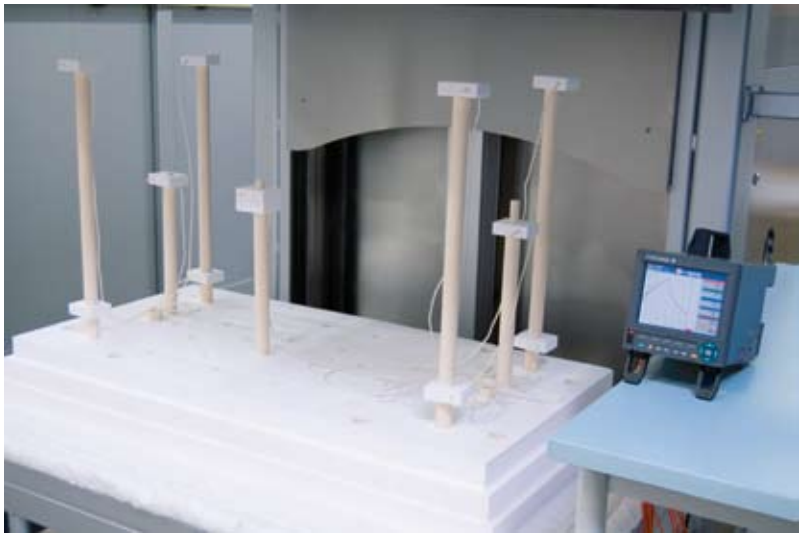
*Please see page 70 for more information about mains voltage

[1]All dimensions without transformer housing, without hydraulic unit, and without switchgear cabinet

HTC 1275 LT, heated by SiC rods with lift-top table on rails

High-temperature furnace HT 273/17S with table by transportable fork lift

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



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

Production system consisting of a bogie hearth furnace for debinding and a high-temperature furnace for residual debinding and sintering with shared catalytic afterburning system

High-Temperature Chamber Furnaces with Fiber Insulation up to 1800 °C

HT 160/17 with catalytic afterburning system

HT 16/16

HT 04/16 - HT 450/18

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

High-temperature chamber furnaces can either be insulated with fiber material or lightweight refractory bricks. Furnaces with fiber insulation achieve significantly shorter heating up times because of the low thermal mass. An insulation made of lightweight refractory bricks (see HFL models on page 33), on the other hand, has the advantage of better chemical stability.

Protection of heating elements against mechanical damage

These furnaces can also be tailored to specific processes by means of a wide range of additional equipment. The addition of a debinding package, for example, allows the use of these models as combi furnaces for debinding and sintering in one process. Thermal or catalytic exhaust cleaning equipment round up the system.

- Tmax 1600 °C, 1750 °C or 1800 °C
- Double-walled housing with fan cooling for low shell temperatures
- Heating from both sides via molybdenum disilicide heating elements
- High-quality fiber insulation backed by special insulation
- Side insulation constructed with tongue and groove blocks provide for low heat dissipation to the outside
- Long-life roof insulation with special suspension
- Chain-guided parallel swivel door for defined opening and closing of the door without destroying the insulation
- Labyrinth sealing ensures the least possible temperature loss in the door area
- Specially reinforced furnace floor for accommodating high charge weights for model HT 40 and above
- Exhaust air opening in the furnace roof
- Heating elements switched via SCR's
- Over-temperature limit controller with manual reset for thermal protection class 2 in accordance with EN 60519-2 as temperature limiter to protect the furnace and load

HT 330/17S

HT 128/17 S with lift door for opening in hot state

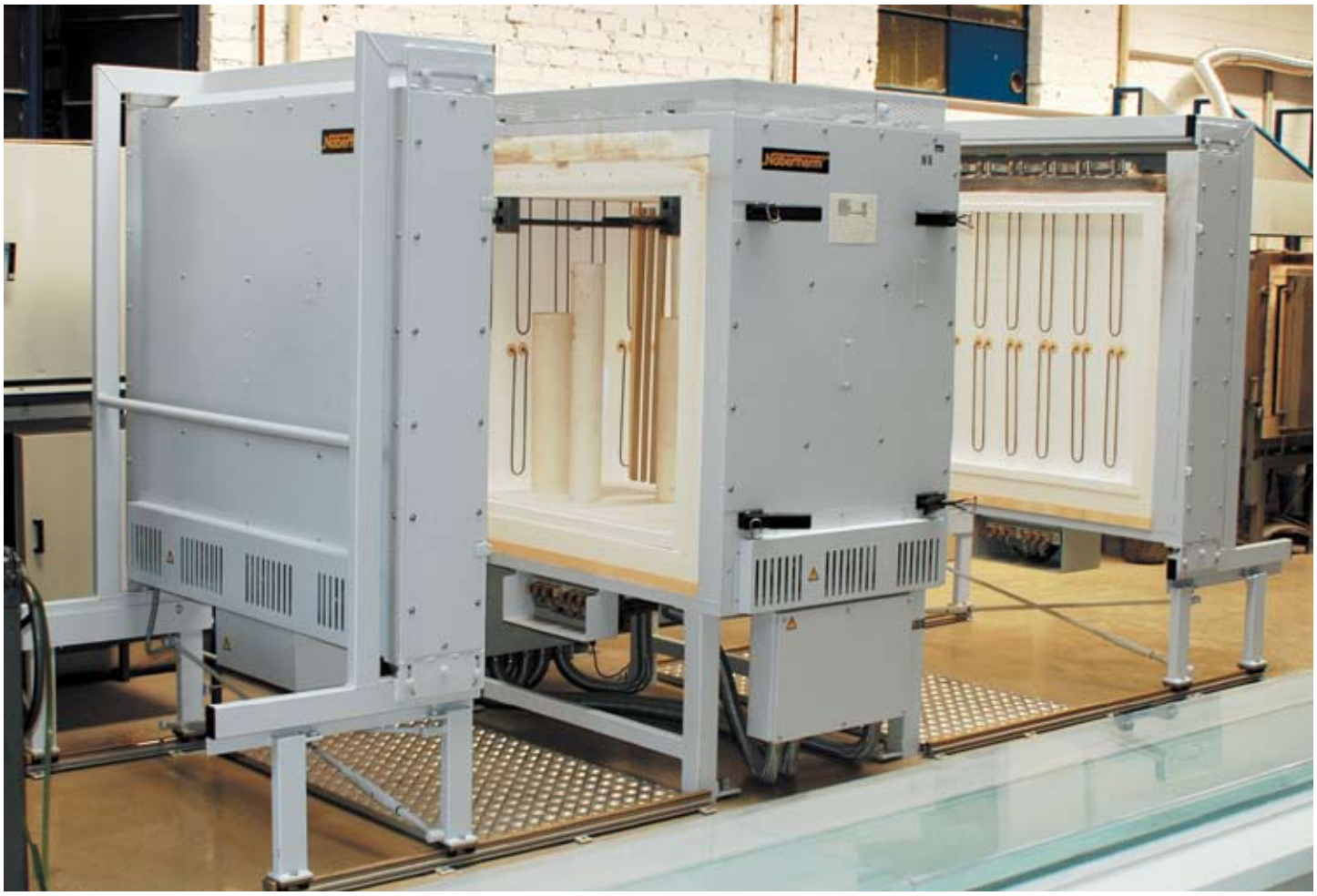
Additional equipment

- Customized dimensions
- Controlled cooling system with frequency-controlled cooling fan
- Commissioning of the furnace with test firing and temperature uniformity measurement (also with load) for the purpose of process optimization
- Temperature measurement with thermocouples, types B and type S with automatic pull-out device for precise control results in the low temperature range
- Protection grid in front of the heating elements to prevent mechanical damages, see page 33
- Protective gas connection as well as sealing of the furnace housing to purge with protective gases
- Manual or automatic gas supply system
- Gas supply system in the furnace chamber with ceramic bell jar, protective gas inlet and outlet from below for better sealing when operating with protective gases and/or to prevent from chemical interactions between the load and the insulation or the heating elements
- Parallel swivel door opening upwards, also motor driven
- Motorized exhaust air flap, switchable via the program
- Debinding Package I with passive safety package and monitoring of the underpressure in the furnace chamber, exhaust gas fan, fresh air fan, preset underpressure in the furnace chamber, controlled by Nabertherm controller P 300, see page 6
- Debinding Package II with passive safety concept, see page 7
- Emergency purging with nitrogen
- Exhaust air and exhaust gas piping
- Thermal or catalytic exhaust cleaning systems, see page 35
- Process documentation, display and control via HiproSystems control system, see page 70

Fresh air injection through perforated injection tubes with Debinding Package II

Display of pressure and volume flow with Debinding Package II

High-Temperature Chamber Furnaces with Fiber Insulation up to 1800 °C



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

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

Gas supply system for protective gases

Model	Tmax	Inner dimensions in mm			Volume	Outer dimensions in mm			Supply	Electrical	Weight
	°C	w	d	h	in l	W	D	H	power/kW	connection*	in kg
HT 04/16	1600	150	150	150	4	610	470	1400	5.2	three-phase[1]	150
HT 08/16	1600	150	300	150	8	610	610	1400	8.0	three-phase[1]	200
HT 16/16	1600	200	300	260	16	710	650	1500	12.0	three-phase[1]	270
HT 32/16	1600	200	600	260	32	710	930	1500	18.0	three-phase	350
HT 40/16	1600	300	350	350	40	810	710	1610	12.0	three-phase	380
HT 64/16	1600	400	400	400	64	1020	840	1700	18.0	three-phase	550
HT 128/16	1600	400	800	400	128	1020	1250	1700	26.0	three-phase	750
HT 160/16	1600	500	550	550	160	1140	1020	1900	21.0	three-phase	800
HT 276/16	1600	500	1000	550	276	1140	1470	1900	36.0	three-phase	1100
HT 450/16	1600	500	1150	780	450	1140	1620	2060	64.0	three-phase	1500
HT 04/17	1750	150	150	150	4	610	470	1400	5.2	three-phase[1]	150
HT 08/17	1750	150	300	150	8	610	610	1400	8.0	three-phase[1]	200
HT 16/17	1750	200	300	260	16	710	650	1500	12.0	three-phase[1]	270
HT 32/17	1750	200	600	260	32	710	930	1500	18.0	three-phase	350
HT 40/17	1750	300	350	350	40	810	710	1610	12.0	three-phase	380
HT 64/17	1750	400	400	400	64	1020	840	1700	18.0	three-phase	550
HT 128/17	1750	400	800	400	128	1020	1250	1700	26.0	three-phase	750
HT 160/17	1750	500	550	550	160	1140	1020	1900	21.0	three-phase	800
HT 276/17	1750	500	1000	550	276	1140	1470	1900	36.0	three-phase	1100
HT 450/17	1750	500	1150	780	450	1140	1620	2060	64.0	three-phase	1500
HT 04/18	1800	150	150	150	4	610	470	1400	5.2	three-phase[1]	150
HT 08/18	1800	150	300	150	8	610	610	1400	9.0	three-phase[1]	200
HT 16/18	1800	200	300	260	16	710	650	1500	12.0	three-phase[1]	270
HT 32/18	1800	200	600	260	32	710	930	1500	18.0	three-phase	350
HT 40/18	1800	300	350	350	40	810	710	1610	12.0	three-phase	380
HT 64/18	1800	400	400	400	64	1020	840	1700	18.0	three-phase	550
HT 128/18	1800	400	800	400	128	1020	1250	1700	26.0	three-phase	750
HT 160/18	1800	500	550	550	160	1140	1020	1900	21.0	three-phase	800
HT 276/18	1800	500	1000	550	276	1140	1470	1900	36.0	three-phase	1100
HT 450/18	1800	500	1150	780	450	1140	1620	2060	64.0	three-phase	1500

[1]Only heating between two phases

*Please see page 70 for more information about mains voltage

Chamber Furnaces with Refractory Insulation up to 1700 °C

HFL 160/17 with gas supply system

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

HFL 16/16 - HFL 160/17

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

Standard equipment like HT models, except:

- Tmax 1600 °C or 1700 °C
- Sturdy lightweight refractory bricks and special backing insulation
- Furnace floor made of lightweight refractory bricks accommodates high charge weights

Additional equipment like HT models

Gas supply system for HFL 160/17

Protection grid in front of heating elements prevent against mechanical damages

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
HFL 16/16	1600	200	300	260	16	770	830	1550	12	three-phase[1]	500
HFL 40/16	1600	300	350	350	40	880	880	1710	12	three-phase	660
HFL 64/16	1600	400	400	400	64	980	930	1830	18	three-phase	880
HFL 160/16	1600	500	550	550	160	1090	1080	2030	21	three-phase	1140
HFL 16/17	1700	200	300	260	16	770	830	1550	12	three-phase[1]	530
HFL 40/17	1700	300	350	350	40	880	880	1710	12	three-phase	690
HFL 64/17	1700	400	400	400	64	980	930	1830	18	three-phase	920
HFL 160/17	1700	500	550	550	160	1090	1080	2030	21	three-phase	1190

[1]Only heating between two phases

*Please see page 70 for more information about mains voltage

Gas-Fired Chamber Furnaces up to 1600 °C

HTB 645/17

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

- Tmax 1600 °C
- Customized furnace dimensions
- Powerful, sturdy high-speed burners with pulse control and special flame guidance in the furnace chamber provide for good temperature uniformity
- Operation with natural gas, propane or liquified gas
- Fully automatic PLC control of the temperature, including monitoring of the burner function
- Gas fittings according to DVGW (German Technical and Scientific Association for Gas and Water) with flame monitoring and safety valve
- Reduction-resistant fiber insulation with low heat storage provides for short heating and cooling times
- Double-walled housing provides for low outside temperatures
- Exhaust hood with fittings for further discharge of the exhaust gases
- PLC control with touch panel as user interface, see page 70

Additional equipment

- Automatic lambda control to set the furnace atmosphere
- Debinding package for debinding and sintering with corresponding safety technology, see page 6
- Exhaust air and exhaust gas piping
- Recuperator burners
- Thermal or catalytic exhaust cleaning systems, see page 35
- Process display and documentation via Nabertherm Control Center (NCC), see page 70

Catalytic and Thermal Afterburning Systems

Combi chamber furnace system with catalytic afterburning for debinding and sintering

Chamber furnace N 150/14 with catalytic afterburning system

Catalytic and Thermal Afterburning Systems (KNV and TNV)
For exhaust gas cleaning, in particular in debinding, Nabertherm offers exhaust gas cleaning systems tailored to the process. The afterburning system is permanently connected to the exhaust gas fitting of the furnace and accordingly integral part of the control system and the safety matrix of the furnace. For existing furnaces, independent exhaust gas cleaning systems are also available that can be separately controlled and operated.

Catalytic exhaust cleaning is especially recommended due to energetic reasons when only pure hydrocarbon compounds must be cleaned during the debinding process in air. Thermal afterburning systems are used if large volumes of exhaust gas from the debinding process in air must be cleaned and/or if there is a risk that the exhaust gases might damage the catalyst. Thermal afterburning is also used for debinding applications under protective gas or under hydrogen.

Catalytic afterburning systems (KNV)
- Perfectly suited for debinding processes in air with only organic exhaust gases
- Catalytic conversion of the unburned hydrocarbons to their nontoxic, natural components
- Integrated in a compact stainless steel housing
- Electric heating provides for preheating of the exhaust gas to the optimal reaction temperature for catalytic treatment
- Cleaning in different layers of catalytic honeycombs within the system
- Thermocouples for measuring the temperatures of raw gas, reaction honeycombs and discharge
- Over-temperature limit controller with adjustable cutout temperature protects the catalyst
- Tight connection between the exhaust gas outlet of the debinding furnace and the exhaust gas fan with corresponding integration into the overall system with respect to control and safety technology
- Catalyst dimensioned in reletion to the exhaust gas flow
- Measuring port for clean gas measurements (FID), see additional equipment

Thermal afterburning systems (TNV)
- Optimally suited for debinding processes in air with large exhaust gas flow, erratic large exhaust gas volumes, large volume flow or for debinding processes under protective gases, hydrogen or in vacuum
- Burn-off at temperatures up to 850 °C provides for thermal decomposition of the exhaust gases
- Heating with compact gas burner with automatic firing device
- Thermocouples in the combustion chamber and in the raw gas inlet
- Over-temperature limit controller for protecting the thermal afterburning
- Design depending on the exhaust gas flow
- Measuring port for clean gas measurements (FID), see additional equipment

Additional equipment for catalytic afterburners and thermal afterburners
- Design for retrospective integration in existing furnace systems, including system-independent control of the thermal afterburner heating or catalytic afterburner heating
- Compliance with national exhaust gas regulations
- Emission measurements (FID) for compliance with exhaust gas regulations

High-temperature furnace HT 166/17 LTS with thermal afterburning system

Rotary Hearth Furnaces up to 1300 °C, Electrically heated or Gas-Fired

Rotary hearth furnace DH 2500 S, movable on rails, for preheating molds for two melting furnaces

Gear rim drive under the furnace

Rotary table with base plates made of highly heat-resistant steel to protect the insulation

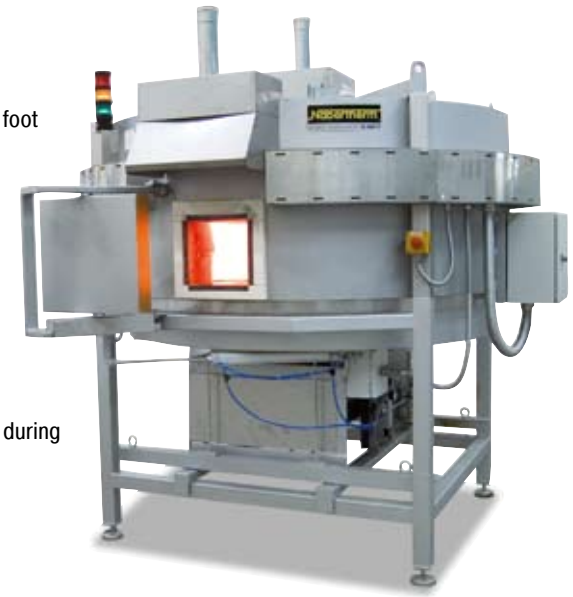
Exhaust hood above charging opening

The compact furnaces of the DH product line are optimally suited for continuous processes on a small floor space. They are designed for preheating processes such as the preheating of ceramic molds in precision casting. Charging and discharging can, be done at one position – either by a person or fully automatic. The hearth rotates in pre-set segments individually reconciled with the workpart geometry. The rotational speed and rotational intervals can be defined by the control system or by manual switching. Customized furnace design accommodates individual throughput requirements.

- Tmax 1100 °C, 1200 °C or 1300 °C
- Wire heating elements in the furnaces ceiling for furnaces up to 1200 °C
- SiC heating rods in the furnace ceiling for furnaces up to 1300 °C
- Gas heating as an alternative to electrical heating
- Very compact design compared with continuous furnaces
- Designed for continuous operation at one working temperature
- Table diameter up to 3000 mm
- Hearth movement in defined segments
- Low-vibration movement of the rotary hearth
- Parallel swivel door
- Automatic drive or rotational motion initiated by foot switch

Additional equipment

- Customized dimensions
- Exhaust hood above the door opening for discharge of the warm exhaust air when door is open
- Pneumatic drive of the parallel swivel door
- Multi-zone control for adjustable thermal profile during the cycle



Rotary hearth furnace DH 630/S

Continuous Furnaces

Continuous furnace D 650/S with chain conveyor for 950 °C

Continuous furnaces are a good choice for processes with fixed cycle times such as drying or preheating. The standard models are available for temperatures between 100 °C and 1000 °C. The furnace design in subject to the required throughput, the process requirements for the heat treatment and the required cycle time.
The conveyor technology (e.g. belt, rollers) is tailored to the required operational temperature and the charge geometry to be handled. The conveyor speed and the number of control zones also depend on process requirements.

- Temperatures between 100 °C and 1000 °C
- Conveyor speed infinitely variable
- Customized conveyor belt width

Additional equipment
- Charge and discharge section tailored to process requirements
- Heating-up and cooling section with defined gradients to follow specific temperature profiles
- Exhaust gas treatment facilities
- Different conveyor specifications corresponding to the parts to be conveyed
- Roller conveyors
- Charging aids for loading and unloading
- Different heating concepts depending on process requirements, e.g. radiation heating, air circulation, infrared or gas-fired
- Retorts for operation under protective gas

Service flap door at furnace side

Discharge of D 650/S

Continuous roller furnace N 650/45 AS for heat treatment of heavy workparts

Cooling facility at discharge of a continuous belt furnace

Chamber Retort Furnaces up to 1100 °C

NRA 50/06 IDB for debinding under protective gas

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

NRA 12/06 - NRA 430 /11

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

Inside heating in models NRA ../06

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

Models NRA .../06 with Tmax 650 °C

- Heating elements located inside the retort
- Temperature uniformity up to ΔT 6 K inside the working chamber from 100 °C - 600 °C
- Retort made of 1.4571
- Gas circulation fan in the back of the retort provides for optimal temperature uniformity

Heating from outside around the retort in models NRA ../09 and NR ../11

Models NRA .../09 with Tmax 950 °C

- Outside heating with heating elements surrounding the retort as well as an additional door heater
- Temperature uniformity up to ΔT 6 K inside the working chamber from 200 °C - 900 °C
- Retort made of 1.4841
- Gas circulation fan in the back of the retort provides for optimal temperature uniformity

Models NR .../11 with Tmax 1100 °C

- Outside heating with heating elements surrounding the retort as well as an additional door heater
- Temperature uniformity up to ΔT 20 K inside the working chamber from 200 °C - 1050 °C
- Retort made of 1.4841

NRA 150/11 H_2 for operation with hydrogen

Gas supply system for hydrogen

Vacuum pump for cold evacuation of the retort

Touchpanel H 3700 for automatic version

Standard Equipment for all models

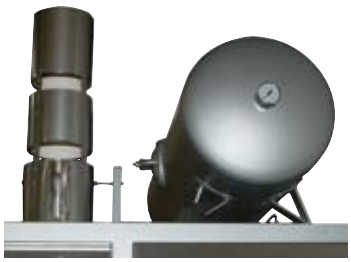
Basic version

- Compact housing in frame design with removable stainless steel sheets
- Controls and gas supply integrated in the furnace housing
- Welded charging supports in the retort
- Swivel door hinged on right side with open cooling water system
- Multi-zone control, divided between furnace chamber and door. Depending on furnace dimensions, chamber also divided into one or more heating zones
- Gas supply system for one nonflammable protective gas with flow meter and solenoid valve, switchable via the control system
- Operation under vacuum up to 600 °C with optional single-stage rotary vane pump (not for models NRA ../06)
- Port for vacuum pump for cold evacuation
- PLC controls with touch panel H 700 for data input, see page 70

Additional equipment

- Upgrade for other nonflammable gases
- Automatic gas injection, including MFC flow controller for alternating volume flow, PLC controlled with touch panel H 3700
- Temperature control as charge control with temperature measurement inside and outside the retort
- Vacuum pump for evacuating of the retort up to 600 °C, attainable vacuum up to 10^{-5} mbar subject to selected pump
- Cooling system for shortening process times
- Heat exchanger with closed-loop cooling water circuit for door cooling

Chamber Retort Furnaces up to 1100 °C



Emergency flood container and exhaust gas torch for model NRA 150/11 H_2

Pneumatic door lock for the H_2 version

H_2 Version for Operation under Hydrogen

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

NR 200/11 H_2 for heat treatment under hydrogen

- H_2 supply at controlled overpressure of 50 mbar relative
- Certified safety concept
- PLC controls with graphic touch panel H 3700 for data input
- Redundant gas inlet valves for hydrogen
- Monitored pre-pressures of all process gases
- Bypass for safe flushing of furnace chamber with inert gas
- Exhaust gas torch for H_2 afterburning
- Emergency flood container for purging the furnace in case of failore

IDB Version for Debinding under Protective Gas or for Pyrolysis Processes

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

- Process control under monitored and controlled overpressure of 50 mbar relative
- Certified safety concept
- PLC controls with graphic touch panel H 1700 for data input
- Monitored gas pre-pressure of the process gas
- Bypass for safe flushing of furnace chamber with inert gas
- Exhaust gas torch for H_2 afterburning

Debinding under protective gas with a gas box in a chamber furnace

Debinding under protective with a gas box in a bogie hearth furnace

Chamber and Bogie Hearth Furnaces with Gas Box for Debinding under Protective Gases

Certain debinding processes under protective gas can also be realized in a chamber or bogie hearth furnace with inserted gas box as a cost-effective alternative. In our state-of-the-art test center we would be glad to make tests in order to select the most suitable furnace model.

Model	Tmax °C	Model	Tmax °C	Working chamber dimensions in mm w	d	h	Useful volume in l	Electrical connection*
NR, NRA 17/..	600 or 900	NR 17/11	1100	225	350	225	17	three-phase
NR, NRA 25/..	600 or 900	NR 25/11	1100	225	500	225	25	three-phase
NR, NRA 50/..	600 or 900	NR 50/11	1100	325	490	325	50	three-phase
NR, NRA 75/..	600 or 900	NR 75/11	1100	325	700	325	75	three-phase
NR, NRA 150/..	600 or 900	NR 150/11	1100	450	750	450	150	three-phase
NR, NRA 200/..	600 or 900	NR 200/11	1100	450	1000	450	200	three-phase
NR, NRA 300/..	600 or 900	NR 300/11	1100	570	900	570	300	three-phase
NR, NRA 400/..	600 or 900	NR 400/11	1100	570	1200	570	400	three-phase

*Please see page 70 for more information about mains voltage

Pit-Type Retort Furnaces up to 1100 °C

Pit-type retort furnace SRA 200 with thermal afterburning system

SRA 500 - SR 1000

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

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

Models SR .../11 with Tmax 1100 °C
- Four-side heating outside the retort
- Temperature uniformity up to ΔT 14K within the working chamber of 500 °C - 1100 °C
- Retort made of 1.4841
- Top down multi-zone control of the furnace heating

Models SRA ../09 with Tmax 950 °C
Design like models SR.../11 with following differences:
- Atmosphere circulation with powerful fan in the furnace lid provides for perfect temperature uniformity of up to ΔT 8 K within the working chamber of 200 °C - 900 °C

Standard Equipment (all models)
Design like standard equipment of models NR and NRA with following differences:
- Charging from above with crane or other lifting equipment from customer
- Hinged lid with opening to the side and with cooling water
- Multi-zone control of the furnace heating from the top down

Additional equipment, see models NR and NRA

H_2 version for operation under hydrogen, see models NR and NRA

IDB version for debinding under protective gas or for pyrolysis processes, see models NR and NRA

SR 600 basic version

Model	Tmax	Inside dimensions of alloy retort		Volume	Outer dimensions in mm			Supply	Electrical	Weight
	°C	ø in mm	h in mm	in l	W	D	H	power/kW	connection*	in kg
SRA 500	950	800	1000	500	1400	1600	2400	46	three-phase	1500
SRA 600	950	800	1200	600	1400	1600	2600	52	three-phase	1600
SRA 800	950	1000	1000	800	1600	1800	2400	70	three-phase	1900
SRA 1000	950	1000	1300	1000	1600	1800	2700	90	three-phase	2200
SR 100	1100	450	600	100	950	950	1200	16	three-phase	800
SR 200	1100	600	800	200	1200	1200	1400	24	three-phase	1100
SR 300	1100	600	1000	300	1200	1200	1600	35	three-phase	1300
SR 500	1100	800	1000	500	1400	1400	1600	46	three-phase	1500
SR 600	1100	800	1200	600	1400	1400	1800	54	three-phase	1600
SR 800	1100	1000	1000	800	1600	1600	1600	70	three-phase	1700
SR 1000	1100	1000	1300	1000	1600	1600	1900	90	three-phase	1900

*Please see page 70 for more information about mains voltage

High-Temperature Chamber Retort Furnaces up to 2400 °C

VHT 8/22-GR with graphite insulation and heating as well as automation package

VHT 40/22-GR with graphite insulation and heating

The compact furnaces of the VHT product line are available as electrically heated chamber furnaces with graphite, molybdenum or MoSi heating. A wide variety of heating designs as well as a complete range of accessories provide for optimal furnace configurations even for sophisticated applications.

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

The H_2 version provides for operation under hydrogen or other flammable gases. Key of the specification up is a certified safety package providing for a safe operation at all times and triggers an appropriate emergency program in case of failure.

For debinding applications under vacuum, we recommend the VDB version, which besides the corresponding safety technology has an additional debinding retort in the heating chamber and prevents the exhaust gases from contaminating the furnace chamber. The exhaust gases are channelled from the debinding retort into the exhaust gas torch.

Alternative Heating Specifications

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

VHT ../GR with Graphite Insulation and Heating

- Suitable for processes under protective and reaction gases or under vacuum
- Tmax 1800 °C or 2200 °C
- Max. vacuum up to 10^{-2} mbar depending on pump type used
- Graphite felt insulation
- Temperature measurement using type B thermocouple (version to 1800 °C)
- Temperature measurement using optical pyrometer (version to 2200 °C)

VHT ../MO with Molybdenum Insulation and Heating

- Suitable for high-purity processes under protective and reaction gases or under high vacuum
- Tmax 1600 °C
- Max. vacuum up to 5 x10^{-5} mbar depending on pump type used
- Insulation made of Molybdenum steel sheets
- Temperature measurement by thermocouple type B

Graphite heating chamber

VHT ../KE with Fiber Insulation and Heating through Molybdenum Disilicide Heating Elements

- Suitable for processes under protective and reaction gases, in air or under vacuum
- Tmax 1800 °C
- Max. vacuum up to 10^{-2} mbar (up to 1300 °C) depending on pump type
- Insulation made of high purity aluminum oxide fiber
- Temperature measurement by thermocouple type B

	VHT ...-18/GR	VHT ...-16/MO	VHT ...-18/KE
Inert gas	✓	✓	✓
Air	to 400 °C	-	✓
Hydrogen	✓	✓	-
Rough vacuum and fine vacuum (>10^{-3} mbar)	✓	✓	✓
High vacuum (<10^{-5} mbar)	-	✓	-

Molybdenum heating chamber

Standard Equipment for all Models

Basic version

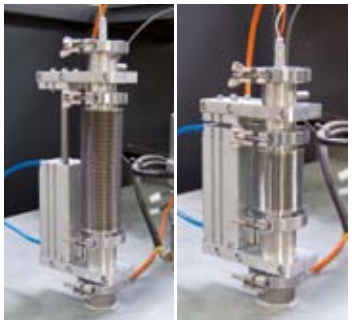
- Standard furnace sizes 8, 40 and 100 liters
- A water-cooled stainless steel process reactor sealed with temperature-resistant o-rings
- Frame made of stable steel profiles, easy to service due to easily removable stainless steel panels
- Housing of the VHT 8 model on castors for easy repositioning of furnace
- Cooling water manifold with manual stopcocks in supply and return lines, automatic flowmeter monitoring, openloop cooling water system
- Adjustable cooling water circuits with flowmeter and temperature indicator and overtemperature fuses
- Switchgear and controller integrated in furnace housing
- H 700 PLC control with clearly laid out 5.7“ touchpanel control for program entry and display, 10 programs each with 20 segments
- Over-temperature limit controller with manual reset for thermal protection class in accordance with EN 60519-2
- Manual operation of the process gas and vacuum functions
- Manual gas supply for one process gas (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 relative)
- Single-stage rotary vane pump with ball valve for pre-evacuating and heat treatment in a rough vacuum to 5 mbar
- Pressure gauge for visual pressure monitoring

Ceramic fiber heating chamber

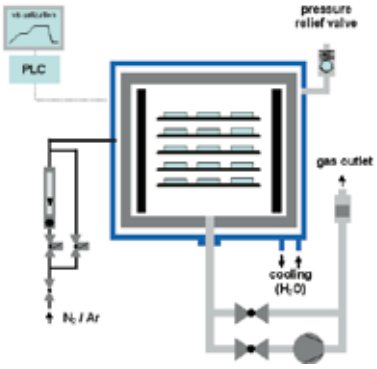
Additional equipment

- Tmax 2400 °C
- Housing, optionally divisible, for passing through narrow door frames (VHT 08)
- 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 uniformity 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
- Temperature measurement at 2200 °C with pyrometer and thermocouple, type S with automatic pull-out device for precise control results in the low temperature range
- Turbo molecular pump with slide valve for pre-evacuation and for heat treatment in a vacuum to 10^{-5} mbar including electric pressure transducer and booster pump (only VHT.../MO)

Continued on next page



Thermocouple, type S with automatic pull-out device for precise control results in the low temperature range



VHT gas supply diagram, automatic operation

Nitrogen emergency purging and exhaust gas torch for hydrogen version

VHT 40/16MOH$_2$

Continuation of additional equipment

- Heat exchanger with closed-loop cooling water circuit
- Automation package with graphic touch panel H 3700
  - 12" graphic touch panel H 3700
  - Input of all process data like temperatures, heating rates, gas injection, vacuum at the touch panel
  - Display of all process-relevant data on a process control diagram
  - Automatic gas supply for one process gas (N_2 or argon) with adjustable flow
  - Bypass for flooding and filling the chamber with process gas controlled by the program
  - Automatic pre- and post programs, including leak test for safe furnace operation
  - Automatic gas outlet with bellows valve and overflow valve (20 mbar)
  - Transducer for absolute and relative pressure
- MFC flow controller for alternating volume flow and generation of gas mixtures with second process gas (only with automation package)
- Partial pressure operation: protective gas flushing at controlled underpressure (only with automation package)
- PC control via NCC with corresponding optional documentation and connection to customer PC networks

Turbo-molecular pump

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

H_2 Version VHT.../MO-H_2 or VHT.../GR-H_2 for Operation with Hydrogen or other Reaction Gases

In the H_2 version the furnaces of the VHT.../MO or VHT.../GR product line can be operated under hydrogen or other reaction gases. For these applications, the systems are additionally equipped with the required safety technology. Only certified and industry proven safety sensors are used. The furnaces are controlled by a fail-safe PLC control system (S7-300F/ safety controller).

- Certified safety concept
- Automation package (see additional equipment above)
- Redundant gas inlet valves for hydrogen
- Monitored pre-pressures of all process gases
- Bypass for safe purging of furnace chamber with inert gas
- Pressure-monitored emergency flooding with automated solenoid valve opening
- Electric or gas-heated exhaust gas torch for H_2 post-combustion
- Atmospheric operation: H_2-purging of process reactor starting from room temperature at controlled over pressure (50 mbar relative)

Additional equipment

- Partial pressure operation: H_2 flushing at underpressure in the process reactor starting from 750 °C furnace chamber temperature
- Retort in the process chamber for debinding under hydrogen

VHT 08/16 MO with hydrogen extension package as automatic version

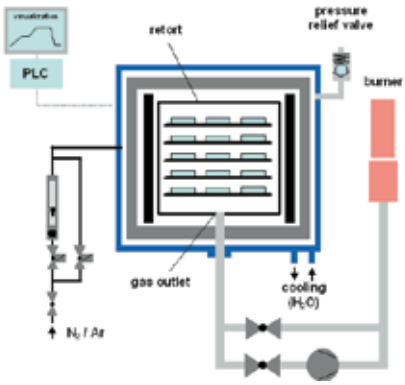
VDB Version VHT.../MO-VDB or VHT.../GR-VDB for Debinding under Protective Gas, Hydrogen or in Vacuum

Certain processes require debinding under protective gases or in vacuum. For these processes the models VHT.../MO-VDB or VHT.../GR-VDB are perfectly suited. They are equipped with the necessary safety technology for debinding. The furnace chamber has an additional debinding retort with a direct discharge into the exhaust gas torch. This system ensures that exhaust gases during debinding do not get into and contaminate the furnace chamber.

- Adapted safety concept for debinding
- Automation package (see additional equipment above)
- Exhaust gas torch for burning the exhaust gases
- Debinding retort in the furnace chamber with direct discharge of the exhaust gases into the exhaust gas torch
- Bypass for safe flushing of furnace chamber with inert gas
- Dry-running vacuum pump

Additional equipment

- Condensate trap for separation of large binder volumes during vacuum debinding
- Heated exhaust gas discharge to prevent condensate deposits in the exhaust gas section
- Exhaust gas treatment depending on the process with binder trap, washer or exhaust gas torch



VHT gas supply diagram, debinding and sintering

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 insulation/heater
VHT 8/18-GR	1800	170	240	200	8	1250 (800)[1]	1100	2000	27.0	three-phase[2]	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[2]	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[2]	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[2]	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
[2]Only heating between two phases

*Please see page 70 for more information about mains voltage.

Chamber Retort Ovens for Catalytic Debinding

NRA 40/02 CDB

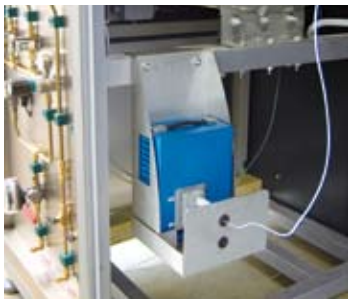
NRA 40/02 CDB and NRA 150/02 CDB

The chamber ovens NRA 40/02 CDB and NRA 150/02 CDB are specially developed for debinding of ceramics and metallic powder injection molded parts according to the BASF CATAMOLD®-method. They are equipped with a gastight retort with inside heating and air circulation. During catalytic debinding, the polyacetal-containing (POM) binder chemically decomposes in the oven under nitric acid and is carried out of the oven by a nitrogen carrier gas and burned in an exhaust gas torch. Both furnaces have a comprehensive safety package to protect the operator and the surrounding.

Model NRA 40/02 CDB is very compact and excels with its excellent cost-performance ratio. This model is pefectly suited for repeating lab processes and in production. As a professional production furnace, model NRA 150/02 CDB is also designed for frequent charge changes. The furnace has an automatic torch control that detects the end of the process measuring the torch temperature.

NRA 150/02 CDB

- Tmax 200 °C
- Process retort made of acid-resistant stainless steel 1.4571 with large swiveling door
- Four-side heating inside the retort through chromium steel tube heating elements for good temperature uniformity
- Horizontal air circulation for uniform distribution of the process gas
- Acid pump and acid vessel (to be provided by the customer) accommodated in the furnace frame
- Gas-heated exhaust gas torch with flame monitoring
- Non-wearing ceramic cup for uniform evaporation of the nitric acid



Acid pump for nitric acid

Version NRA 40/02 CDB

- Gas supply system with fixed values
- Safety package provides for safe shut-down and floods of the furnace with nitrogen in case of a failure
- Controller P 300 for setting the temperature curve

Process chamber with internal heating

Version NRA 150/02 CDB

- Extensive safety package with redundantly operating safety PLC for safe operation with nitric acid
- Automatic gas supply system for nitrogen with mass flow controller
- Large, graphic touch panel H 3700 for entering data and for process visualization
- Adjustable acid volume and correspondingly adjusted gas spply volumes

Additional equipment

- Scale for the nitric acid vessel, connected to the PLC monitors the acid consumption and visualizes the fill level of the acid vessel (NRA 150/02 CDB)
- NCC software package for visualization, control and charge documentation of the process (NRA 150/02 CDB)
- Lift truck for easy loading of the furnace

Model	Tmax	Inner dimensions in mm			Volume	Outer dimensions in mm			Supply	Electrical	Weight	Acidic quantity	Nitrogen
	°C	w	d	h	in l	W	D	H	power/kW	connection*	in kg	(HNO_3)	(N_2)
NRA 40/02 CDB	200	300	450	300	40	1100	1250	2450	5	three-phase[1]	350	30 ml/h	500 l/h
NRA 150/02 CDB	200	450	700	450	150	1650	1960	2850	23	three-phase[1]	1650	max. 180 ml/h	max. 4000 l/h

[1]Only heating between two phases

*Please see page 70 for more information about mains voltage.

Fast-Firing Furnaces

LS 12/13 and LS 25/13

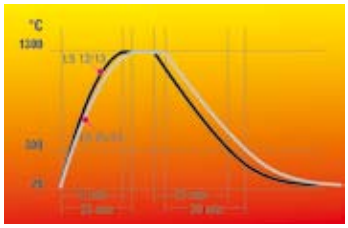
These models are ideal for simulation of typical fast-firing processes up to a maximum firing temperature of 1300 °C. The combination of high performance, low thermal mass and powerful cooling fans provides for cycle times from cold to cold of under 35 minutes.

- Tmax 1300 °C
- Very compact design
- Ceramic grid tubes as charge support
- Floor and lid heating
- Two-zone control, bottom and lid
- Integrated cooling fans, automatically programmable to speed up charge cooling including housing cooling
- Programmable lid opening of approximately 20 mm for faster cooling without activating the fan
- Thermocouple PtRh-Pt, type S for top and bottom zone
- Castors for easy furnace moving
- Description of the control system see page 70

LS 12/13

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
LS 12/13	1300	350	350	40	12	600	800	985	15	3-phase	130
LS 25/13	1300	500	500	100	25	750	985	1150	22	3-phase	160

*Please see page 70 for more information about mains voltage



Firing curves LS 12/13 and LS 25/13

Gradient or Lab Strand Annealing Furnaces

GR 1300/13

The furnace chamber of the gradient furnace GR 1300/13 is divided in six control zones of equal length. The temperature in each of the six heating zones is separately controlled. The furnace is usually charged from the side through the parallel swivel door. A maximum temperature gradient of 400 °C can then be stabilized over the heated length of 1300 mm. On request the furnace also is designed as a strand furnace with a second door on the opposite side. Other available additional equipment consists of fiber chamber separators dividing the furnace chamber into six equally sized chambers. Charging then occurs from above by opening the large lid.

GR 1300/13

- Tmax 1300 °C
- Heated length: 1300 mm
- Heating elements on support tubes providing for free heat radiation in the kiln chamber
- Charging from the top or through the right side door
- Gas damper suspension of the lid
- 6-zone control
- Separate control of heating zones (each 160 mm long)
- Temperature gradient of 400 °C over the entire length of the kiln chamber, each zone can individually be controlled
- Description of the control system: see page 70

Additional equipment

- Up to ten control zones
- Fiber separators dividing the chamber in six equally sized chambers
- Second parallel swivel door for use as conveyor furnace
- Vertical instead of horizontal strand furnace

Furnace chamber of the GR 1300/13 with second door as additional equipment

Model	Tmax	Inner dimensions in mm			Outer dimensions in mm			Supply	Electrical	Weight
	°C	w	d	h	W	D	H	power/kW	connection*	in kg
GR 1300/13	1300	1300	100	60	1660	740	1345	18	three-phase	300

* Please see page 70 for more information about mains voltage

Professional Chamber Furnaces with Brick or Fibre Insulation

LH 15/12 with brick insulation

LH 60/12 with scale to measure weight reduction during annealing

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
- Five-sided heating for very good temperature uniformity
- Heating elements on support tubes ensure free heat radiation and a long service life
- Protection of bottom heating and flat stacking surface provided by embedded SiC plate in the floor
- LH models: 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
- Description of the control system see page 70

LF 120/12 with fibre insulation

Additional equipment

- Parallel swinging door, pivots away from operator, for opening when hot
- Lift door with electro-mechanic linear drive
- Separate wall-mounting or floor standing cabinet for switchgear
- Automatic vent flap
- Cooling fan for shorter cycle times
- Protective gas connector, sealed housing
- Retort made of quartz glass for very clean atmosphere, quartz glass covered door with lid function
- Manual or automatic gas supply system
- Scale to measure weight reduction during annealing

LH 120/12S with quartz glass retort

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
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
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

[1]Heating only between two phases

*Please see page 70 for information on mains voltage

Parallel swinging door for opening when hot

Gas panel

High-Temperature Chamber Furnaces with SiC Rod Heating

HTCT 08/15 with lift door

HTC 08/14 with flap door and gas supply system

HTC 01/14 - HTCT 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 materials and SiC heating rods on both sides of the furnace

- Tmax 1400 °C, 1500 °C, or 1600 °C
- High-quality fibre material, selected for the working temperature
- Housing made of sheets of textured stainless steel
- Double-walled housing for low external temperatures and high stability
- Optional flap door (HTC) which can be used as work platform or lift door (HTCT) 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 solid-state-relays, power tuned to the SiC rods
- Easy replacement of heating rods
- Description of the control system see page 70

Saggars with top lid

Additional equipment

- Over-temperature limit controller with manual reset for thermal protection class 2 in accordance with EN 60519-2 as temperature limiter to protect the oven and load
- Square saggar for charging of up to three layers
- Spacer recommended to be placed under the bottom saggar for better temperature uniformity
- Manual or automatic gas supply system

Spacers

Over-temperature limit controller

Model	Tmax °C	Inner dimensions in mm w	d	h	Volume in L	Outer dimensions in mm W	D	H²	Power kW	Electrical connection*	Weight in kg	Minutes to Tmax
HTC, HTCT 01/14	1400	90	150	130	1	470	700	750	2.2	single-phase	55	40
HTC, HTCT 03/14	1400	120	210	120	3	400	535	530	9.0	3-phase¹	30	40
HTC, HTCT 08/14	1400	170	290	170	8	450	620	570	13.0	3-phase	40	40
HTC, HTCT 01/15	1500	90	150	130	1	470	700	750	2.2	single-phase	55	50
HTC, HTCT 03/15	1500	120	210	120	3	400	535	530	9.0	3-phase¹	30	50
HTC, HTCT 08/15	1500	170	290	170	8	450	620	570	13.0	3-phase	40	50
HTC, HTCT 01/16	1600	90	150	130	1	470	700	750	2.2	single-phase	55	60
HTC, HTCT 03/16	1600	120	210	120	3	400	535	530	9.0	3-phase¹	30	60
HTC, HTCT 08/16	1600	170	290	170	8	450	620	570	13.0	3-phase	40	60

¹Heating only between two phases

²Plus maximum 270 mm for models HTCT when open

*Please see page 70 for more information about mains voltage

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

LHT 02/17

LHT 08/17

LHT 02/16 - LHT 08/18

Designed as tabletop models, these compact high-temperature chamber 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
- Housing made of sheets of textured stainless steel
- Double-walled housing with additional fan cooling for low surface temperature
- Furnace sizes of 2, 4, or 8 liters
- With lift door, whereby the hot side is away from the operator
- Adjustable air inlet
- Exhaust air opening in the roof
- Type B thermocouple
- Switching system with phase-angle firing thyristors (SCRs)
- Description of the control system see page 70

Saggars with top lid

Additional equipment

- Over-temperature limit controller with manual reset for thermal protection class 2 in accordance with EN 60519-2 as temperature limiter to protect the oven and load
- Square saggar for charging of up to three layers
- Spacer recommended to be placed under the bottom saggar for better temperature uniformity
- Protective gas connection
- Manual or automatic gas supply system

Spacers

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 70 for more information about mains voltage

Over-temperature limit controller

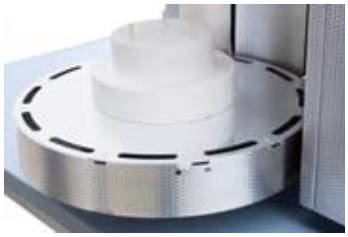
High-temperature Lift-bottom Furnace without or with Retort

LHT 02/16 LB with a set of saggars

LHT 16/17 LBR

LHT/LB and LHT/LBR

The electrically driven lift-bottom considerably facilitates charging of the LHT/LB(R) furnaces. With their all-round heating of the cylindric chamber, these furnaces achieve outstanding temperature uniformity. Model LHT 02/16 LBR is specifically recommend when possible contamination is an issue. A ceramic retort between the charge and the heating elements optimally protects the furnace against chemical contamination. The load can be placed in saggars made of technical ceramics. Up to three saggars can be charged and provide for high output. As additional equipment these furnaces can be furnished with a cooling system using compressed air which is induced to shorten the process cycle.



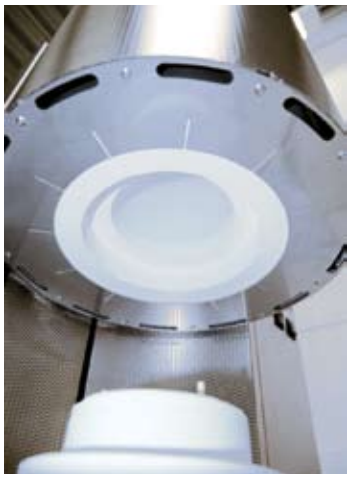
Lift-bottom with adjustable air inlet

- Tmax 1600 °C or 1700 °C
- High-quality molybdenum disilicide heating elements
- Furnace chamber lined with first-class, durable fiber materials
- Heating from all around for good temperature uniformity
- Outstanding temperature uniformity due to all-round furnace chamber heating
- Tubular plasma ceramic retort for the LBR version to prevent a certain level of contamination and to improve temperature uniformity
- Furnace chamber with a volume of 2 or 16 liters, table with large footprint
- Spacers to lift-up the saggars already installed in the table
- Precise, electric spindle drive with push button operation
- Housing made of sheets of textured stainless steel
- Adjustable air inlet through the floor
- Exhaust air vent in the roof
- Type B thermocouple
- Switchgear with thyristor
- Description of the control system see page 70

Additional equipment

- Over-temperature limit controller with manual reset for thermal protection class 2 in accordance with EN 60519-2 as temperature limiter to protect the furnace and load
- Square saggar for charging of up to three layers
- Protective gas connection
- Manual or automatic gas supply system, particularly effective in the LBR version with retort
- Forced-Air Cooling Package for model LHT 02/LBR for shorter process cycles

  The forced-air cooling package can be installed in models LHT 02/16 LBR and LHT 02/17 LBR. The furnace will be equipped with a quick lock for compressed air and a valve which can be activated by means of the extra function in the controller. To protect the charge, the cooling air will be injected behind the ceramic retort in the furnace chamber. Cooling times can be cut by about 45 minutes.



Plasma ceramic retort for protection of the heating elements and to avoid charge contimination [in the LHT 02/16 LBR]

Model	Tmax	Inner dimensions in mm		Volume	Outer dimensions in mm			Power	Electrical	Weight	Minutes
	°C	Ø	h	in L	W	D	H	kW	connection*	in kg	to Tmax
LHT 02/16 LB, LBR	1600	Ø 120	130	2	540	610	740	3.0	single-phase	85	85
LHT 02/17 LB, LBR	1700	Ø 120	130	2	540	610	740	3.0	single-phase	85	85
LHT 16/16 LB, LBR	1600	Ø 260	260	16	650	1250	1980	12.0	3-phase	410	120
LHT 16/17 LB, LBR	1700	Ø 260	260	16	650	1250	1980	12.0	3-phase	410	120

*Please see page 70 for more information about mains voltage

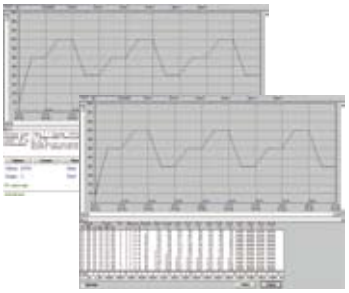
High-Temperature Furnaces with Scale for Determination of Combustion Loss and Thermographical Analyses (TGA)

Customized LHT 04/16 SW with scale for measuring weight reduction during annealing and with gas supply system

LHT 04/16 SW and LHT 04/17 SW

These furnaces were specially developed to determine combustion loss during annealing and for thermographic analysis (TGA) in the lab. The complete system consists of the high-temperature furnace for 1600 °C or 1750 °C, a table frame, precision scale with feedthroughs into the furnace and powerful software for recording both the temperature curve and the weight loss over time.

- Technical description of the furnaces: see models LHT 04/16 and LHT 04/17, page 51



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

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 04/16 SW	1600	150	150	150	4	655	370	890	5.0	3-phase[1]	85	25
LHT 04/17 SW	1750	150	150	150	4	655	370	890	5.0	3-phase[1]	85	40

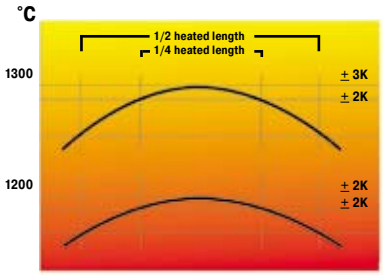
[1]Heating only between two phases

*Please see page 70 for more information about mains voltage

Compact Tube Furnaces

R 50/250/12 single-zoned

R 100/750/13, three-zone control with H100



Temperature uniformity, 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
- Housing made of sheets of textured stainless steel
- 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
- Type S thermocouple
- Solid state relays provide for lownoise operation
- Standard working tube see chart on page 67
- Description of the control system see page 70

Additional equipment

- Over-temperature limit controller with manual reset for thermal protection class 2 in accordance with EN 60519-2 as temperature limiter to protect the oven and load
- Charge control with temperature measurement in the working tube and in the oven chamber behind the tube, please see page 63
- Three-zoned design with HiProSystem control (heated length from 750 mm, for 1300 °C models)
- Alternative working tubes see chart on page 67
- Please see page 64 for additional equipment

Model	Tmax °C[3]	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 three-zones
[2]Heating only between two phases
*Please see page 70 for information about mains voltage
[3]Tmax is reached outside the tube. Realistic working temperature inside the tube is approx. 70 °C lower.

Universal Tube Furnaces with Stand for horizontal or vertical Operation

RT 50-250/11 with gas supply system for nitrogen

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.

RT 50-250/11

- 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
- Type S thermocouple
- Operation also possible separate from stand if safety guidelines are observed
- Control system integrated in furnace base
- Please see page 64 for additional equipment
- Description of the control system see page 70

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 70 for more information about mains voltage

Hinged Tube Furnaces for Horizontal or Vertical Operation up to 1300 °C, Gas Atmosphere or Vacuum

RS 80/300/11 for horizontal operation

RS 80/750/13 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
- Housing made of sheets of textured stainless steel
- Tmax 1100 °C: Type K thermocouple
- Tmax 1300 °C: Type S thermocouple
- Frame for vertical operation, which can also be retrofitted as additional equipment
- 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
- Switchgear and control unit separate from furnace in own wall or standing cabinet
- Standard working tube see chart on page 67
- Description of the control system see page 70

Model	Tmax	Exterior dimensions[3] in mm			Max. outer tube Ø	Heated	Length constant	Tube length	Power	Electrical	Weight
	°C[5]	W[2]	D	H	/mm	length mm	temperature ΔT 10K	in mm	kW	connection*	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	7.0 [7]	3-phase[1]	115
RS 170/1000/11	1100	1255	575	490	170	1000	330	1350	9.0 [7]	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
[5]Tmax is reached outside the tube. Realistic working temperature inside the tube is approx. 50 °C lower.
[7]Only valid for single-zone version
*Please see page 70 for more information about mains voltage

RS 120/1000/13S with gastight tube, charge control and check valve at gas outlet

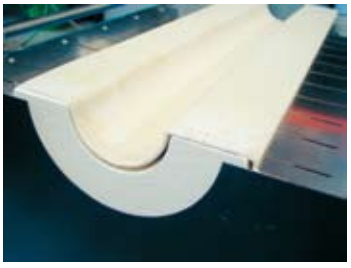
The RS tube furnace line can be custom-fit to your needs with a variety of extras. Starting with various working tubes of different materials to protective gas or vacuum operation. For optimum temperature uniformity, all RS furnaces are also available as three-zone tube furnaces with modern PLC controls. 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 64.

Additional equipment

- Charge control with temperature measurement in the working tube and in the oven chamber behind the tube, please see page 66
- Working tubes designed for process requirements
- Display of inner tube temperature with additional thermocouple
- Different gas supply packages (starting on page 64) for protective gas and vacuum operation
- Three-zone control for optimization of temperature uniformity
- Check valve at gas outlet avoids intrusion of false air
- Ceramic half pipe for heating elements and/or as support surface for the load
- Stand for vertical operation
- Base frame with integrated switchgear and controller
- Alternative working tubes see chart on page 67
- Please see page 64 for more additional equipment

Quartz glass and flanges for protective gas operation as optional equipment

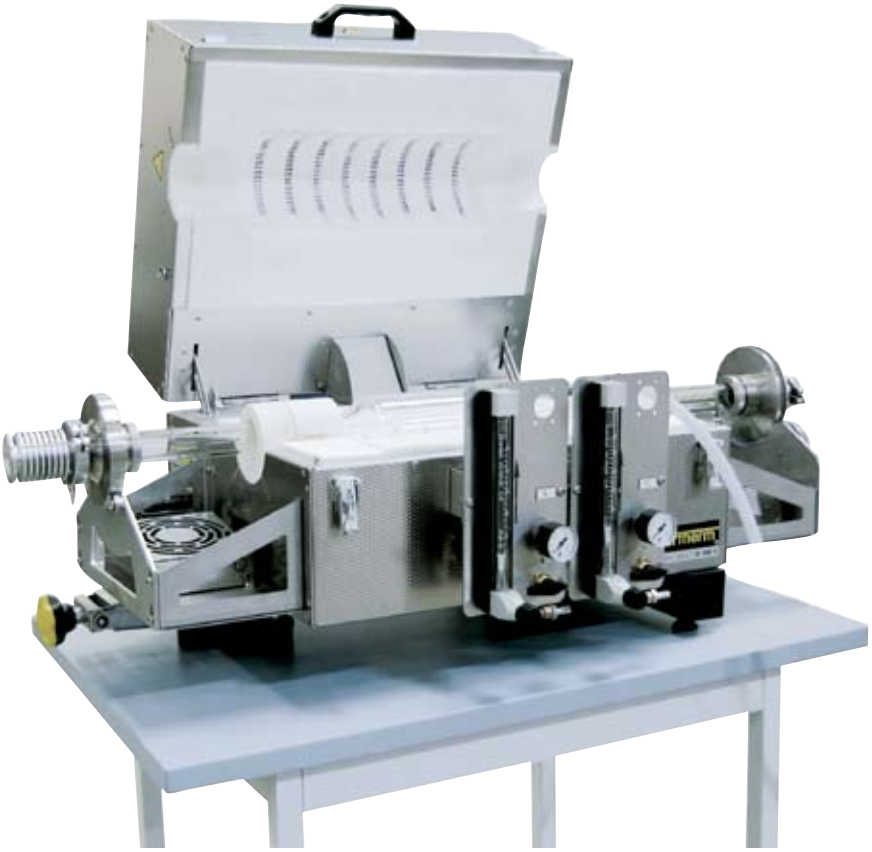
RS 120/750/13 with gas supply system 4, hydrogen applications



Ceramic half pipe for heating elements and/or as support surface for the load

Rotary Tube Furnaces

RSR 80-500/11 with tilting frame for continuous operation



RSR 80-300/11 in tiltable version with glass tube and protective gas operation

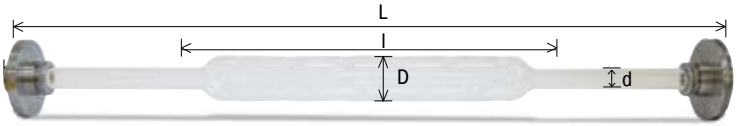
Adapters for alternative operation with working tube or process reactor

Connection set for vacuum operation

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

When the retention of the granular characteristics of the material is important, as in drying or calcining, the rotary tube furnaces of the RSR product line provide for the optimal solution. The permanent rotation of the working tube in one direction makes sure that the charge is constantly in motion. The furnaces may be operated either horizontally with a quartz glass reactor or in a preset tilting angle with a quartz glass tube for continuous conveying of the charge through the tube. Equipment like the filling funnel, electrically driven feeder and outlet with conveying paddles in the tube can be added to upscale these continuous furnaces into a small production plant.

- Design like RS models, see page 56
- 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 housing
- 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
- Description of the control system see page 70



Quartz glass reactor, flat or dimpled with flange KF 40 according to DIN 28403

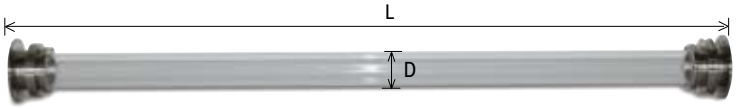
RSR 120/750/11 with filling funnel and conveying technology

Additional equipment

- Gastight rotary feedthrough for connection to gas supply systems (suitable for operation in rough vacuum)
- Display of inner tube temperature with additional thermocouple
- Different gas supply systems
- Gas cooler at tube outlet
- Check valve at gas outlet avoids intrusion of false air
- Three-zone control
- Tube adaptor for alternative operation either with glass reactor or ceramic tube
- Tilting frame with adjustable tilting angle for conveying the powder through the tube
- Feeder with electrically driven screw conveyor and adjustable rotational speed
- Filling funnel with closable powder outlet
- Powder outlet with conveying paddles in the working tube at the tube end

Screw conveyor with adjustable rotational speed

Protective gas inlet at tube exit



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

Model	Tmax °C[3]	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]Heating only between two phases
[2]Without tube
*Please see page 70 for information on mains voltage
[3]Tmax is reached outside the tube. Realistic working temperature inside the tube is approx. 50 °C lower.

High-temperature Tube Furnaces for Horizontal Operation and for Vertical Operation up to 1800 °C, Gas Atmosphere or Vacuum

Horizontal tube furnace RHTH 120/300/16 with vacuum flanges as additional 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 housing with slots for convection cooling
- Models RHTV with hinges for wall mounting
- Housing made of sheets of textured stainless steel
- Ceramic working tube made of material C 799 incl. fibre plugs operation under air
- Type B thermocouple
- Power unit with low-voltage transformer and thyristor
- Switchgear and control unit separate from furnace in separate floor standing cabinet
- Standard working tube see chart on page 67
- Description of the control system see page 70

Additional equipment

- Over-temperature limit controller with manual reset for thermal protection class 2 in accordance with EN 60519-2 as temperature limiter to protect the oven and load
- Charge control with temperature measurement in the working tube and in the oven chamber behind the tube, please see page 66
- Working tubes designed for process requirements
- Display of inner tube temperature with additional thermocouple
- Gastight flanges for protective gas and vacuum operation
- Manual or automatic gas supply system
- Three- or five-zone control for optimization of temperature uniformity
- Check valve at gas outlet avoids intrusion of false air
- Stand for vertical operation
- Alternative working tubes see chart on page 67
- Please see page 64 for more additional equipment

Over-temperature limit controller

RHTH 120/600/16 with upstream furnace RT 50-250/11 to preheat the process gas

RHTV 120/150/17 vertical tube furnace with stand and gas supply system 2 as additional equipment

RHTV 120/300/15 integrated in a tensile strength testing machine

Model	Tmax	Outer dimensions in mm			Max. outer tube Ø	Heated	Length constant	Tube length	Power	Electrical	Weight
Horizontal design	°C[3]	W[2]	D	H	/mm	length mm	temperature ΔT 10K	in mm	kW	connection*	in kg
RHTH 120/150/..	1600 or	470	550	640	50	150	50	470	5.4	3-phase[1]	70
RHTH 120/300/..	1700 or	620	550	640	80	300	100	620	9.0	3-phase[1]	90
RHTH 120/600/..	1800	920	550	640	120	600	200	920	14.4	3-phase[1]	110

Model	Tmax	Outer dimensions in mm			Max. outer tube Ø	Heated	Length constant	Tube length	Power	Electrical	Weight
Vertical design	°C[3]	W	D	H[2]	/mm	length mm	temperature ΔT 10K	in mm	kW	connection*	in kg
RHTV 120/150/..	1600 or	570	650	510	50	150	30	480	5.4	3-phase[1]	70
RHTV 120/300/..	1700 or	570	650	660	80	300	80	630	10.3	3-phase[1]	90
RHTV 120/600/..	1800	570	650	960	120	600	170	880	19.0	3-phase[1]	110

[1]Heating only between two phases
[2]Without tube
*Please see page 70 for information on mains voltage
[3]Tmax is reached outside the tube. Realistic working temperature inside the tube is approx. 50 °C lower.

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

RHTC 80-230

RHTC 80-450/15 with manual gas supply system

RHTC 80-230/15 - RHTC 80-710/15

These compact tube furnaces with SiC rod heating and integrated switchgear and controller 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 uniformity. The price-performance ratio for this temperature range is unbeatable.

SiC rod heating

- Tmax 1500 °C
- Housing made of sheets of textured stainless steel
- High-quality fiber insulation
- Active cooling of housing for low surface temperatures
- Type S thermocouple
- Solid state relays provide for low-noise operation
- Prepared for assembly of working tubes with water-cooled flanges
- Ceramic tube, C 799 quality
- Standard working tube see chart on page 67
- Description of the control system see page 70

Additional equipment

- Over-temperature limit controller with manual reset for thermal protection class 2 in accordance with EN 60519-2 as temperature limiter to protect furnace and load
- Charge control with temperature measurement in the working tube and in the oven chamber behind the tube, please see page 66
- Fiber plugs
- Check valve at gas outlet avoids intrusion of false air
- Working tubes for operation with water-cooled flanges
- Display of inner tube temperature with additional thermocouple
- Alternative gas supply systems for protective gas or vacuum operation, starting on page 64
- Alternative working tubes see chart on page 67

Model	Tmax °C[3]	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 80-230/15	1500	600	430	580	80	230	80	600	6.3	3-phase[2]	50
RHTC 80-450/15	1500	820	430	580	80	450	150	830	9.5	3-phase[1]	70
RHTC 80-710/15	1500	1070	430	580	80	710	235	1080	11.7	3-phase[1]	90

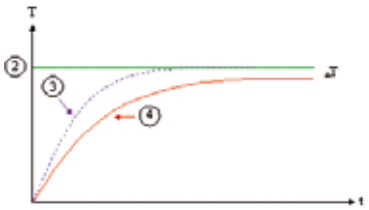
[1]Heating only between two phases
[2]Heating only on one phase
*Please see page 70 for more information about mains voltage
[3]Tmax is reached outside the tube. Realistic working temperature inside the tube is approx. 50 °C lower.

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

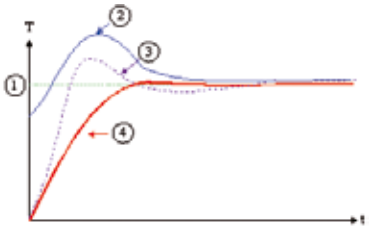
Extension Package for Furnace Chamber Control

with additional temperature measurement in the working tube and display of the measured temperature

Charge 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



Charge control

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

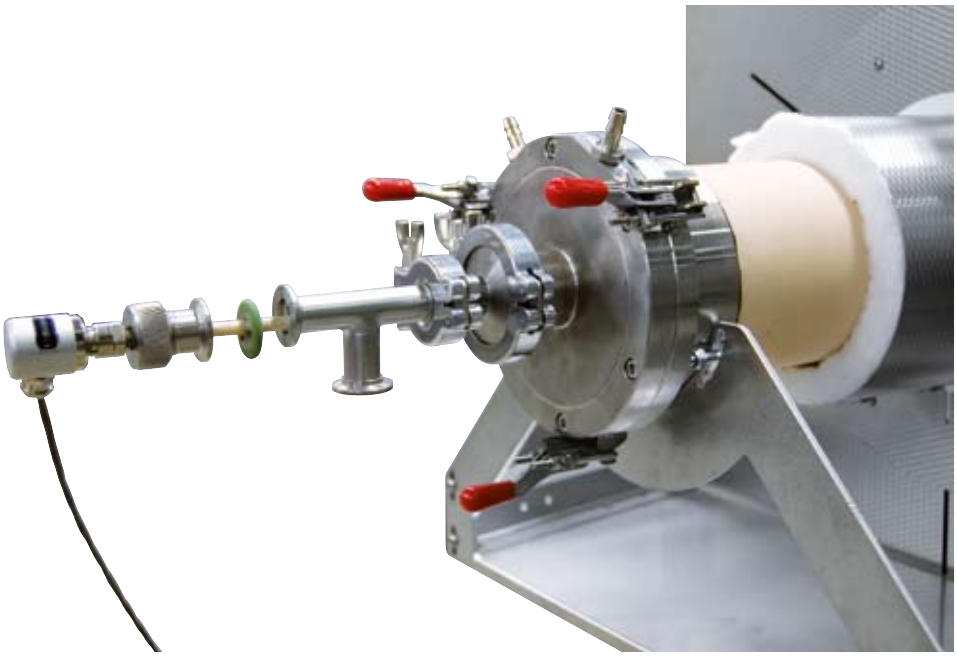
Furnace Chamber vs. Charge Control Comparison

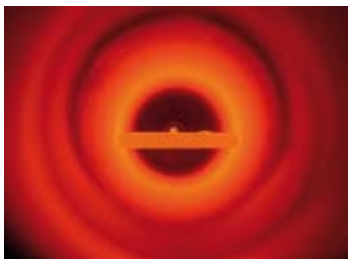
Furnace Chamber Control

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.

Charge Control

If the charge control 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.


Thermocouple for charge control in the RHTH 120/600/18 furnace


Sintering under hydrogen in a tube furnace of RHTH product line

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

When equipped with various equipment packages, the tube furnace of RS, RHTC, RHTH, and RHTV product line 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.

- Standard working tube 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 330)

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 protective gas applications with nonflammable gases/ 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 gastight design. Besides the longer working tube, the scope of delivery also includes gastight flanges and a corresponding bracket system in the furnace. The system can also be equipped for vacuum operation.

- Longer, gastight 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), gas outlet valve, piped and ready to connect (gas intake pressure at 300 mbar to be provided by customer)

Observation window as additional equipment for gastight flanges

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 330)
- Water-cooled end flange with quick connectors
- Cooling unit for closed loop water circuit
- Window for charge observation in combination with gastight flanges

Vacuum Operation

- Vacuum package for evacuation of the working tube, consisting of connector for the gas outlet, 1 ball valve, 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^{-2} mbar
- Alternative pumps for max. final pressure of up to 10^{-5} mbar on request (see page 65)

Gas Supply System 3 for hydrogen applications, manual operation in supervised mode

Adding gas supply system 3 to the tube furnace provides for operation under a hydrogen atmosphere. During hydrogen operation, a safety pressure of approx. 30 mbar is ensured in the working tube. Surplus hydrogen is burnt off in an exhaust gas torch. The operator manually takes care of inerting the working chamber before process start, after process end, and in case of default.

- Safety system for operation with flammable gases including torch function and tube breakage monitoring (checking overpressure)
- Longer, gastight working tube
- 2 vacuum-tight, water-cooled stainless steel flanges (cooling water supply to be provided by customer via hose connector)
- Exhaust gas torch
- Pressure switch for monitoring the safety pressure
- Gas supply system for H_2 and N_2. Volume adjustment is carried out by hand (the customer provides an H_2 supply at 1 bar, an N_2 supply at 10 bar, an O_2 supply at 6-8 bar and a propan supply at 300 mbar)

RHTH 120-600/18 with gas supply system 4 for hydrogen operation

Gas Supply System 4 for hydrogen applications, fully-automatic, unattended operation

With extended safety logic and an integrated nitrogen purge container, the system can be used for fully-automatic, unattended operation. Equipped with a Safety-PLC control system, pre-purging, hydrogen inlet, operation, fault monitoring and purging at the end of the process are carried out automatically. In case of default, the tube is immediately purged with nitrogen and the system is automatically switched to a safe status.

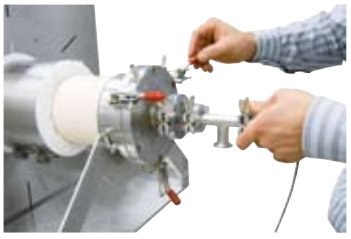
Equipment in Addition to System 3

- Extended safety control system with emergency tube purging in case of default
- Emergency purge container
- Safety-PLC control system with touchpanel for data input

Additional equipment for systems 3 - 4

- Simplified safety package for operation when purging with hydrogen above 800 °C
  - Tube can be opened at working temperature above 800 °C
  - Pilot flame at tube outlet
  - Purging with hydrogen below 800 °C not possible, locked
  - Available for models RS
- Gas supply system extension for additional nonflammable gas types
- Bottle pressure reducer for use with bottled gas
- Cooling unit for closed loop water circuit
- Vacuum packages (with hydrogen operation, this package can only be used for pre-evacuation)
- PLC control system (as standard with gas supply system 4)
- Gas supply via program-dependent, controllable mass flow controllers (with PLC control system only)

Gastight design with water-cooled flanges



Water-cooled end flange with quick connectors as additional equipment

Vacuum Pumps

With respect to the final pressure different pumps are available (see also page 44):

- 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 66).

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

Tube Furnaces for Integration into Customized Systems

RS 100-250/11S in split-type design for integration into a test stand

Tube furnace with five-zone control for optimal temperature uniformity

RS 120/1000/11-S in divided version. Both half furnaces are manufactured identically and will be integrated in an extisting gas-heating system with space-saving design

Bolts for connection of two separated half furnaces

With their high level of flexibility and innovation, Nabertherm offers the optimal solution for customer-specific applications.

Based on our standard models, we develop individual solutions for integration in overriding process systems. The solutions shown on this page are just a few examples of what is feasible. From working under vacuum or protective gas via innovative control and automation technology for a wide selection of temperatures, sizes, lenghts and other properties of tube furnace systems – we will find the appropriate solution for a suitable process optimization.

Working Tubes

Working tube closed at one end with gastight flanges as additional equipment

Various working tubes as option

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

Material	Tube outside Ø mm	Max. heat-up ramp K/h	Tmax in air* °C	Tmax in vacuum operation °C	Gastight
C 530 (Sillimantin)	< 120	unlimited	1300	not possible	no
	from 120	200			
C 610 (Pytagoras)	< 120	300	1400	1200	yes
	from 120	200			
C 799 (99.7 % Al_2O_3)	< 120	300	1800	1400	yes
	from 120	200			
Quartz glass	all	unlimited	1100	950	yes
CrFeAl-Alloy	all	unlimited	1300	1100	yes

*the max. allowed temperature might be reduced operating under aggressive atmospheres

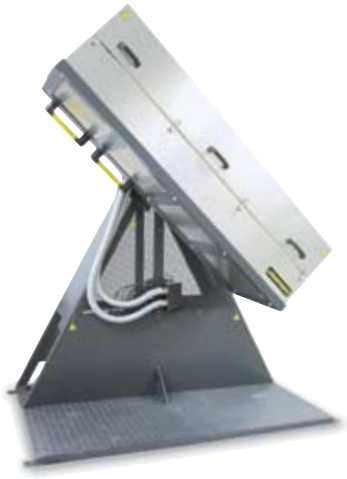
Working Tubes: Standard (●) and Options (○)

Working tube outer Ø x inner Ø x length	Article No.	Model																						
		R				RS								RHTC			RHTH			RHTV			RSR			
		50-250	50-500	100-750	120-1000	80-300	80-500	80-750	120-500	120-750	120-1000	170-750	170-1000	80-230	80-450	80-710	120-150	120-300	120-600	120-150	120-300	120-600	80-500	80-750	120-500	120-750
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 1100 mm	692071659											●														
170 x 150 x 1350 mm	692071660												●													
Vacuum tube[1] C 610																										
60 x 50 x 1030 mm	692070179					○																				
60 x 50 x 1230 mm	692070180						○		○																	
60 x 50 x 1480 mm	692070181							○		○		○														
80 x 70 x 1230 mm	692070182						○		○																	
80 x 70 x 1480 mm	692070183							○		○		○														
120 x 100 x 1230 mm	692070184								○																	
120 x 100 x 1480 mm	692070185									○		○														
120 x 100 x 1730 mm	692070186										○		○													
170 x 150 x 1480 mm	692070187											○														
170 x 150 x 1730 mm	692070188												○													
C 799																										
50 x 40 x 380 mm	692071664																●			●						
50 x 40 x 530 mm	692071665																	○			○					
50 x 40 x 830 mm	692070163																		○			○				
80 x 70 x 600 mm	692070600													●												
80 x 70 x 830 mm	692071670														●				○			○				
80 x 70 x 530 mm	692071669																	●			●					
80 x 70 x 1080 mm	692071647															●										
120 x 105 x 830 mm	692071713																		●			●				
Vacuum tube[1] C 799																										
50 x 40 x 990 mm	692070149																○			○						
50 x 40 x 1140 mm	692070176																	○			○					
50 x 40 x 1440 mm	692070177																		○			○				
80 x 70 x 990 mm	692070190													○												
80 x 70 x 1140 mm	692070148																	○			○					
80 x 70 x 1210 mm	692070191														○											
80 x 70 x 1470 mm	692070192															○										
80 x 70 x 1440 mm	692070178																		○			○				
120 x 105 x 1440 mm	692070147																		○			○				
Vacuum tube[2] APM																										
75 x 66 x 1090 mm	691402564					○																				
75 x 66 x 1290 mm	691402565						○																			
75 x 66 x 1540 mm	691400835							○																		
115 x 104 x 1290 mm	691402566								○																	
115 x 104 x 1540 mm	691402567									○																
115 x 104 x 1790 mm	691402568										○															
164 x 152 x 1540 mm	691402569											○														
164 x 152 x 1790 mm	691402570												○													
Quartz glass tubes[3]																										
76 x 70 x 1140 mm	601403142																						●		○	
Spare tube	691402556																						●		○	
76 x 70 x 1390 mm	601403143																							●		○
Spare tube	691402636																							●		○
106 x 100 x 1140 mm	601403144																								●	
Spare tube	691402637																								●	
106 x 100 x 1390 mm	601403145																									●
Spare tube	691402635																									●
Quartz glass tube [3]																										
76 x 70 x 1140 mm	601402746																						○		○	
Spare tube	691402548																						○		○	
76 x 70 x 1390 mm	601402747																							○		○
Spare tube	691402272																							○		○
106 x 100 x 1140 mm	601402748																								○	
Spare tube	691402629																								○	
106 x 100 x 1390 mm	601402749																									○
Spare tube	691402638																									○

[1]With grinded tube ends for the use with water-cooled end flanges
[2]With attached holder for gas tight flange
[3]Tubes/reactors incl. mounted sleeves for connection to the rotary drive. Spare tubes come without sleeves.

● Standard working tube
○ Working tube available as an option

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
- Three-zoned control system for optimization of temperature uniformity

- 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 alloy 314 (AISI)/(DIN material no. 1.4841)
- Load carrier made of alloy 314 (AISI)/(DIN material no. 1.4841)
- 1-stage rotary vane pump for vacuum down to 10^{-1} mbar
- Tmax 1100 °C
- Heated length: 1000 mm
- Tube interior diameter: 100 mm

- RS 100/1000/11 hinged tube furnace for debinding under protective gas atmospheres
- Gastight 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

- Vertical tube furnace R 50/5000/13S for drop-down experiments under temperature
- Steel tube assembled vertically
- Furnace consists of 6 modules, each hinged separately
- Each furnace module equipped with a controller for zone control
- Tmax 1300 °C
- Overall tube length approx. 6000 mm
- Heated length 6 x 800 mm
- Tube interior diameter 50 mm

RS 80/2350/11S with tube made of quartz glass in special length for protective gas and vacuum operation

The Nabertherm Product Range – www.nabertherm.com

Arts & Crafts

Art is the union of style and technical skill. Good tools are functional and efficient. Are Nabertherm's kilns for pottery, fused glass, painted porcelain, and enamel ware tools or art?

Laboratory/Dental

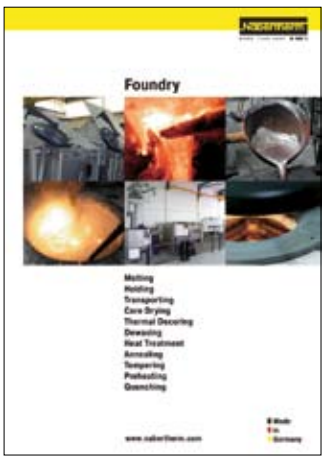
Apart from the furnaces shown for production Nabertherm offers a wide range of standard furnaces for laboratories. We keep standard units in stock for short delivery times. Please ask for our special laboratory brochure which provides more detailed information on the furnaces which could be of interest to you.

Glass

Nabertherm offers a wide range of products and concepts for annealing, bending, slumping, decorating, tempering and for finishing of glass and quartz glass.

Heat Treatment of Metals, Plastics and Surface Finishing

Tempering, annealing, hardening and quenching, solution annealing, forging, curing, preheating, drying, ageing – these are only some of the applications which are possible with our extensive program of furnaces and systems. From the compact hardening furnace to fully-automatic systems with conveying technology and process documentation – we certainly will find a solution tailored to your application.



Foundry

Every furnace for the shop that casts metal, beginning with ovens to dry cores and dewax investments, to fuel-fired and electric resistance melting furnaces, to thermal decoring and heat treatment systems. All Nabertherm Foundry furnaces are designed for energy efficiency and integration with automation systems for low total cost of ownership.

Process Control and Documentation

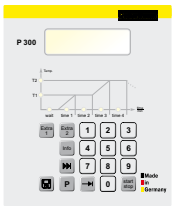
B 180

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.

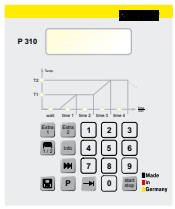
Standard Controller

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, PID microprocessor control with self-diagnosis system and a computer interface, we have a solution to meet your requirements.

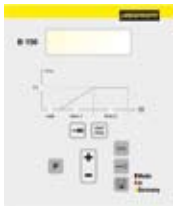
P 330



P 300



P 310



B 150

C 40/C 42

Assignment of Standard Controllers to Furnace Families

	N ../65 HACDB	W ../60 HACDB	TR	N 100/WAX - N 2000/WAX	NB 600/WAX - NB 1000/WAX	W .. + W .../DB	H ../LB oder LT	N 200/DB - N 1000/HDB	N 100 - N 2200/14	NB 300 - NB 600	HTC ../LB oder LT	HT	HFL	HTB	NRA 12/06 - NRA 430/11	NRA .. H_2 version	NRA .. IDB version	SRA 500 - SR 1000	VHT	NRA ..CDB	LS	GR	LH	HTC	LHT	LHT/LB und LHT/LBR	R	RT	RS	RSR	RHTH/RHTV	RHTC
Catalog page	8	9	11	12	12	14	18	20	22	24	26	30	32	34	38	40	40	41	42	46	47	47	48	50	51	52	54	55	56	58	60	62
Controller																																
P 300	●[1]	●[1]				●	●	●	●	○	●			●	●			●					○						○	○		
P 310												○	○							●					●	●						
R 6																																
B 150										●													●						●	●		
B 180			●																					●			●	●				●
P 330			○																		●	●		○			○	○				○
C42												●	●								●	●				○					●	
H 100/PLC																							○						○	○	○	
H 700/PLC															○				●													
H 1700/PLC	○	○					○	○	○		○	○	○	○			●	○		○									○	○	○	
H 3700/PLC												○				●			○	○									○	○	○	

Functionality of the Standard Controllers

	P 300	P 310	R 6	B 150	B 180	P 330	C 42	H 100	H 700	H 1700	H 3700
Number of programs	9	9		1	1	9	9	50	10	10	10
Segments	40	40		2	2	40	18	99	20	20	20
Extra functions (e.g. fan or autom. flaps)	2[1]	2[1]				2	2	2	2	5	8
Maximum number of control zones	1	2	1	1	1	1	**1**	**2**[2]	4	8	8
Graphic color display									5,7"	5,7"	12"
Status messages in clear text	●	●		●	●	●	●	●	●	●	●
Start time configurable (e.g. to use night power rates)	●	●		●	●	●	●	●	●	●	●
Operating hour counter	●	●		●	●	●	●		●	●	●
Auto tune	●	●		●	●	●		●			
Program entry in steps of 1 °C or 1 min.	●	●		●	●	●	●	●	●	●	●
Keypad lock				●							
Skip-button for segment jump	●	●		●		●			●	●	●
Drive of manual zone regulation		●									
Interface for MV software	○	○		○	○	●	●				
Programmable power outlet						●					
kWh meter	●	●		●	●	●	●				
Real-time clock						●	●	●	●	●	●
Bath control/charge control								○	●	○	○
Data entry via touchpanel									●	●	●
Data input via number pad	●	●			●	●	●				

● Standard
○ Option
[1] only for Debinding Package I
[2] as an extra feature in ovens with air circulation

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.

Professional Control and Documentation Alternatives

HiProSystems Control and Documentation

This professional control system for single and multi-zone furnaces is based on Siemens hardware and can be adapted and upgraded extensively. HiProSystems control is used when more than two process-dependent functions, such as exhaust 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 required. 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 colored, tabular depiction of the data

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 (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.

Extension Package, PC-based for Control, Visualisation and Documentation Nabertherm Control Center NCC

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

H 3700 with colored graphic presentation of data

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

Controltherm MV software for the documentation, monitoring and control of the furnace

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

Documentation and reproducibility gain increased attention with steadily rising quality standards. The powerful Nabertherm software Controltherm MV provides for an optimum solution for the control and documentation of one or more furnaces as well as charge data. This software is also perfectly suitable for retrofi tting in order to comply with new norms and directives.

Features

- Simple installation without specific knowledge
- All Nabertherm controllers with interface connectable
- Temperature cycles of up to 16 furnaces (also multi-zone controlled) can be archived in manipulation-safe files
- Redundant storage on a network server possible
- Programming, archiving and printing of programs and graphics
- Free input of descriptive charge data text with comfortable search function
- Data exportable into Excel format for further evaluation
- Start/stop of the controller from the local PC
- 400 additional programs storable (only with Nabertherm controllers)
- Connection of other furnaces/controllers by means of an additional temperature adapter possible and retrofittable
- Extension of additional measuring points for archiving possible and retrofittable

Temperature recorder

Temperature Recorder

Reliable documentation method with a dot printer or continuous pen and up to six measuring points, also available with digitally storing graphic printer (e.g. CF card, USB-stick).

Nabertherm
MORE THAN HEAT 30-3000 °C

The whole World of Nabertherm: www.nabertherm.com

Please visit our website **www.nabertherm.com** and find out all you want to know about us - and especially about our products.

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

Professional Solutions for:

- **Arts & Crafts**
- **Glass**
- **Advanced Materials**
- **Laboratory/Dental**
- **Heat Treatment of Metals, Plastics and Surface Finishing**
- **Foundry**

Headquarters:

Nabertherm GmbH
Bahnhofstr. 20
28865 Lilienthal, Germany

contact@nabertherm.de
Phone: (+49) 4298 922-0
Fax: (+49) 4298 922-129

Sales and Service Subsidiaries

Nabertherm Shanghai Ltd.
150 Lane, No. 158 Pingbei Road, Minhang District
201109 Shanghai, China

contact@nabertherm-cn.com
Phone: (+86) 21 6490 2960
Fax: (+86) 21 6490 3107

Nabertherm S.A.S
51 Rue de Presles
93531 Aubervilliers, France

contact@nabertherm.fr
Phone: (+33) 1 5356 1800
Fax: (+33) 1 5356 1809

Nabertherm Italia
via Trento N° 17
50139 Florence, Italy

contact@nabertherm.it
Phone: (+39) 348 3820278
Fax: (+39) 055 480835

Nabertherm Schweiz AG
Batterieweg 6
4614 Hägendorf, Switzerland

contact@nabertherm.ch
Phone: (+41) 62 209 6070
Fax: (+41) 62 209 6071

Nabertherm Ltd.
Vigo Place, Aldridge
West Midlands WS9 8YB, United Kingdom

contact@nabertherm.co.uk
Phone: (+44) 1922 455 521
Fax: (+44) 1922 455 277

Nabertherm Inc.
54 Reads Way
New Castle, DE 19720, USA

contact@nabertherm-usa.com
Phone: (+1) 302 322 3665
Fax: (+1) 302 322 3215

Nabertherm Ibérica, S.L.
c/Castella 33, Esc. B2, 5º3ª
08018 Barcelona, Spain

contact@nabertherm.es
Phone: (+34) 93 303 65 91
Fax: (+34) 93 303 66 05

www.nabertherm.com