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

RHTC 80-230/15

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.

- 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 43
- Controls description see page 60

SiC rod heating

Additional equipment

- Over-temperature limiter 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 furnace chamber outside the tube see page 46
- 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 see page 44
- Alternative working tubes see chart on page 43

Model	Tmax °C[3]	Outer dimensions in mm W	D	H	Outer tube Ø /mm	Heated length/mm	Length constant temperature ΔT 10 K in mm	Tube length in mm	Connected load kW	Electrical connection*	Weight in kg
RHTC 80-230/15	1500	600	430	580	80	230	80	600	7.5	3-phase[2]	50
RHTC 80-450/15	1500	820	430	580	80	450	150	830	11.3	3-phase[1]	70
RHTC 80-710/15	1500	1070	430	580	80	710	235	1080	13.8	3-phase[1]	90

[1]Heating only between two phases
[2]Heating only between phase 1 and neutral
*Please see page 60 for more information about supply 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 and Vertical Operation up to 1800 °C Gas Atmosphere or Vacuum

RHTH 120/600/17

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 fiber 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 non-flammable or flammable protective or reactive gases or under vacuum.

Over-temperature limiter

- Tmax 1600 °C, 1700 °C, or 1800 °C
- $MoSi_2$ heating elements, mounted vertically for easy replacement
- Insulation with vacuum-formed ceramic fiber 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. fiber plugs operation under air
- Type B thermocouple
- Power unit with low-voltage transformer and thyristor
- Over-temperature limiter with manual reset for thermal protection class 2 in accordance with EN 60519-2 as temperature limiter to protect the oven and load and with selectable maximum temperature gradient as tube protection
- Switchgear and control unit separate from furnace in separate floor standing cabinet
- Standard working tube see chart on page 43
- Controls description see page 60

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

Additional equipment

- Charge control with temperature measurement in the working tube and in the furnace chamber outside the tube see page 46
- Display of inner tube temperature with additional thermocouple
- Gas tight flanges for protective gas and vacuum operation
- Manual or automatic gas supply system
- Three-zone control for optimization of temperature uniformity (only RHTH)
- Check valve at gas outlet avoids intrusion of false air
- Stand for vertical operation
- Alternative working tubes designed for process requirements see chart on page 43
- Please see page 44 for more additional equipment

RHTV 120/480/16 LBS with working tube closed at one side, protective gas and vacuum option as well as with electric screw drive of the lift table

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

Model	Tmax	Outer dimensions in mm			Max. outer tube Ø	Heated	Length constant temperature ΔT 10 K	Tube length	Connected	Electrical	Weight
Horizontal design	°C[3]	W[2]	D	H	/mm	length mm	in mm	in mm	load kW	connection*	in kg
RHTH 120/150/..	1600 or	470	550	640	50	150	50	380	5.4	3-phase[1]	70
RHTH 120/300/..	1700 or	620	550	640	80	300	100	530	9.0	3-phase[1]	90
RHTH 120/600/..	1800	920	550	640	120	600	200	830	14.4	3-phase[1]	110

Model	Tmax	Outer dimensions in mm			Max. outer tube Ø	Heated	Length constant temperature ΔT 10 K	Tube length	Connected	Electrical	Weight
Vertical design	°C[3]	W	D	H[2]	/mm	length mm	in mm	in mm	load kW	connection*	in kg
RHTV 120/150/..	1600 or	570	650	510	50	150	30	380	5.4	3-phase[1]	70
RHTV 120/300/..	1700 or	570	650	660	80	300	80	530	10.3	3-phase[1]	90
RHTV 120/600/..	1800	570	650	960	120	600	170	830	19.0	3-phase[1]	110

[1]Heating only between two phases
[2]Without tube
*Please see page 60 for more information about supply voltage
[3]Tmax. is reached outside the tube. Realistic working temperature inside the tube is approx. 50 °C lower.

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

RS 80/500/11 with gas supply system 1

RS 80/750/13 with stand as additional equipment for vertical operation

Gas supply system for non-flammable protective or reactive gas with shutoff valve and flow meter with regulator valve, piped and ready to connect

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

The tube furnaces of the product line RS can be used for horizontal as well as for vertical operation. The hinged design makes it easy to change the working tube. It allows the different working tubes (e.g. working tubes made of different materials) to be comfortably taken out and put in.

Using the wide range of accessories these profi tube furnaces can be optimally configured for your process. By upgrading the furnaces with different gas supply systems the operation in a protective gas atmosphere, under vacuum or under flammable protective or reactive gases is possible. Besides convenient standard controllers for process control modern PLC control systems are also available.

- 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

Model	Tmax	Outer dimensions[3] in mm			Max. outer tube Ø	Heated	Length constant temperature ΔT 10 K	Tube length	Connected	Electrical	Weight
	°C[5]	W[2]	D	H	/mm	length mm	in mm	in mm	load kW	connection*	in kg
RS 80/300/11	1100	555	475	390	80	300	100	650	1.8	1-phase	80
RS 80/500/11	1100	755	475	390	80	500	170	850	3.4	1-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	1-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]Outer dimensions for vertical operation upon request
[4]Heating only between phase 1 and neutral
[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 60 for more information about supply voltage

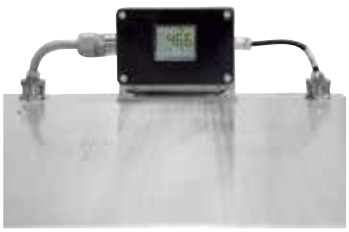
RS 120/1000/13S with gas tight tube, charge control and check valve at gas outlet

- 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 43
- Controls description see page 60

Additional equipment

- Charge control with temperature measurement in the working tube and in the furnace chamber outside the tube see page 46
- Display of inner tube temperature with additional thermocouple
- Different gas supply systems (page 44) for non-flammable or flammable protective or reactive gases 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
- Optical temperature measurement for the use as contiuously working furnace
- Stand for vertical operation
- Base frame with integrated switchgear and controller
- Alternative working tubes designed for process requirements see chart on page 43
- Please see page 44 for more additional equipment

Quartz glass and flanges for protective gas operation as optional equipment



Optical temperature measurement for the use as contiuously working furnace

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

Rotary Tube Furnaces for Continuous Processes and/or Batch Operation

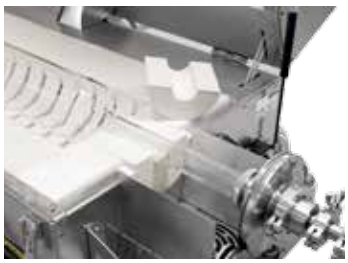
RSR 120/1000/13 for continuous operation

RSR-B 120/750/11 as tabletop version for batch operation

RSR 80-500/11 - RSR 120-1000/13, RSR-B 80-500/11 - RSR-B 120-1000/11

If, for example, the focus lies on maintaining the individual grain characteristics of the material such as in drying or calcination, rotary tube furnaces of the RSR product line are the optimal solution. The permanently rotating working tube allows for the continuous movement of the charge.

In general, these models can be used for continuous processing and/or batch operation. While during a continuous process the charge is transported uniformly from one end to the other of the working tube, during batch operation, it can be heated-treated over a longer period in the furnace chamber thanks to the special shape of the quartz glass reactor (tapered tube ends).



Adapters for alternative operation with working tube or process reactor

The compact furnaces of the RSR-B product line are perfectly suited for batch operation. The versatile RSR furnaces can be equipped both with working tubes for continuous operation as well as with reactors for batch operation.

Depending on the process, charge and the required maximum temperature, various working tubes made of quartz glass, ceramic or metal can be used (see page 42). Depending on the application these models can be upgraded by adding suitable accessories such as filling funnels, electric feed screw for feeding material or gas supply systems for small production furnaces. Operation can take place in air, in non-flammable protective or reactive gases, or in a vacuum. The necessary equipment is available as additional equipment.

Standard design of all models

- Housing made of sheets of textured stainless steel
- Beltless drive and hinged furnace housing provide for very easy removal of working tube or reactor
- Adjustable drive of approx. 2-45 rpm
- Controls description see page 60

Connection set for vacuum operation

RSR 80/750/11 with charging funnel and collection bottle at the outlet

Additional equipment for all models

- Different tube diameters or heated lengths
- Manual or automatic gas supply systems
- Gas tight rotary device for the connection to gas supply systems
- Check valve at gas outlet avoids intrusion of false air
- Three-zone control for the optimization of temperature uniformity
- Temperature display unit in the working tube with measurement by means of an additional thermocouple
- Charge control by means of an additional thermocouple in the working tube

Standard design for batch operation

- Tmax 1100 °C
- Thermocouple type K
- Furnace designed as table-top model with quartz glass reactor which opens on both sides, tapered ends
- Reactor is removed from the furnace for discharging
- Switchgear and control unit separate from furnace in own wall or standing cabinet

Additional equipment for batch operation

- Different gas supply systems
- Vacuum design, up to 10^{-2} mbar depending on the applied pump
- Reactor made of quartz glass, open at both sides, with burling for better conveyance of the charge in the tube
- Information on the different working tubes see page 42
- Package for improved charging and discharging of the working tube in the following design:
  - Single-side closed mixing reactor made of quartz glass with an integrated blade for improved blending of the charge
  - Tilting mechanism to the left/to the right. For charging and heat treatment, the furnace is tilted towards the right side until the stop so that the load is charged into the furnace. For discharge, the furnace is tilted towards the other side to discharge the powder from the reactor. It is no longer necessary to remove the reactor.
  - Furnace assembled on base with integrated switchgear and controller, incl. transport casters
- Digital display for the tilting angle of the furnace

Screw-conveyor with adjustable speed

Screw-conveyors with different pitches for the adaption to the charge

Vibration generator at the charging funnel for improved powder supply

RSR 120/750/11 S with electrically adjustable tilting angle for continuous processes or batch operation

RSR 120/500/11 S with reactor closed at one side for batch operation

Gas tight closing plug for tubes made of silica glass closed at one side

Standard design for continuous processes

- Tmax 1100 °C
  - Thermocouple type K
  - Working tube made of quartz glass open at both sides
- Tmax 1300 °C
  - Thermocouple type S
  - Working tube made of C530 ceramics, open at both sides, not gas tight
- Compact design with switchgear and controller, mounted in the base, including transport casters
- Furnace mounted on base, including manual spindle drive with crank for pre-adjustment of the tilting angle

Additional equipment for continuous processes

- Working tube made of quartz glass with burling for optimized mixing of the charge up to Tmax 1100 °C
- Gas tight working tube made of C610 ceramics up to Tmax 1300 °C
- Information on the different working tubes see page 42
- Higher temperatures up to 1600 °C available on request
- Different gas supply systems with good process gas circulation around the charge thanks to an inlet on one tube side and outlet on the other side (only together with the charging system, see below)
- Charging system for continuous material transport, consisting of:
  - Charging funnel made of stainless steel with lockable powder outlet
  - Electric vibration generator at the charging funnel for the optimization of material supply into the working tube as additional option
  - Electrically driven screw-conveyor at the inlet of the working tube with 10, 20 or 40 mm pitch and adjustable speed between 0.28 and 6 revolutions per minute, different gear transmissions for other speeds on request
  - Collecting bottle made of laboratory glass at the outlet of the working tube
  - Suitable for operation in a gas atmosphere or in a vacuum
- Digital display unit for the tilting angle of the furnace
- Electric linear drive for the adjustment of the tilting angle
- Alternating design for continuous processes or batch operation. The furnace can be tilted on the frame towards both sides. The customer can mount a working tube open at both sides for flow processes as well as a process reactor (Tmax 1100 °C) closed at one side for batch operation.
- PLC controls for temperature control and the control of connected aggregates such as gearshift and speed of the screw-conveyor, speed of the working tube, switching of the vibration generator, etc.

Model Rotary tube furnace	Tmax °C[3]	Outer dimensions in mm W	D	H	Length constant Temperature ΔT 10 K in mm	Tube dimensions in mm Total length	Length working zone[5]	Ø Outer	Ø Terminal end[5]	Connected load kW	Electrical connection*	Weight in kg
Batch operation												
RSR-B 80-500/11	1100	1145[4]	475	390	170	1140	500	76	34	3.7	1-phase	555
RSR-B 80-750/11	1100	1395[4]	475	390	250	1390	750	76	34	4.9	3-phase[2]	570
RSR-B 120-500/11	1100	1145[4]	525	440	170	1140	500	106	34	5.1	3-phase[2]	585
RSR-B 120-750/11	1100	1395[4]	525	440	250	1390	750	106	34	6.6	3-phase[1]	600
RSR-B 120-1000/11	1100	1645[4]	525	440	330	1640	1000	106	34	9.3	3-phase[1]	605
Continuous operation												
RSR 80-500/11	1100	2505	1045	1655	170	1540	500	76	34	3.7	1-phase	555
RSR 80-750/11	1100	2755	1045	1655	250	1790	750	76	34	4.9	3-phase[2]	570
RSR 120-500/11	1100	2505	1045	1715	170	1540	500	106	34	5.1	3-phase[2]	585
RSR 120-750/11	1100	2755	1045	1715	250	1790	750	106	34	6.6	3-phase[1]	600
RSR 120-1000/11	1100	3005	1045	1715	330	2040	1000	106	34	9.3	3-phase[1]	605
RSR 80-500/13	1300	2505	1045	1655	170	1540	500	76	34	6.3	3-phase[1]	555
RSR 80-750/13	1300	2755	1045	1655	250	1790	750	76	34	9.6	3-phase[1]	570
RSR 120-500/13	1300	2505	1045	1715	170	1540	500	106	34	8.1	3-phase[1]	585
RSR 120-750/13	1300	2755	1045	1715	250	1790	750	106	34	12.9	3-phase[1]	600
RSR 120-1000/13	1300	3005	1045	1715	330	2040	1000	106	34	12.9	3-phase[1]	605

[1]Heating only between two phases
[2]Heating only between phase 1 and neutral
[3]Tmax is reached outside the tube. Realistic working temperature inside the tube is approx. 50 °C lower.
*Please see page 60 for more information about supply voltage
[4]Without tube
[5]Only for reactors

Tube Furnaces for Integration into Customized Systems

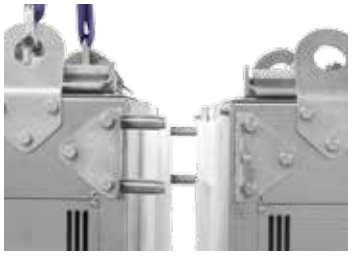
RS 120/1000/11S in divided version. Both half furnaces are manufactured identically and will be integrated in an extisting gas-heating system with space-saving design

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

Tube furnace with five-zone control for optimal temperature uniformity

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.



Bolts for connection of two separated half furnaces

Working Tubes

Working tube closed at one end with gas tight 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	Gas tight
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 for Rotary Tube Furnaces: Standard (●) and Options (○)

Measurements outer Ø x inner Ø x length	Article No.[1] work tube	Article No.[1] spare tube	Rotary tube furnace, continuous operation RSR 1100 °C 80-500	80-750	120-500	120-750	120-1000	RSR 1300 °C 80-500	80-750	120-500	120-750	120-1000	Batch operation RSR-B 1100 °C 80-500	80-750	120-500	120-750	120-1000
Ceramic tube C 530																	
80 x 65 x1540 mm	601404699	691404536	○					●									
80 x 65 x 1790 mm	601404700	691404537		○		○			●		○						
80 x 65 x 2040 mm	601404701	691404538					○					○					
110 x 95 x 1540 mm	601404702	691404539			○					●							
110 x 95 x 1790 mm	601404703	691403376				○					●						
110 x 95 x 2040 mm	601404704	691404540					○					●					
Ceramic tube C 610																	
80 x 65 x1540 mm	601404705	691404541	○					○									
80 x 65 x 1790 mm	601404706	691404542		○		○			○		○						
80 x 65 x 2040 mm	601404707	691404543					○					○					
110 x 95 x 1540 mm	601404708	691404544			○					○							
110 x 95 x 1790 mm	601404709	691404561				○					○						
110 x 95 x 2040 mm	601404710	691403437					○					○					
Quartz glass tube																	
76 x 70 x 1540 mm	601404711	691404545	●					○		○							
76 x 70 x 1790 mm	601404712	691404546		●		○			○		○						
76 x 70 x 2040 mm	601404713	691404547					○					○					
106 x 100 x 1540 mm	601404714	691403519			●					○							
106 x 100 x 1790 mm	601404715	691403305				●					○						
106 x 100 x 2040 mm	601404716	691404548					●					○					
Quarz glass tube with pimple																	
76 x 70 x 1540 mm	601404717	691404549	○					○									
76 x 70 x 1790 mm	601404718	691404550		○		○			○		○						
76 x 70 x 2040 mm	601404719	691404551					○					○					
106 x 100 x 1540 mm	601404720	691404552			○					○							
106 x 100 x 1790 mm	601404721	691403442				○					○						
106 x 100 x 2040 mm	601404722	691404553					○					○					
Quartz glas reactor																	
76 x 70 x 1140 mm	601402746	691402548											●		○		
76 x 70 x 1390 mm	601402747	691402272												●		○	
106 x 100 x 1140 mm	601402748	691402629													●		
106 x 100 x 1390 mm	601402749	691402638														●	
Quartz glass reactor with pimples																	
76 x 70 x 1140 mm	601404723	691402804											○		○		
76 x 70 x 1390 mm	601404724	691403429												○		○	
106 x 100 x 1140 mm	601404725	691403355													○		
106 x 100 x 1390 mm	601404726	691403296														○	
Quarz glass mixing reactor																	
76 x 70 x 1140 mm	601404727	691403407											○				
76 x 70 x 1390 mm	601404728	691404554												○		○	
106 x 100 x 1140 mm	601404732	691404557													○		
106 x 100 x 1390 mm	601404733	691404558														○	

● Standard working tube
○ Working tube available as an option

[1]Tubes/reactors incl. mounted sleeves for connection to the rotary drive. Spare tubes come without sleeves.

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

Working tube outer Ø x inner Ø x length	Article No.	Model																		
		R				RS								RHTC			RHTH			RHTV		
		50-250	50-500	100-750	120-1000	80-300	80-500	80-750	120-500	120-750	120-1000	170-750	170-1000	80-230	80-450	80-710	120-150	120-300	120-600	120-150	120-300	120-600
C 530																						
40 x 30 x 450 mm	692070274	○																				
40 x 30 x 700 mm	692070276		○			○																
50 x 40 x 450 mm	692070275	●																				
50 x 40 x 700 mm	692070277		●																			
60 x 50 x 650 mm	692070106					○																
60 x 50 x 850 mm	692070305						○		○													
60 x 50 x 1100 mm	692070101			○				○		○		○										
70 x 60 x 1070 mm	692070048			○				○		○		○										
80 x 70 x 650 mm	692070036					●																
80 x 70 x 850 mm	692070108						●		○													
80 x 70 x 1100 mm	692070109			○				●		○		○										
95 x 80 x 1070 mm	692070049			●						○		○										
120 x 100 x 850 mm	692070110								●													
120 x 100 x 1100 mm	692070111									●		○										
120 x 100 x 1350 mm	692070131										●		○									
120 x 100 x 1400 mm	692070279				●																	
170 x 150 x 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												○									
Vacuum quartz glass tube																						
60 x 54 x 1030 mm	691404422					○																
60 x 54 x 1230 mm	691404423						○		○													
60 x 54 x 1480 mm	691404424							○		○		○										
80 x 74 x 1230 mm	691404425						○		○													
80 x 74 x 1480 mm	691404426							○		○		○										
120 x 114 x 1230 mm	691404427								○													
120 x 114 x 1480 mm	691404428									○		○										
120 x 114 x 1730 mm	691404429										○		○									
170 x 162 x 1480 mm	691404430											○										
170 x 162 x 1730 mm	691404431												○									

[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

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

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

When equipped with various equipment packages, the tube furnace product lines RS, RHTC, RHTH, and RHTV can be adapted for operation with nonflammable or flammable gasses or for vacuum operation.

Gas Supply System 1 for non-flammable protective or reactive gases (no vacuum operation)

This package represents a basic version sufficient for many applications, for operation with non-flammable protective or reactive 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 fiber 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)

Water-cooled stainless steel flange

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 system, which can be switched on and off through a controller with programmable extra functions (e.g. P 330)

Gas Supply System 2 for non-flammable protective or reactive 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 gas tight design. Besides the longer working tube, the scope of delivery also includes gas tight flanges and a corresponding bracket system in the furnace. The system can also be equipped for vacuum operation.

Gas supply system for non-flammable protective or reactive gas with shutoff valve and flow meter with regulator valve, piped and ready to connect

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

Observation window as additional equipment for gas tight flanges

Vacuum Operation

- Vacuum package for evacuation of the working tube, consisting of connector for the gas outlet, 1 ball valve, manometer, 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 45

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

Adding gas supply system 4 to the tube furnace allows 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. 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.

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

- Safety system for operation with flammable gases including monitoring of torch function and overpressure
- Extended safety control system with emergency tube purging in case of default
- Emergency purge container
- Safety-PLC control system with touchpanel for data input
- Longer, gas tight 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)

Water-cooled end flange with quick connectors as additional equipment

Additional equipment

- Gas supply system extension for additional nonflammable gas types
- Operation with other flammable gases on request
- 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)
- Gas supply via program-dependent, controllable mass flow controllers

Vacuum Pumps

With respect to the final pressure different pumps are available see page 56:

- 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.
- Turbomolecular pump stand (rotary vane pump with following turbomolecular pump for a max. final pressure of 10^{-5} mbar.
- Independent pressure gauge for a pressure range of 10^{-3} mbar or 10^{-9} mbar as additional equipment

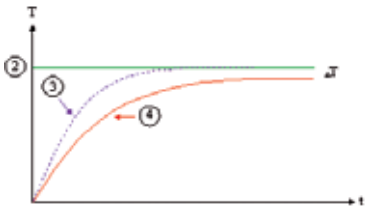
Vacuum pump stand for operation up to 10^{-5} mbar

Independent pressure gauge for a pressure range of 10^{-3} mbar or 10^{-9} 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 42.

Control Alternatives for Tube Furnaces



Furnace control

Three-Zone Furnace Chamber Control

The temperature is measured by thermocouples positioned outside of the working tube, one in the middle and two on the sides. The outer zones are controlled with a setpoint-offset in relation to the middle zone. This allows the heat loss at the ends of the tube to be compensated to ensure an extended zone of constant temperature ($\Delta T \leq 10$ K).

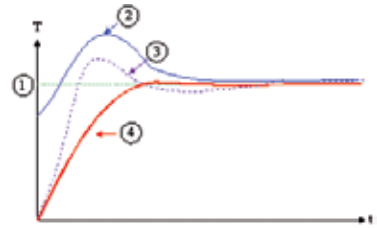
Furnace Chamber Control

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

Extension Package for Furnace Chamber Control

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



Charge control

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

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

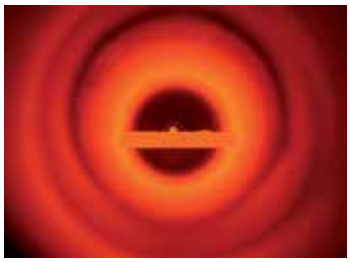
Furnace Chamber vs. Charge Control Comparison

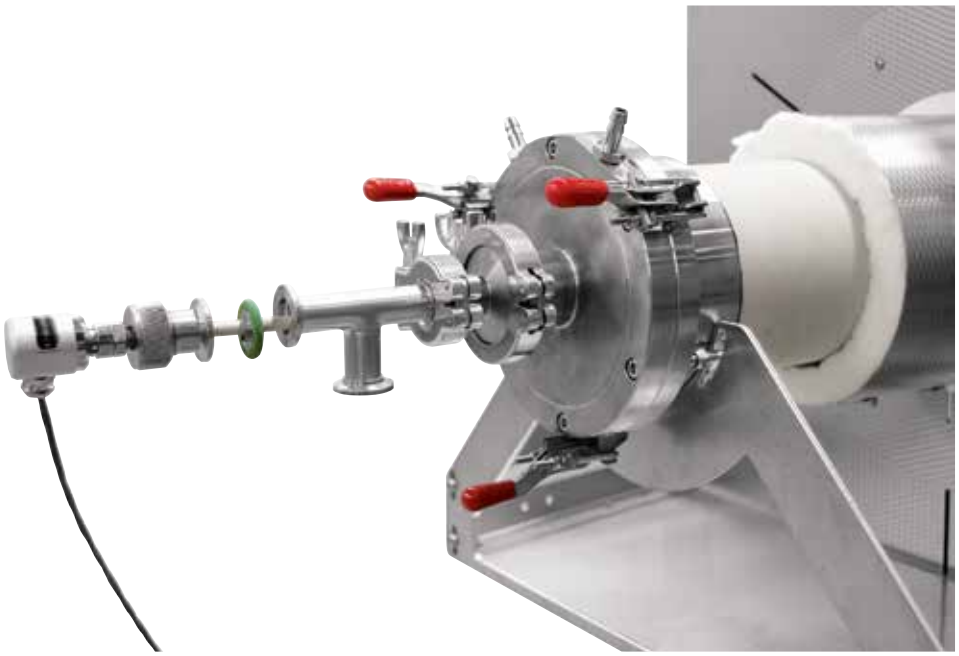
Furnace Chamber Control

Only the furnace chamber temperature is measured and controlled. Regulation is carried out slowly to avoid out-of-range values. As the charge temperature is not measured and controlled, it may vary a few degrees from the chamber temperature.

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.


Sintering under hydrogen in a tube furnace of RHTH product line


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

Thermocouple Calibration Set

Thermocouple calibration set, consisting of calibrated temperature display, calibrated reference thermocouple and tube furnace

For heat treatment processes, continuous quality can only be ensured by the regular calibration of control or charge thermocouples. The calibration set can be used with every tube furnace which is equipped with heating transformer (models R../13, RS../13, RHTH, RHTV) for professional calibration of thermocouples.

The thermocouple calibration set is mounted in a compact housing and consists of a temperature display unit for two thermocouples, a reference thermocouple with compensation wire and a plug connection for different types of thermocouples. Both the display unit and the whole measuring circuit to the reference thermocouple are calibrated ex works and are supplied with a calibration certificate.

The set is used with a tube furnace, e.g. model R 50/250/13. For calibration, the furnace is set for one temperature. From one side, the reference thermocouple is inserted into the working tube. From the other side, the thermocouple to be tested is positioned in the tube. The measuring points of both thermocouples must face as close as possible to each another. Depending on the furnace model, a ceramic temperature compensation block can be offered for the positioning of both thermocouples. After a defined period of time, the temperature of both thermocouples can be read off from the display unit of the thermocouple calibration set and be compared.

Calibrated thermocouples in various designs

- Compact housing
- 1-phase connection see page 60
- Digital display unit for the test thermocouple and the reference thermocouple, with calibration certificate in steps of 100 °C
- Reference thermocouple, type N, with calibration certificate (for 3 temperatures)
- Thermocouple inputs type K, S, N for test thermocouples. Only one input per measurement is possible.
- Furnace has to be ordered separately

Additional equipment

- Reference thermocouple type K or type S
- Further thermocouple inputs for specimen, e.g. type B, type J or type R
- Fiber plug with passages and ceramic temperature compensation block for the support of the thermocouples in the test furnace

Laboratory Melting Furnaces

K2/10 as crucible furnace with steel crucible for lead melting

KC 2/15

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

These compact melting furnaces for the melting of non-ferrous metals and alloys are one of a kind and have a number of technical advantages. Designed as tabletop models, they can be used for many laboratory applications. The practical counter balanced hinge with shock absorbers and the spout (not for KC) on the front of the furnace make exact dosing easy when pouring the melt. The furnaces are available for furnace chamber temperatures of 1000, 1300, or 1500 °C. This corresponds to melt temperatures of about 80-110 °C lower.

KC 2/15

- Tmax 1000 °C, 1300 °C, or 1500 °C, with melt temperature about 80 - 110 °C lower
- Crucible sizes of 1, 2, or 4 liters
- Crucible with integrated pouring spout of iso-graphite included with delivery
- Spout (not for KC), mounted at the furnace for exact pouring
- Compact bench-top design, simple emptying of crucible by tiltiing system with gas damper
- Crucible for heating of furnace insulated with a hinged lid, lid opened when pouring
- Controls description see page 60

Additional equipment

- Other crucible types available, e.g. steel
- Design as crucible furnace without tilting device, e.g. for lead melting
- Over-temperature limiter for the furnace chamber with automatic reset to protect against overtemperature. The limit controller switches off the heating when the pre-set limit temperature has been reached and does not switch it on again until the temperature falls below the setting again.
- Observation hole for melt

Model	Tmax °C	Crucible	Volume in l	Outer dimensions in mm W	D	H	Connected load kW	Electrical connection*	Weight in kg
K 1/10	1000	A 6	1.0	520	680	660	3.0	1-phase	85
K 2/10	1000	A10	2.0	520	680	660	3.0	1-phase	90
K 4/10	1000	A25	4.0	570	755	705	3.6	1-phase	110
K 1/13[2]	1300	A 6	1.0	520	680	660	3.0	1-phase	120
K 2/13[2]	1300	A10	2.0	520	680	660	3.0	1-phase	125
K 4/13[2]	1300	A25	4.0	570	755	705	5.5	3-phase[1]	170
KC 1/15[3]	1500	A6	1.0	580	630	580	10.5	3-phase	170
KC 2/15[3]	1500	A10	2.0	580	630	580	10.5	3-phase	170

[1]Heating only between two phases

*Please see page 60 for more information about supply voltage

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

[3]Switchgear and controller mounted in a floor standing cabinet

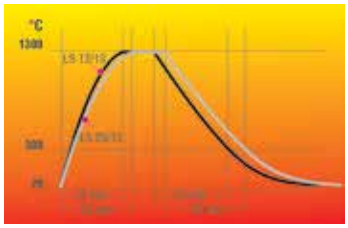
Fast-Firing Furnaces

LS 12/13

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, 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
- Controls description see page 60



Firing curves LS 12/13 and LS 25/13

Model	Tmax °C	Inner dimensions in mm w	d	h	Volume in l	Outer dimensions in mm W	D	H	Connected load kW	Electrical connection*	Weight 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 60 for more information about supply voltage

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
- Controls description see page 60

Additional equipment

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

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

Model	Tmax °C	Inner dimensions in mm w	d	h	Outer dimensions in mm W	D	H	Connected load kW	Electrical connection*	Weight in kg
GR 1300/13	1300	1300	100	60	1660	740	1345	18	3-phase	300

*Please see page 60 for more information about supply voltage

Hot-Wall Retort Furnaces up to 1100 °C

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

NR 17/06 with gas supply system

Inside heating in models NRA ../06

NRA 17/06 - NRA 1000/11

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

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

Models NRA ../06 with Tmax 650 °C
- Heating elements located inside the retort
- Temperature uniformity up to ΔT 6 K inside the work space from 100 °C - 600 °C see page 59
- Retort made of 1.4571
- Gas circulation fan in the back of the retort provides for optimal temperature uniformity

Models NRA ../09 with Tmax 950 °C
- Outside heating with heating elements surrounding the retort as well as an additional door heater
- Temperature uniformity up to ΔT 6 K inside the work space from 200 °C - 900 °C see page 59
- Retort made of 1.4841
- Fan in the back of the retort provides for optimal temperature uniformity

Models NR ../11 with Tmax 1100 °C
- Outside heating with heating elements surrounding the retort as well as an additional door heater
- Temperature uniformity up to ΔT 10 K inside the work space from 200 °C - 1050 °C see page 59
- Retort made of 1.4841

NRA 480/04S

NRA 50/09 H_2

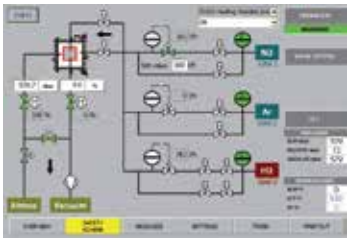
Basic version

- Compact housing in frame design with removable stainless steel sheets
- Controls and gas supply integrated in the furnace housing
- Welded charging supports in the retort or air-baffle box in the furnace with air circulation
- Swivel door hinged on right side with open cooling water system
- Multi-zone control for 950 °C and 1100 °C version, separated by furnace chamber and door. Depending on furnace chamber additionally subdivided into one or several heating zones
- Temperature control as charge control with temperature measurement inside and outside the retort
- Gas supply system for one non-flammable protective or reaction gas with flow meter and solenoid valve, switchable via the control system
- Operation under vacuum up to 600 °C with optional single-stage rotary vane pump
- Port for vacuum pump for cold evacuation
- PLC controls with touch panel H 700 for data input (resp. P 300 for 650 °C-version) see page 60

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
- 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
- Measuring device for residual oxygen content

Vacuum pump for cold evacuation of the retort



Touchpanel H 3700 for automatic version

NR 200/11 H_2 for heat treatment under hydrogen

Charging of the NR 300/06 furnace with a pallet truck

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).

Bayonet quick-lock for the retort, also with electric drive as additional equipment

- 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
- Torch for thermal afterburning of exhaust gases
- Emergency flood container for purging the furnace in case of failore

IDB Version for Debinding under Non-flammable Protective Gases or for Pyrolysis Processes

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

Parallel guided door to open the hot furnace as additional equipment

- 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
- Torch for thermal afterburning of exhaust gases

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

Model	Tmax	Model	Tmax	Work space dimensions in mm			Useful volume	Electrical
	°C		°C	w	d	h	in l	connection*
NRA 17/..	650 or 950	NR 17/11	1100	225	350	225	17	3-phase
NRA 25/..	650 or 950	NR 25/11	1100	225	500	225	25	3-phase
NRA 50/..	650 or 950	NR 50/11	1100	325	475	325	50	3-phase
NRA 75/..	650 or 950	NR 75/11	1100	325	700	325	75	3-phase
NRA 150/..	650 or 950	NR 150/11	1100	450	750	450	150	3-phase
NRA 200/..	650 or 950	NR 200/11	1100	450	1000	450	200	3-phase
NRA 300/..	650 or 950	NR 300/11	1100	570	900	570	300	3-phase
NRA 400/..	650 or 950	NR 400/11	1100	570	1250	570	400	3-phase
NRA 500/..	650 or 950	NR 500/11	1100	720	1000	720	500	3-phase
NRA 700/..	650 or 950	NR 700/11	1100	720	1350	720	700	3-phase
NRA 1000/..	650 or 950	NR 1000/11	1100	870	1350	870	1000	3-phase

*Please see page 60 for more information about supply voltage

Pit-Type Cold-Wall Retort Furnaces up to 2400 °C or up to 3000 °C

SVHT 9/24-W with tungsten heating

SVHT 2/24-W - SVHT 9/30-GR

Compared with the VHT models (page 54 ff), the furnaces of the SVHT product line offer improved performance data with regard to achievable vacuum and maximum temperature.
Due to the design as pit-type furnace with tungsten heating, processes up to max. 2400 °C even in high vacuum can be implemented with models of the SVHT..-W product line. Models of the SVHT..-GR product line with graphite heating, also in pit-type design, can be operated in an inert gas atmosphere even up to max. 3000 °C.

- Standard sizes with a furnace chamber of 2 or 9 liters
- Designed as pit-type furnace, charged from above
- Frame construction with inserted sheets of textured stainless steel
- Dual shell water-cooled stainless steel container
- Manual operation of process gas and vacuum functions
- Manual gas supply for non-combustible process gas
- A step in front of the furnace for an ergonomic charging height
- Retort lid with gas-charged shock absorbers
- Controls and switchgear as well as gas supply integrated in furnace housing
- Further standard product characteristics see description for standard design of VHT models page 54

Heating Options

SVHT ..-GR

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

Cylindrical retort with tungsten heating

SVHT ..-W

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

Graphite heating module

Additional equipment such as automatic process gas control or design for the operation with flammable gases incl. safety system see VHT models page 54.

Model	Tmax	Work space dimensions	Useful volume	Outer dimensions in mm			Connected	Electrical
	°C	Ø x h in mm	in l	W	D	H	load KW	connection*
SVHT 2/24-W	2400	150 x 150	2,5	1400	2500	2100	55	3-phase
SVHT 9/24-W	2400	230 x 230	9,5	1500	2750	2100	95	3-phase
SVHT 2/30-GR	3000	150 x 150	2,5	1400	2500	2100	55	3-phase
SVHT 9/30-GR	3000	230 x 230	9,5	1500	2750	2100	95	3-phase

*Please see page 60 for more information about supply voltage

Water-cooling controls

Cold-Wall Retort Furnaces up to 2400 °C

VHT 500/22-GR H_2 with CFC-process box and extension package for operation under hydrogen

VHT 8/18-KE with fiber insulation and molybdenum disilicide heating elements

Heat treatment of copper bars under hydrogen in VHT 08/16 MO

VHT 8/18-GR - VHT 500/18-KE

The compact furnaces of the VHT product line are available as electrically heated chamber furnaces with graphite, molybdenum, tungsten or $MoSi_2$ heating. A wide variety of heating designs as well as a complete range of accessories provide for optimal furnace configurations even for sophisticated applications.

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

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 (2400 °C as additional equipment)
- Max. vacuum up to 10^{-4} mbar depending on pump type used
- Graphite felt insulation

VHT ../MO or ../W with Molybdenum or Tungsten Heating

- Suitable for high-purity processes under protective and reaction gases or under high vacuum
- Tmax 1200 °C, 1600 °C or 1800 °C (see table)
- Max. vacuum up to 5 x 10^{-5} mbar depending on pump type used
- Insulation made of molybdenum rsp. tungsten radiation sheets

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

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

Standard Equipment for all Models

Basic version

- Standard furnace sizes 8 - 500 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 limiter with manual reset for thermal protection class in accordance with EN 60519-2
- Manual operation of the process gas and vacuum functions
- Manual gas supply for one process gas (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

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
- Inner process box made of molybdenum, tungsten or CFC, especially recommended for debinding processes. The box is installed in the furnace with direct gas inlet and outlet and provides for better temperature uniformity. Due to a change in gas supply direction after debinding a clean process atmosphere for sintering is achieved.
- Charge thermocouple with display
- Temperature measurement at 2200 °C models with pyrometer and thermocouple, type S with automatic pull-out device for precise control results in the low temperature range (VHT 40 and larger)
- Two-stage rotary vane pump with ball valve for pre-evacuating and heat-treating in a vacuum to 10^{-2} mbar
- 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)
- Other pumps on request
- 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, argon or forming gas) with adjustable flow
  - Bypass for flooding and filling the chamber with process gas controlled by the program
  - Automatic pre- and post programs, including leak test for safe furnace operation
  - Automatic gas outlet with bellows valve and overflow valve (20 mbar)
  - Transducer for absolute and relative pressure
- MFC flow controller for alternating volume flow and generation of gas mixtures with second process gas (only with automation package)
- Partial pressure operation: protective gas flushing at controlled underpressure (only with automation package)
- PC control via NCC with corresponding optional documentation and connection to customer PC networks

Graphite heating chamber

Molybdenum heating chamber

Tungsten heating chamber

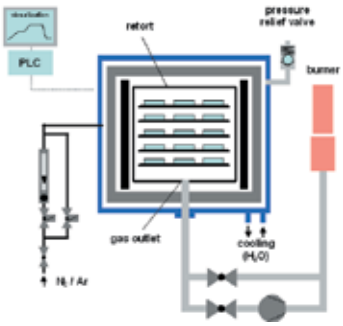
Ceramic fiber insulation

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

VHT 40/16MO H_2

VHT 40/22 GR with motor-driven lift door and front frame for connection to a glove box

Turbo-molecular pump



VHT gas supply diagram, debinding and sintering

H_2 Version for Operation with Hydrogen or other Reaction Gases

In the H_2 version the furnaces 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

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

Process Box for Debinding in Inert Gas

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

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

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

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

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

VHT 8/16 MO with hydrogen extension package and process box

	VHT ...-../GR	VHT ...-../MO	VHT ...-18/W	VHT ...-18/KE
Tmax	1800 °C or 2200 °C	1200 °C or 1600 °C	1800 °C	1800 °C
Inert gas	✓	✓	✓	✓
Air/Oxygen	up to 350 °C	-	-	✓
Hydrogen	✓[3]	✓[3]	✓[3]	✓[1,3]
Rough vacuum and fine vacuum (>10^{-3} mbar)	✓	✓	✓	✓[2]
High vacuum (<10^{-3} mbar)	-	✓	✓	✓[2]
Material of heater	Graphite	Molybdenum	Tungsten	$MoSi_2$
Material of insulation	Graphite felt	Molybdenum	Tungsten/Molybdenum	Ceramic fiber

[1]Up to 1400 °C
[2]Depending on Tmax
[3]Only with safety package for flammable gases

Model	Inner dimensions of process box in mm			Volume
	w	d	h	in l
VHT 8/..	120	210	150	3,5
VHT 40/..	250	430	250	25,0
VHT 70/..	325	475	325	50,0
VHT 100/..	425	500	425	90,0
VHT 250/..	575	700	575	230,0
VHT 500/..	725	850	725	445,0

Model	Inner dimensions in mm			Volume	Max. charge	Outer dimensions in mm			Heating power in kW[4]			
	w	d	h	in l	weight/kg	W	D	H	Graphite	Molybdenum	Tungsten	Ceramic fiber
VHT 8/..	170	240	200	8	5	1250 (800)[1]	1100	2000	27	19/34[3]	50	12
VHT 40/..	300	450	300	40	30	1600	2100	2300	83/103[2]	54/100[3]	134	30
VHT 70/..	375	500	375	70	50	1700	2500	2400	105/125[2]	70/130[3]	160	55
VHT 100/..	450	550	450	100	75	1900	2600	2500	131/155[2]	90/165[3]	210	85
VHT 250/..	600	750	600	250	175	2300	2800	2800	180/210[2]	125/220[3]	on request	on request
VHT 500/..	750	900	750	500	350	2500	3200	3000	220/260[2]	on request	on request	on request

[1]With the switching system unit removed
[2]1800 °C/2200 °C
[3]1200 °C/1600 °C
[4]Depending on furnace design connected load might be higher

Catalytic and Thermal Afterburning Systems, Exhaust Gas Washer

Exhaust gas washer to clean generated process gases by washing out

Standard laboratory muffle furnace L 5/11 with catalyst KAT 50
see page 12

Chamber furnace N 150/14 with catalytic afterburning system

Thermal afterburning system

Catalytic and Thermal Afterburning Systems (KNV and TNV), Exhaust Gas Washer

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 non-flammable or flammable protective or reaction gases.

An exhaust gas washer is often used if large amounts of exhaust gases are generated respectively, if the gases cannot be treated with a thermal afterburner system or with a torch. The gases will be lead through a water shower and fall out as condensate.

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 limiter 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)

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 non-flammable or flammable protective or reaction gases
- 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 limiter for protecting the thermal afterburning
- Design depending on the exhaust gas flow
- Measuring port for clean gas measurements (FID)

Temperature Uniformity and System Accuracy

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

Specification of Temperature Uniformity in Δ K in the Standard Furnace

In the standard design the temperature uniformity is specified as the relative, maximum deviation from a defined reference temperature within the work space in the empty furnace at dwell time. Temperature uniformity is defined as ΔT in K. If, for example, a standard temperature uniformity of ΔT 10 K at 750 °C is specified, it means that the actual temperature in the furnace can vary between 740 °C and 750 °C or between 750 °C and 760 °C.

Specification of the Temperature Uniformity in +/- °C as Additional Feature

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

System Accuracy

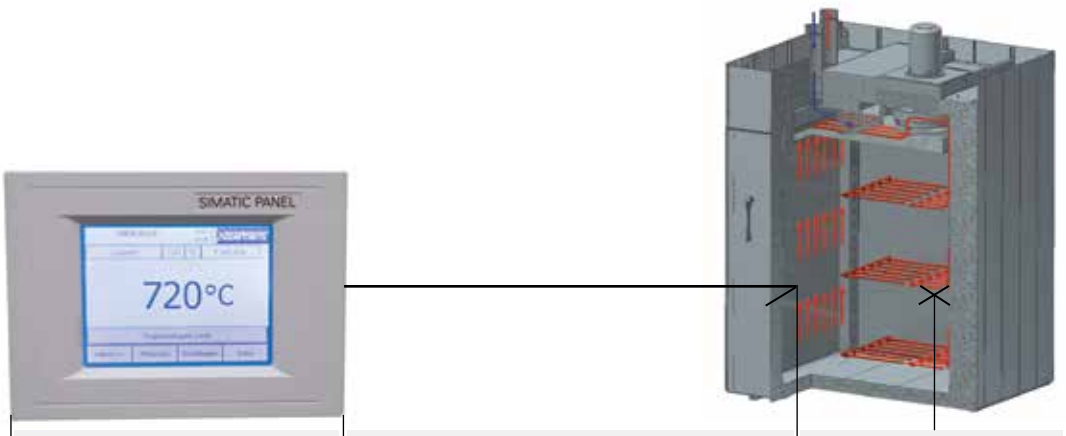
Tolerances may occur not only in the work space, they also exist with respect to the thermocouple and in the controls. If an absolute temperature uniformity in +/- °C at a defined set temperature or within a defined working temperature range is required, the following measures have to be taken:

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

Temperature Uniformity in the Work Space incl. Protocol

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

Holding frame for measurement of temperature uniformity



The system accuracy is defined by adding the tolerances of the controls, the thermocouple and the work space

Precision of the controls, e.g. +/- 2 °C

Deviation of thermocouple, e.g. +/- 1.5 °C

Deviation from measuring point to the average temperature in the work space +/-3 °C

Process Control and Documentation

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 Controllers

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

Assignment of Standard Controllers to Furnace Families	L1/12	L 3 - LT 40	LE 1/11 + LE 4/11	LE 6/11 + LE 14/11	LV, LVT	L 9/11/SKM	L(T) 9/../SW	N 110/HS, S 73/HS, N 7/HS	N 7/H - N 87/H	LH 15/12 - LF 120/14	HTCT	LHT 02/16 - LHT 08/18	LHT 02/17 LB + LHT 16/17 LB	LHT 04/16 SW + LHT 04/17 SW	HT	HTC 16/16 - HTC 450/16	HFL	TR	N 15/../HA	N 30/../HA - N 500/../HA	RD	R	RT	RHTC	RHTH/RHTV	RS	RSR	K	KC	LS	GR	NRA 17/06 - NRA 1000/11	NR, NRA .. H_2	NR, NRA .. IDB	SVHT	VHT
Catalog page	4	4,7	6	6	8	10	11	13	14	16	18	19	20	21	22	24	25	26	28	28	30	31	32	33	34	36	38	48	48	49	49	50	52	52	53	54
Controller																																				
B 180		●			●	●	●				●							○	●			●	●	●												
P 330		○			○	○	○				○							○	○			○	○	○												
R 6	●		●															●			●															
C 6/3208																				○								●	●							
B 150				●					●	●										●						●	●									
P 300				○				●	○	○										○						○	○				●					
P 310												●	●	●	●[1]	●[1]	●[1]								●											
3216	○		○																		○															
3504								○										○		○		○		○	○	○	○				○					
H 500/PLC										○																○				●						
H 700/PLC															●[1]	●[1]	●[1]								○		○								●	●
H 1700/PLC																				○										●	○		●			
H 3700/PLC																				○					○	○	○			○	○	●		○	○	

[1] Standard controller, depending on requirements

Functionality of the Standard Controllers	R 6	C6	3216	3208	B 130	B 150	B 180	C 280	P 300	P 310	P 330	3504	H500	H 700	H 1700	H 3700	NCC
Number of programs	1	1	1		2	1	1	9	9	9	9	25	20	1/10[4]	10	10	50
Segments	1	2	8		3	2	2	3	40	40	40	500[4]	20	20	20	20	20
Extra functions (e.g. fan or autom. flaps)								2	2[3]	2[3]	2	2-8[4]	3[4]	○[4]	6/2[4]	8/2[4]	16/4[4]
Maximum number of control zones	1	1	1	1	1	1	1	1	1	1	1	2[1,2]	1-3[4]	○[4]	8	8	8
Drive of manual zone regulation										●							
Charge control/bath control												○	○	○	○	○	○
Auto tune			●	●	●	●	●	●	●	●	●	●					
Graphic color display													4"	5,7"	5,7"	12"	19"
Status messages in clear text				●	●	●	●	●	●	●	●	●	●	●	●	●	●
Data input via number pad							●		●	●	●						
Data entry via touchpanel													●	●	●	●	
Keypad lock					●	●		●				●					
Skip-button for segment jump									●	●	●		●	●	●	●	●
Program entry in steps of 1 °C or 1 min.	●		●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Start time configurable (e.g. to use night power rates)					●	●	●	●	●	●	●		●	●	●	●	●
Switch-over °C/°F	○		○	○	●	●	●	●	●	●	●	○	●	●[4]	●[4]	●[4]	●[4]
kWh meter					●	●	●	●	●	●	●						
Operating hour counter					●	●	●	●	●	●	●		●	●	●	●	●
Programmable power outlet											●[5]						
Real-time clock											●		●	●	●	●	●
NTLog Comfort for HiProSystems: Recording of process data on an external storage medium													○		○	○	
NTLog Basic for Nabertherm Controller: Recording of process data with USB-flash drive					○	○	○	○	○	○	○						
Interface for MV software					○	○	○	○	○	○	●						

● Standard
○ Option

[1] Not for melt bath control
[2] Control of additional separate slave regulators possible
[3] As an extra feature in air circulation furnaces
[4] Depending on the design
[5] Not for model L(T)15..

Mains Voltages for Nabertherm Furnaces

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

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

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

HiProSystems Control and Documentation

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

Alternative User Interfaces

Touch panel H500/H 700

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

Touch panel H 1700

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

Touch panel H 3700

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

For Control, Visualisation and Documentation

Nabertherm Control Center NCC

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

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

For Documentation

Nabertherm Documentation Center NDC and Data Recording via NTLog

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

Temperature Recorder

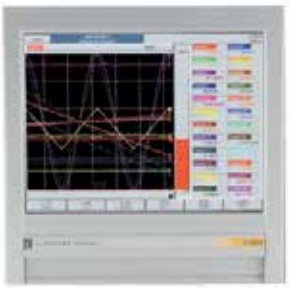
Besides the documentation via the software which is connected to the controls, Nabertherm offers different temperature recorders which can be used with respect to the application.

	Model 6100e	Model 6100a	Model 6180a
Data input using touch panel	x	x	x
Size of colour display in inch	5.5	5.5	12.1
Number of thermocouple inputs	3	18	48
Data read-out via USB-stick	x	x	x
Input of charge data		x	x
Evaluation software included	x	x	x
Applicable for TUS-measurements acc. to AMS 2750 E			x

PC for HiProSystems control in a separate cabinet

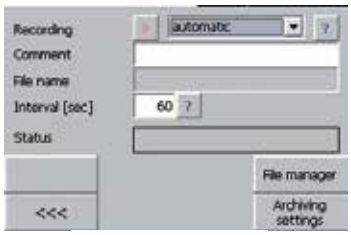
H 1700 with colored, tabular depiction of the data

H 3700 with colored graphic presentation of data

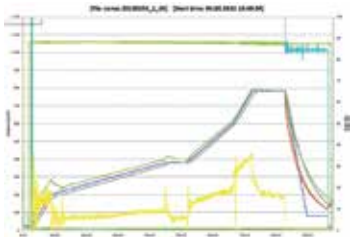


Temperature recorder

NTLog Basic for data recording of Nabertherm Controllers



NTLog Comfort for data recording of a Siemens PLC



NTGraph, a freeware for the easy-to-read analysis of recorded data using MS Excel

Documentation of Nabertherm Controller – Extension Module NTLog/NTGraph Basic

The extension module NTLog Basic is an economical way to record process data using the respective Nabertherm Controllers (P 300/310/330, B 130/150/180, C 280, all from version 3.0) on a USB stick. For this purpose the controller is enhanced with an intelligent interface adapter to accommodate a USB stick.

The process documentation with NTLog Basic requires no additional thermocouples or sensors. Only data recorded which are available in the controller via the control thermocouple (difference instead of real-time, program segment no., temperature setpoint, temperature actual value, control function 1, control function 2) is recorded.

The data stored on the USB stick (up to 16,000 data records, format CSV) can afterwards be evaluated on the PC either via NTGraph or a spreadsheet software used by the customer (e.g. MS Excel). Process data is stored with a differential time and not with an absolute time stamp. Charge data, start time and start date are assigned later (e.g. in the spreadsheet software or with the file name) by the operator at the PC.

For protection against accidental data manipulation the generated data records contain checksums. A retrofit of NTLog Basic on existing controllers can be done with a retrofit kit including a manual.

Documentation of PLC Controls with Touch Panel H 1700 or H 3700 - Extension Module NTLog/NTGraph Comfort

The extension module NTLog Comfort offers the same functionality of NTLog Basic module. Process data from a Siemens PLC Controller is read out from Touch Panel H 1700 or H 3700 and stored in real time on a USB stick. The extension module NTLog Comfort can also be connected using an Ethernet connection to a computer in the same local network so that data can be written directly onto this computer.

Process Data from NTLog

The process data from NTLog can be presented either using the customer‘s own spreadsheet program (e.g. MS Excel) or NTGraph. With NTGraph Nabertherm provides for a user-friendly tool free of charge for the visualization of the data generated by NTLog. Prerequisite for its use is the installation of the program MS Excel (version 2003/2010/2013). After data import presentation as diagram, table or report can be chosen. The design (color, scaling, reference labels) can be adapted by using eight prepared sets.

NTGraph is available in seven languages (DE/EN/FR/SP/IT/CH/RU). In addition, selected texts can be generated in other languages.

Controltherm MV Software for Control, Visualisation and Documentation

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

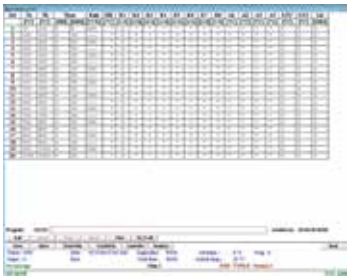
Controltherm MV Software for Control, Visualisation and Documentation

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

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

Features

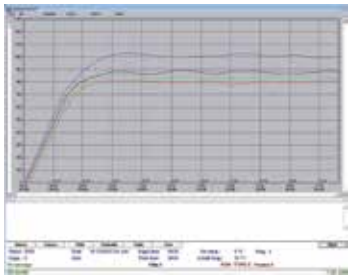
- Simple installation without specific knowledge
- Suitable for PC with operating system Microsoft Windows 7 (32 Bit), Vista (32 Bit), XP with SP3, 2000, NT4.0, Me, 98
- All Nabertherm controllers with interface connectable
- Manipulation protected storage of temperature curves of up to one, four, eight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



Data input in table format if used together with Nabertherm controllers

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

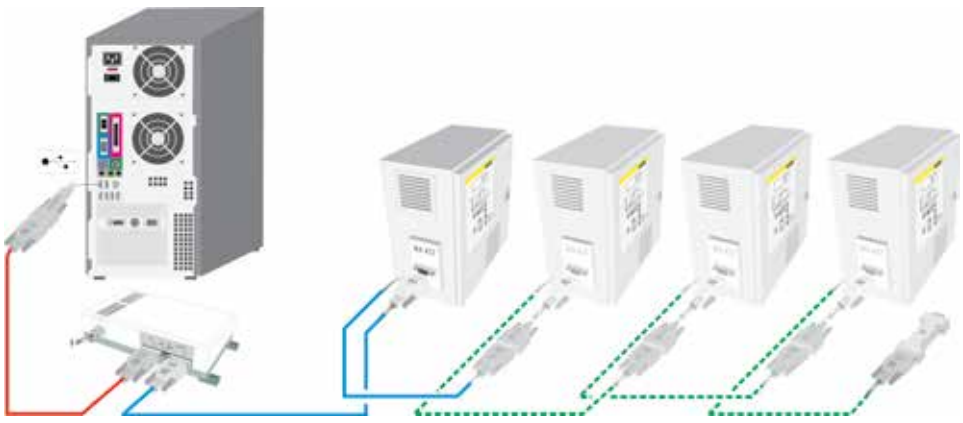
- Connection of an independent thermocouple, type K or S with display of the measured temperature on the included controller C 6 D, e.g. for documentation of charge temperature
- Conversion and transmission of measured data to the MV-software
- For data evaluation see MV-software features



Graphical display of set and actual temperature curve

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

- Connection of three thermocouples, type K, S, N or B to the supplied connection box
- Extendable to two or three connection boxes for up to nine temperature measuring points
- Conversion and transmission of measured data to the MV-software
- For data evaluation, please see MV-software features



Extendable for connection of up to 16 furnaces

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Headquarters:

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

Sales and Service Subsidiaries:

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

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

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

Great Britain
Nabertherm Ltd., United Kingdom
contact@nabertherm.com

Switzerland
Nabertherm Schweiz AG
Batterieweg 6
4614 Hägendorf, Switzerland
contact@nabertherm.ch

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

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

All other Countries: Follow

http://www.nabertherm.com/contacts

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