Nabertherm

MORE THAN HEAT 30-3000 °C

Ceramics






Debinding
Sintering
Firing
Decorating
Laboratory

www.nabertherm.com

Made
in
Germany



Made in Germany

With over 300 employees, Nabertherm has developed and produced industrial furnaces in many fields for over 50 years. 150,000 customers in all countries of the world are part of the company`s success story. A wide range of standard furnaces and a high value added of skilled labour in our factory provide for short delivery times. Experienced sales partners or own sales companies in key countries assure for individual quotes and after sales service tailored to the needs of our customers.

Setting Standards in Quality and Reliability

From a wide range of standard furnaces up to state-of-the-art sintering plants including integrated afterburning systems, Nabertherm can provide it all. With customised fully-fledged heat treatment systems technology, even complicated production processes can be solved. The innovative Nabertherm control and automation technology assures the professional monitoring, control and documentation of debinding, firing and sintering processes. Sophisticated technical details like our concept of freely radiating heating elements on ceramic support tubes which provide for not only a perfect temperature distribution and energy efficiency but also for a long service life are the key competitive edge.

World-Wide Sales Network

With our world-wide sales network we are close to every customer in order to provide for the necessary support and service you need. Reference customers with respective furnaces are also close to you helping you to make the right decision.

Customer Service and Spare Parts

Our experienced staff members in the service department will help you to solve any problem. Whether on site or with the help of telecommunications, they will be available for you. For fully-fledged heat treatment plants we recommend our teleservice via modem anyways. Particularly proud we are upon our world-wide spare parts service. In no time we will reach you all over the world. If you need an answer for your application, our R&D department will take care of the respective testing in our laboratory which is equipped with all kind of furnaces.

Experience in other Industry Segments and Applications

Beyond the production of kilns for ceramics processing, Nabertherm offers a wide range of standard furnaces and and systems for many other industry segments. Please, ask for advice or visit our website. The modular design and technology of our products will make sure that we can solve most of your problems without expensive modifications.

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DEBINDING
Electrically Heated Chamber Furnaces

N 1000/G

N 150/G

Chamber furnaces N 100/G - N 2200/G

These sturdy chamber furnaces are ideal for simple debinding production processes with low binder concentration.

Standard Version

- T_{max} 900 °C
- Heating from 5 sides with special positioning of the heating elements for optimum temperature distribution
- Heating elements based on support tubes resulting in long service life of the heating wire
- Floor heating elements protected by SiC plate providing for level stacking support
- High quality wear-free thermocouple, type S
- Multi-layer insulation with lightweight refractory bricks and special rear insulation
- Side walls and door double walled, side walls made of stainless steel (up to N 300..)
- Perforated plate cover made from brushed stainless steel (up to N 300..)
- Infinitely variable airinlet, exhaust air in the furnace ceiling (from N 450 designed as flap)
- Self-supporting brick ceiling construction, arch-shaped
- Removable stand (up to N 300…)

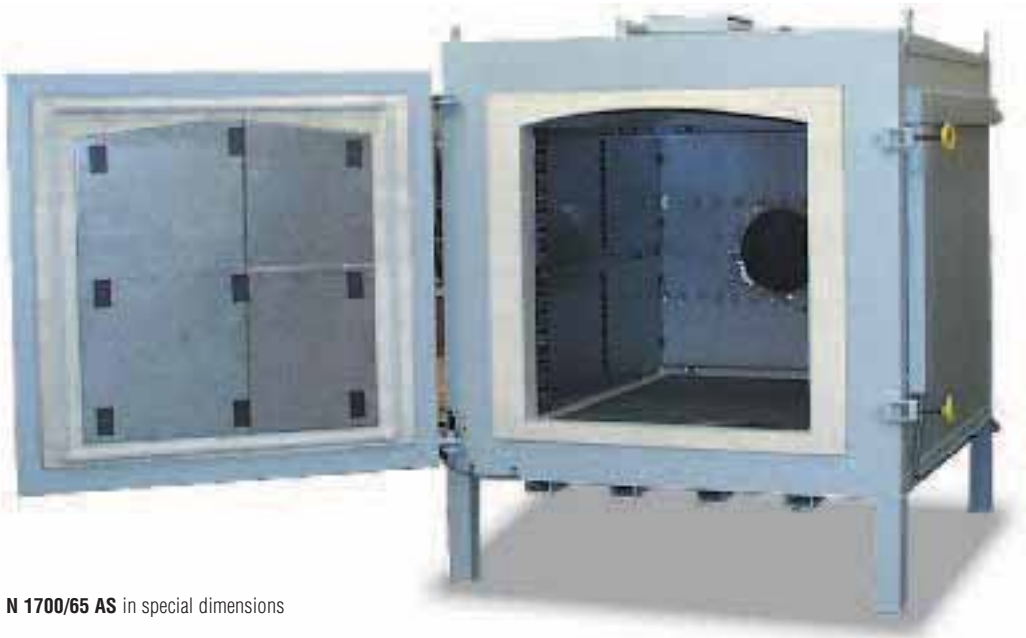
Extras

- Customised dimensions
- Fan for better control of air in- and outflow
- Automatic vapour vent flaps
- Catalytic or thermal air cleaning systems
- Multizone control for temperature distribution up to +/-5 °C according to DIN 17052

Model	T_{max} °C	Inner dimensions in mm w	d	h	Volume in litres	Outer dimensions in mm W	D	H	Connected power/kW	Connection voltage[1]	Weight in kg
N 100/G	900	400	530	460	100	710	1150	1430	7	3-phase	270
N 150/G	900	450	530	590	150	760	1150	1560	9	3-phase	305
N 200/G	900	500	530	720	200	810	1150	1690	11	3-phase	345
N 300/G	900	550	700	780	300	860	1340	1750	15	3-phase	430
N 450/G	900	600	750	1000	450	1000	1440	1820	20	3-phase	700
N 650/G	900	600	1100	1000	650	1000	1540	1930	26	3-phase	850
N 1000/G	900	800	1000	1250	1000	1290	1730	1830	40	3-phase	1680
N 1500/G	900	900	1200	1400	1500	1390	1930	1990	57	3-phase	2300
N 2200/G	900	1000	1400	1600	2200	1490	2130	2190	75	3-phase	2800

[1] Notes on connection voltages please see page 39

Chamber Air - Circulation Furnaces Electrically Heated



N 1700/65 AS in special dimensions

N 120/65 DB

Air-Circulation Furnaces N 120/65 DB - N 500/65 DB

When debinding technical ceramics an optimum temperature distribution during the heating-up phase is essential to make sure that the charge is not damaged. For many applications air circulation furnaces are the only alternative because the guided air swirl optimises the temperature uniformity in the furnace chamber. The air-circulation furnaces N 120/65 DB - N 500/65 DB furnaces are specifically developed for this application.

Standard Version

- Horizontal air-circulation for temperature distribution from + 3 K according to DIN 17052
- Housing almost gas tight with special door sealing
- 3 shelves included in the delivery package
- Additional rails for extra shelves included
- Automatic control of vapour vent flap
- Additional alternative for ventilation through ball valve
- Protective gas inlet and outlet

Automatic vapor vent flap as standard

Extras

- Stainless steel interior housing
- Customised dimensions
- Hot-gas fan
- Inert gas purging
- Automatic process control (atmosphere on request)
- Tube system for exhaust gas
- Catalytic or thermal afterburner

Powerful air circulation motor

Model	T_{max} °C	Inner dimensions in mm w	d	h	Volume in litres	Outer dimensions in mm W	D	H	Connection voltage[1]	Connected power/kw	max. sheets
N 120/65 DB	650	450	600	450	120	1030	1290	1500	3-phase	9	11
N 250/65 DB	650	600	750	600	250	1190	1505	1860	3-phase	18	14
N 500/65 DB	650	750	900	750	500	1340	1755	2010	3-phase	27	17

[1] Notes on connection voltages please see page 39

DEBINDING
Chamber Air Circulation Furnaces, Electrically or Gas Heated

N 2000/25 HA electrically heated with horizontal air supply and observation window

Low temperature air circulation furnaces N 560/25 - N 10000/45

Chamber air-circulation furnaces under normal atmosphere for debinding, drying and preheating.

Loading can take place using stackers, charging or lift trucks.

Standard Version

- Temperatures up to 250 or 450 °C
- Chamber furnaces available with horizontal (type/HA) or vertical air circulation (type/A)
- Indirect electrically or gas heated
- Ground-level, no floor insulation
- Optimum temperature distribution [according to DIN 17052] of up to ±5 °C
- High atmosphere turn-over (controlable)
- Furnace size suitable for common charging systems

N 1000/45 HA

Extras

- Ground level with floor insulation with or without recesses
- Observation window and furnace chamber lighting
- Exhaust gas fan and safety equipment for evaporating solvents (design according to EN 1539)
- Customised dimensions up to 20,000 litres and charge weights up to 20 tons
- Catalytic or thermal afterburners

Model	T_{max} °C	Inner dimensions in mm w	d	h	Volume in litres	Outer dimensions in mm W	D	H	Connected power/kW	Connected voltage[1]
N 560/25..	250	750	1000	750	560	1070	1680	1070	13.0	3-phase
N 1000/25..	250	1000	1000	1000	1000	1380	1820	1200	17.5	3-phase
N 1500/25..	250	1500	1000	1000	1500	1880	1820	1200	20.5	3-phase
N 1500/25..1	250	1000	1500	1000	1500	1380	2320	1200	20.5	3-phase
N 2000/25..	250	1500	1100	1200	2000	1880	1930	1420	20.5	3-phase
N 2000/25..1	250	1100	1500	1200	2000	1480	2330	1420	20.5	3-phase
N 4000/25..	250	1500	2200	1200	4000	1880	2830	1420	46.0	3-phase
N 4000/25..1	250	2200	1500	1200	4000	2380	2330	1420	46.0	3-phase
N 5600/25..	250	1500	2500	1500	5600	1880	2780	2260	64.5	3-phase
N 6750/25..	250	1500	3000	1500	6750	1880	3280	2260	91.0	3-phase
N 7200/25..	250	2000	1500	2400	7200	2380	2330	2620	91.0	3-phase
N 10000/25..	250	2000	2500	2000	10000	2380	2780	2760	111.0	3-phase
N 560/45..	450	750	1000	750	560	1190	1800	1190	19.0	3-phase
N 1000/45..	450	1000	1000	1000	1000	1500	1940	1320	39.0	3-phase
N 1500/45..	450	1500	1000	1000	1500	2000	1940	1320	39.0	3-phase
N 1500/45..1	450	1000	1500	1000	1500	1500	2440	1320	39.0	3-phase
N 2000/45..	450	1500	1100	1200	2000	2000	2050	1540	45.0	3-phase
N 2000/45..1	450	1100	1500	1200	2000	1600	2550	1540	45.0	3-phase
N 4000/45..	450	1500	2200	1200	4000	2000	2950	1540	64.0	3-phase
N 4000/45..1	450	2200	1500	1200	4000	2500	2450	1540	64.0	3-phase
N 5600/45..	450	1500	2500	1500	5600	2000	2900	2380	90.0	3-phase
N 6750/45..	450	1500	3000	1500	6750	2000	3400	2380	109.0	3-phase
N 7200/25..	450	2000	1500	2400	7200	2500	2550	2740	109.0	3-phase
N 10000/45..	450	2000	2500	2000	10000	2500	2900	2880	135.0	3-phase

[1] Notes on connection voltages please see page 39

DEBINDING
Bogie Hearth Air-Circulation Furnaces

W 2200/65A
with atmosphere box

Bogie Hearth Air-Circulation Furnaces W 1000/65A - W 10000/85A

Bogie hearth furnaces are recommended especially for debinding heavy loads and/or for charging outside the furnace. The standard furnace already achieves a particularly good temperature distribution of up to ±7 °C.

Standard Version

- Temperatures up to 550 or 750 °C
- Freely travelling bogie on Tefolan castors
- 3-side heating from both sides and the bogie
- Vertical air circulation with fans in the furnace roof

Extras

- Atmosphere box for operation with inert gas
- Electro-hydraulic lift door
- Air inflow and outflow system
- Bogie on rails and/or electrical drive of the bogie
- Cooling systems
- Multi-zone control for optimising the temperature distribution up to +/- 3 K according to with DIN 17052
- Control of vapor vent flaps for quick cooling
- Customised dimensions up to 20,000 l furnace volume

Bogie hearth furnace **W 2160/S**
in customised dimensions with
lift-door and rail operation

Model	T_{max} °C	Inner dimensions in mm w	d	h	Volume in litres	Outer dimensions in mm W	D	H	Connected power/kW	Connected voltage[1]
W 1000/65A	650	800	1600	800	1000	1450	2400	2300	42	3-phase
W 1500/65A	650	900	1900	900	1500	1550	2750	2400	58	3-phase
W 2000/65A	650	1000	2200	1000	2200	1650	3000	2500	77	3-phase
W 3300/65A	650	1000	3300	1000	3300	1650	4000	2500	90	3-phase
W 5000/65A	650	1200	3400	1200	5000	1850	4100	2700	110	3-phase
W 7500/65A	650	1400	3800	1400	7500	2050	4500	2900	140	3-phase
W 10000/65A	650	1600	3900	1600	10000	2250	4600	3100	220	3-phase
W 1000/85A	850	800	1600	800	1000	1450	2400	2300	42	3-phase
W 1500/85A	850	900	1900	900	1500	1550	2750	2400	58	3-phase
W 2200/85A	850	1000	2200	1000	2200	1650	3000	2500	77	3-phase
W 3300/85A	850	1000	3300	1000	3300	1650	4000	2500	90	3-phase
W 5000/85A	850	1200	3400	1200	5000	1850	4100	2700	110	3-phase
W 7500/85A	850	1400	3800	1400	7500	2050	4500	2900	140	3-phase
W 10000/85A	850	1600	3900	1600	10000	2250	4600	3100	220	3-phase

[1] Notes on connection voltages please see page 39

DEBINDING
Retort Furnace for Debinding under Vacuum and in a Defined Atmosphere

Retort Furnaces GLO and V-GLO

The horizontal or vertical retort furnaces are used for debinding ceramics under vacuum or in defined atmosphere up to 1300 °C. Tailored to the respective process, the following applications can be done:

- Thermal debinding and presintering of ceramic and/or metal parts (e.g. pressing, injection moulding, CIM/MIM)
- Pyrolytic decomposition of organic pre-stages (e.g. C resins, Si-C compounds, fibre composites, fibre reinforced materials CMC/MMC)
- Vacuum annealing of dental ceramic intermediates
- Surface modification of ceramic products e.g. using forming gas or H_2

Extras

- Metallic or quartz retort
- Heated door, heated gas outlet
- Condensate traps, thermal or catalytic afterburners
- Gas supply, safety package for H_2 operation
- Vacuum pump stand
- Multi-zone control
- Fan for air-circulation
- Fast cooling (max. cool-down rates up to 20 K/min)
- Charging devices for horizontal or vertical operation
- Gas preheating
- Gas dampening
- Cascade control through charge thermocouples

V-GLO 125/11

Model	T_{max} [1] °C	Retorts [2] Ø	Retorts [2] L	Outer dimensions in mm W	Outer dimensions in mm D	Outer dimensions in mm H	Heating rate [K/h]	Cooling rate [3] [K/min]	Weight kg
Front loader									
GLO 26/13	1300	236	600	1000	1800	1800	500	20	750
GLO 40/11	1150	300	600	1000	1800	1800	500	20	750
GLO 75/11	1150	400	600	1200	1800	1800	500	20	1000
GLO 150/11	1150	400	1200	1200	2500	1800	500	20	1250
GLO 235/11	1150	500	1200	1300	2500	1800	500	20	1500
Bottom loader									
V-GLO 125/11	1150	400	1000	1900	2200	4200	500	20	2500
V-GLO 950/11	1150	900	1500	2400	1900	5100	500	20	4000

[1] depending on the retort material used
[2] other diameters and lengths on request
[3] maximum cooling rates with fast cooling

DEBINDING
Retort furnaces for Catalytic Debinding

EBO 120

Retort furnaces EBO 120

The EBO 120 was developed for catalytical debinding of ceramic and/or metallic injection molding parts (CIM/MIM) according to the BASF method. The patented **Advanced Temperature Control System (ATC)** differentiates the EBO 120 from traditional catalytic debinding furnaces.

The substantial differences are:

- Reduction of the acid time and the respective reduction of production costs
- Reliable monitoring of the debinding process
- Online signal recording and evaluation (ATC)
- Elimination of complex empirical test series
- Reduction of the pollutant emissions
- Fully automated process with maximum safety standard

Additional operating and safety comfort:

- Touch panel operation in connection with HiProSystems control
- Automatic carrier gas metering according to acid quantity flow
- Process gas circulation
- Two-stage propane excess gas burner for almost residue-free afterburning

Chamber (w x h x d)	400 x 400 x 750	mm
Useful volume	120	Litres
Outer dimensions (W x H x D)	1750 x 2150 x 1850	mm
Charging shelves	400 x 250	mm
Shelf thicknesses	1.5	mm
Number of charge piles	3	
T_{max}	150	°C
Acid and gas consumption (fully charged):		
HNO_3	ca. 180	ml/h
Nitrogen (carrier gas)	3000	l/h
Propane/natural gas (excess burner gas)	500	l/h

DEBINDING AND SINTERING IN COMBI-FURNACES
Chamber Furnaces with Air Preheating

Production line with **N 300/HDB** for debinding and sintering alumina

N 200/HDB

Combi-Chamber Furnaces N 200/HDB - N 300/HDB with Preheating of Air-Inflow

When producing small components the transfer from the debinding furnace to the sintering furnace does often create many disadvantages and risks. The goods are not allowed to cool down between the processes and the charging of the parts without binder causes incalculable rejects. The models N 200/HDB and N 300/HDB are especially developed to avoid these disadvantages.

Since an optimum temperature distribution is an requirement in the lower temperature range the furnace has a preheating system. Blowing in the warm, separately controlled air ensures an optimum temperature distribution with the help of the controlled air swirl. During the debinding process, the vapour vent flap of the furnace is open so that the waste air can be immediately directed out of the furnace.

Through perforated ceramic pipes in the chamber the preheated air is very evenly blown horizontally in different layers into the furnace chamber. The heating zones of the furnace and the air preheating system are controlled separately but operate jointly up to about 500 °C. Subsequently, the air preheating switches off and the furnace continues the sintering process without having to cool down in between.

Model	T_{max} °C	Inner dimensions in mm w	d	h	Volume in litres	Outer dimensions in mm W	D	H	Connected power/kW	Connected voltage[1]	Weight in kg
N 200/HDB	1340	370	530	720	140	790	1060	1690+400	31	3-phase	490
N 300/HDB	1340	420	700	780	230	840	1230	1750+400	38	3-phase	580

[1] Notes on connection voltages please see page 39

Chamber Furnaces with Air Preheating

Standard Version **N 200/HDB - N 300/HDB**

- Horizontal blowing-in of preheated air up to max. 500 °C, continuation of the process up to the sintering temperature with 5-side heating in the furnace
- Bottom heating covered by SiC heat-conducting plate (level stacking support)
- Automatic control of vapour vent flaps
- Exhaust hood in stainless steel 1.4301
- Two-zone control, preheating of air inflows also controlled separately as a second heating source
- Temperature distribution better than +/- 7 K during the debinding process and better than +/- 10 K [according to DIN 17052] during the dwell time when sintering

Preheated air is blown in through perforated cceramic pipes

Extras

- Customer-specific versions with respect to temperature and size
- Multi-zone control for processes requiring optimum temperature distribution
- Cooling fan to shorten process cycle
- Scales for measuring the weight loss during firing
- Thermal or catalytic afterburning systems

Cooling fan

Scales for documenting the weight loss

N 576/14 DBS in customised dimensions with scales for controlling the weight loss

SINTERING/FIRING
Chamber Kilns

N 650

N 300

N 150

Chamber Kilns N 100/G - N 2200/14

High quality workmanship, appealing design, long service life and an excellent temperature distribution - these are the key quality characteristics of the N 100/G - N 2200/14 chamber kilns. Our broad standard range takes care of most customer' needs.

Standard Version

- Temperature categories 900, 1280, 1340 and 1400 °C
- Customised sizes
- Heating from 5 sides with special positioning of the heating elements for optimum temperature distribution
- Heating elements attached to support tubes resulting in long service life of the heating wire
- Bottom heating elements protected by inlaid SiC plate providing for level stacking support
- High quality wear-free thermocouple, type S
- Door safety switch
- Multi-layer insulation with lightweight refractory bricks and special rear insulation
- Side walls and door double walled, side walls made of stainless steel (up to N 300..)
- Perforated stainless steel cover (up to N 300..)
- Controlled air inflow, vapour vent in the kiln ceiling (from N 450 designed as flap)
- Self-supporting brick ceiling construction, arch-shaped
- Removable stand (up to N 300…)

Additional Equipment **N 100/G - N 2200/14**

- Customised dimensions
- Cooling systems for shortening cycles with simple or fully automatic control gear
- Automatic vapour vent flap control for better ait outflow
- Stainless steel exhaust gas hoods
- Catalytic or thermal afterburners
- Kiln furniture
- Charging devices
- Multi-zone control for an optimum temperature distribution
- Process documentation by temperature recorder or PC software

Model	T_{max} °C	Inner dimensions in mm w	d	h	Volume in litres	Outer dimensions in mm W	D	H	Connected power/kW	Connected voltage[1]	Weight in kg
N 100/G	900	400	530	460	100	710	1150	1430	7	3-phase	270
N 150/G	900	450	530	590	150	760	1150	1560	9	3-phase	305
N 200/G	900	500	530	720	200	810	1150	1690	11	3-phase	345
N 300/G	900	550	700	780	300	860	1340	1750	15	3-phase	430
N 450/G	900	600	750	1000	450	1010	1440	1815	20	3-phase	815
N 650/G	900	700	850	1100	650	1120	1540	1925	26	3-phase	930
N 1000/G	900	800	1000	1250	1000	1290	1730	1960	40	3-phase	1680
N 1500/G	900	900	1200	1400	1500	1390	1930	2120	57	3-phase	2300
N 2200/G	900	1000	1400	1600	2200	1490	2130	2320	75	3-phase	2800
N 100	1280	400	530	460	100	710	1150	1430	9	3-phase	270
N 150	1280	450	530	590	150	760	1150	1560	11	3-phase	290
N 200	1280	500	530	720	200	810	1150	1690	15	3-phase	370
N 300	1280	550	700	780	300	860	1340	1750	20	3-phase	410
N 450	1280	600	750	1000	450	1010	1440	1815	30	3-phase	815
N 650	1280	700	850	1100	650	1120	1540	1925	40	3-phase	930
N 1000	1280	800	1000	1250	1000	1370	1770	1980	57	3-phase	1800
N 1500	1280	900	1200	1400	1500	1470	1970	2140	75	3-phase	2500
N 2200	1280	1000	1400	1600	2200	1570	2170	2340	110	3-phase	3100
N 100/H	1340	400	530	460	100	740	1170	1430	11	3-phase	315
N 150/H	1340	450	530	590	150	790	1170	1560	15	3-phase	350
N 200/H	1340	500	530	720	200	840	1170	1690	20	3-phase	420
N 300/H	1340	550	700	780	300	890	1360	1750	27	3-phase	500
N 450/H	1340	600	750	1000	450	1120	1485	1825	40	3-phase	1040
N 650/H	1340	700	850	1100	650	1220	1585	1935	57	3-phase	1260
N 1000/H	1340	800	1000	1250	1000	1370	1770	1980	75	3-phase	2320
N 1500/H	1340	900	1200	1400	1500	1470	1970	2140	110	3-phase	2700
N 2200/H	1340	1000	1400	1600	2200	1570	2170	2340	140	3-phase	3600
N 100/14	1400	400	530	460	100	740	1170	1430	15	3-phase	345
N 150/14	1400	450	530	590	150	790	1170	1560	20	3-phase	400
N 200/14	1400	500	530	720	200	840	1170	1690	22	3-phase	610
N 300/14	1400	550	700	780	300	890	1360	1750	30	3-phase	575
N 450/14	1400	600	750	1000	450	1120	1485	1825	40	3-phase	1320
N 650/14	1400	700	850	1100	650	1220	1585	1935	57	3-phase	1560
N 1000/14	1400	800	1000	1250	1000	1380	1770	2000	75	3-phase	2500
N 1500/14	1400	900	1200	1400	1500	1480	1970	2160	110	3-phase	3000
N 2200/14	1400	1000	1400	1600	2200	1580	2170	2360	140	3-phase	3900

[1] Notes on connection voltages please see page 39

Cooling systems for shortening the process cycle

Exhausthood

Charging device

Kiln furniture

SINTERING/FIRING
Shuttle Kilns

Production line with **W 10800/HS1**
for sintering grinding wheels

Shuttle Kilns

W 1500/H

Shuttle Kiln **W 15000/S** in customised dimensions, electro-hydraulic door and bogie running on tracks

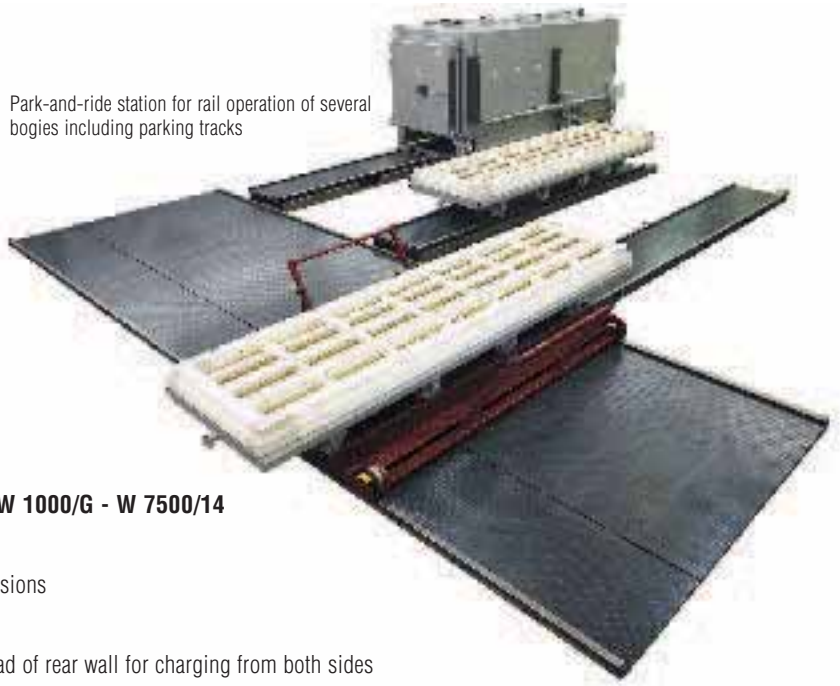
Shuttle Kilns W 1000/G - W 15000/14

Shuttle kilns provide a number of advantages when firing and sintering in production scale.
The bogie can be charged outside the kiln. When using several bogies, one bogie can be charged while the other is in operation.

Standard Version

- Temperature categories 900, 1280 1340 and 1400 °C
- 5-side heating from all four sides and the bogie
- Bogie heating contacts automatically when driven in
- Heating elements attached to support tubes resulting in long service life of the heating wire
- Level stacking support due to SiC plate on the bogie, floor heating elements protected by SiC plates
- Multi-layer insulation with lightweight refractory bricks and special rear insulation
- Side walls and door double walled for good ventilation and low exterior temperatures
- Self-supporting brick ceiling construction, arch-shaped
- Heating from 5 sides (2 sides, door, rear wall, bogie)
- Bogie can be driven freely with rubber tires
- Manually adjustable blower with controllable air-inlet on request
- Vapour vent flap in furnace roof

SINTERING/FIRING
Shuttle Kilns



Park-and-ride station for rail operation of several bogies including parking tracks

Additional equipment **W 1000/G - W 7500/14**

- Customised dimensions
- Second bogie
- Second door instead of rear wall for charging from both sides
- Electro-hydraulic lift door
- Rails and flange wheels for heavy loads
- Electrically powered bogie
- Fan cooling for purging and fast cooling down
- Fan cooling with pre-set speed using a potentiometer
- Fan cooling with control system
  (the set cooling gradient is reached precisely with variable fan speed)
- Automatic vapour vent flap control
- Heat shield to minimise the radiation losses when the bogie has left the furnace
- Multi-zone control for optimum temperature distribution [according to DIN 17052] up to ±5 °C
- Customer specific connected power rates
- Fully automated process control and documentation
- Customised sizes up to 20000 litres and charge weights up to 20 tons

Model	T_{max} °C	Inner dimensions in mm w	d	h	Volume in litres	Outer dimensions in mm W	D	H	Connected power/kW	Connected voltage[1]	Weight in kg
W 1000/G	900	800	1600	800	1000	1400	2350	1880	40	3-phase	3000
W 1500/G	900	900	1900	900	1500	1500	2650	2010	57	3-phase	3500
W 2200/G	900	1000	2200	1000	2200	1600	2950	2120	75	3-phase	4000
W 3300/G	900	1000	2800	1200	3300	1600	3550	2320	110	3-phase	5300
W 5000/G	900	1000	3600	1400	5000	1600	4350	2520	140	3-phase	7500
W 7500/G	900	1000	5400	1400	7500	1600	6150	2520	185	3-phase	9100
W 10000/G	900	1000	7100	1400	10000	1600	7850	2520	235	3-phase	11000
W 1000	1280	800	1600	800	1000	1470	2400	1820	57	3-phase	3000
W 1500	1280	900	1900	900	1500	1570	2700	2010	75	3-phase	3500
W 2200	1280	1000	2200	1000	2200	1670	3000	2120	110	3-phase	4000
W 3300	1280	1000	2800	1200	3300	1670	3600	2320	140	3-phase	5300
W 5000	1280	1000	3600	1400	5000	1670	4400	2520	185	3-phase	7500
W 7500	1280	1000	5400	1400	7500	1670	6200	2520	235	3-phase	9100
W 10000	1280	1000	7100	1400	10000	1670	7900	2520	300	3-phase	11000
W 1000/H	1340	800	1600	800	1000	1470	2400	1880	75	3-phase	3500
W 1500/H	1340	900	1900	900	1500	1570	2700	2010	110	3-phase	3800
W 2200/H	1340	1000	2200	1000	2200	1670	3000	2120	140	3-phase	4400
W 3300/H	1340	1000	2800	1200	3300	1670	3600	2320	185	3-phase	5500
W 5000/H	1340	1000	3600	1400	5000	1670	4400	2520	235	3-phase	8000
W 7500/H	1340	1000	5400	1400	7500	1670	6200	2520	370	3-phase	10000
W 1000/14	1400	800	1600	800	1000	1470	2400	1880	75	3-phase	3500
W 1500/14	1400	900	1900	900	1500	1570	2700	2010	110	3-phase	3800
W 2200/14	1400	1000	2200	1000	2200	1670	3000	2120	140	3-phase	4400
W 3300/14	1400	1000	2800	1200	3300	1670	3600	2320	185	3-phase	5500
W 5000/14	1400	1000	3600	1400	5000	1670	4400	2520	235	3-phase	8000
W 7500/14	1400	1000	5400	1400	7500	1670	6200	2520	370	3-phase	10000

[1] Notes on connection voltages please see page 39

Shuttle Kilns

Shuttle Kiln unit **W 1920/14S**
with customised dimensions, two lift doors, track operation

Envelope-Kiln

Envelope Kiln **W 1260/14S** in customised dimensions, two liftdoors, rail operation, travelling furnance, stationary tables, used for sensitive and complex charge structures

Cooling systems for shortening the process cycle

Automatically controlled vapour vent flaps

PC Monitoring and documentation of the firing process

SINTERING
Top-Hat Furnaces

H 1920/S
in customised dimensions with interchangeable table system

H 250

Top-Hat Furnaces H 125 - H 1000

Easy charging and optimum sealing characteristics of the furnace are crucial advantages of top-hat furnaces. Due to free access from three sides charging is simple to handle.

- Standard T_{max} 1280 °C, higher temperature ranges optionally
- Optimum temperature distribution due to 5-side heating from 4 sides and floor and to the good sealing characteristics of the top hat
- Specification with respect to insulation, heating, etc. like chamber furnaces N 100 and following (see page 12)
- Hood driven hydro-electrically
- Easy charging from three sides
- Working height of table 800 mm
- Customised versions, e.g. multi-table operation, cooling system etc.

Model	T_{max} °C	Inner dimensions in mm w	d	h	Volume in litres	Outer dimensions in mm W	D	H	Connected power/kW	Connected voltage[1]	Weight in kg
H 125	1280	800	400	400	125	1330	1280	1900	12	3-phase	1250
H 250	1280	1000	500	500	250	1530	1380	2100	18	3-phase	1400
H 500	1280	1200	600	600	500	1730	1480	2300	36	3-phase	1800
H 1000	1280	1600	800	800	1000	2130	1680	2700	48	3-phase	2800

[1] Notes on connection voltages please see page 39

H 730/F with mobile table for easy charging

Top-Hat Furnace H 730/F

To save time and energy these top-hat furnaces can also be equipped with mobile tables.
These tables are moved manually on rails or electrically on request.
The furnace design is tailored to the customer's need.

- Furnace size geared to process requirements
- Single table or interchangeable table system
- Table drive manually or automatically
- 5-side heating from 4 sides and the table
- 6-side heating for perfect temperature distribution optionally

Model	T_{max} °C	Inner dimensions in mm w	d	h	Volume in litres	Outer dimensions in mm W	D	H	Connected power/kW	Connected voltage[1]	Weight in kg
H 730/F	1280	900	900	900	729	1950	3460	3020	84	3-phase	2500

[1] Notes on connection voltages please see page 39

Top-Hat Furnaces

HC 1280
with mobile table

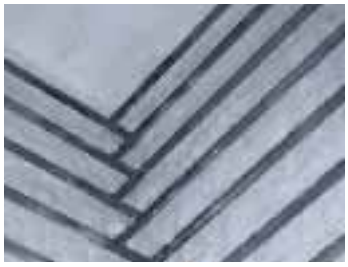
HC 1500

Top-Hat Furnaces HC 665 - HC 1500

For sintering at temperatures above 1350 °C we recommend a furnace heated with SiC rods. The design as a top-hat furnace enables heating from 4 sides and results in extremely good temperature distribution.

- Fast heating-up time and equal temperature distribution due to the hood being heated from 4 sides by SiC rods.
- High connected power rates for fast cycles
- Hood insulation made of fibre materials ensuring fast heating-up and cooling-down cycles with low energy consumption
- Table built of lightweight refractory bricks allowing heavy loads and a permanently level stacking surface
- Electro-hydraulic powered hood enabling the furnace hood to be opened and closed without any vibration
- Thyristor controlled heating system
- Temperature categories up to 1400 and 1500 °C

Manually or electrically operated table



4-side heating with SiC rods

Model	T_{max} °C	Inner dimensions in mm w	d	h	Volume in litres	Outer dimensions in mm W	D	H	Connected power/kW	Connected voltage[1]	Weight in kg
HC 665	1400	1100	550	1100	665	2350	2050	4000	186	3-phase	3000
HC 1275	1400	850	1000	1500	1275	2100	2500	4400	180	3-phase	4100
HC 1440	1400	840	2400	840	1440	2100	3900	3560	400	3-phase	4700
HC 1500	1400	1000	1000	1500	1500	2250	2500	4400	190	3-phase	5300
HC 1280	1450	800	1600	1000	1280	2050	3100	3900	151	3-phase	4200
HC 700	1500	800	800	1100	700	2050	2300	4000	100	3-phase	3100
HC 1400	1500	800	1600	1100	1400	2050	3100	4000	151	3-phase	4500

[1] Notes on connection voltages please see page 39

SINTERING
High-Temperature Chamber Furnaces

HT 16/17

HT 160/17
with cooling fan, automatic flap control and start-up circuit

Furnace roof with special suspension

Parallel motion swivel door for lasting protection of the collar insulation against destruction

Reinforced floor as protection for bottom insulation **HT 32/16**

Chamber Furnaces HT 04/16 - HT 450/17, HT 04/18 - HT 40/18

The high-temperature furnaces have proved their excellence for many years now in producing technical ceramics. Optimum temperature distribution, very solid design and useful details provide for the necessary competitiv edge with respective quality.

Standard Version:

- T_{max} 1600, 1750 or 1800 °C
- Furnace sizes from 4 to 450 l
- High-quality molybdenum disilicide ($MoSi_2$) heating elements
- Chain guided parallel moving swivel door for precise operation protecting the collar fibre insulation
- Door labyrinth sealing provides for optimum temperature distribution
- Door area amored with stainless steel to avoid burn damages
- Reinforced floor as protection for bottom insulation as standard from HT 32/16 upwards
- Temperature limiter for product and furnace protection
- Furnace chamber lined with top quality durable fibre materials
- Special roof construction, for high durability
- Wear-free thermocouple, PtRh-Pt, type B
- Vapour vent in the furnace roof

Extras

- Cooling fan

  For cycle time acceleration specific fans are installed. The fan speed is preselected per segment. The controller is automatically switching on and off. Hence, different speeds can applied e.g. for binder removal or cooling. Also, linear cooling can be used by setting the temperature gradient.

- Air preheating

  Air preheating can also be installed in our high-temperature furnaces (explanation see page 8). Hence,the furnace can also be used as a combi-furnace for debinding and sintering in one process without parts tranfer.

- Start-up circuit

  Due to a special circuit in the switchgear, the characteristics of heating up too fast up to 250 °C, typical for molybdenum disilicide heating elements, is eliminated. This extra is particularly recommended when firing ceramics which are sensitive in this temperature range.

- Automatic control of vapour vent flaps
- Customised furnace dimensions
- Stainless steel exhaust hoods
- Catalytic or thermal afterburning systems (see page 28)
- Charging devices
- Process documentation by temperature recorder or PC software

Model	T_{max} °C	Inner dimensions in mm w	d	h	Volume in litres	Outer dimensions in mm W	D	H	Connected power/kW	Connected voltage[1]	Weight in kg
HT 04/16	1600	150	150	150	4	610	470	1400	5	3-phase	150
HT 08/16	1600	150	300	150	8	610	610	1400	8	3-phase	200
HT 16/16	1600	200	300	260	16	710	650	1500	12	3-phase	270
HT 32/16	1600	200	600	260	32	710	930	1500	18	3-phase	350
HT 40/16	1600	300	350	350	40	810	710	1610	12	3-phase	380
HT 64/16	1600	400	400	400	64	1020	840	1700	18	3-phase	550
HT 128/16	1600	400	800	400	128	1020	1250	1700	26	3-phase	750
HT 160/16	1600	500	550	550	160	1140	1020	1900	21	3-phase	800
HT 276/16	1600	500	1000	550	276	1140	1470	1900	36	3-phase	1100
HT 450/16	1600	500	1150	780	450	1140	1620	1900	64	3-phase	1500
HT 04/17	1750	150	150	150	4	610	470	1400	5	3-phase	150
HT 08/17	1750	150	300	150	8	610	610	1400	8	3-phase	200
HT 16/17	1750	200	300	260	16	710	650	1500	12	3-phase	270
HT 32/17	1750	200	600	260	32	710	930	1500	18	3-phase	350
HT 40/17	1750	300	350	350	40	810	710	1610	12	3-phase	380
HT 64/17	1750	400	400	400	64	1020	840	1700	18	3-phase	550
HT 128/17	1750	400	800	400	128	1020	1250	1700	26	3-phase	750
HT 160/17	1750	500	550	550	160	1140	1020	1900	21	3-phase	800
HT 276/17	1750	500	1000	550	276	1140	1470	1900	36	3-phase	1100
HT 450/17	1750	500	1150	780	450	1140	1620	1900	64	3-phase	1500
HT 04/18	1800	150	150	150	4	610	470	1400	5	3-phase	150
HT 08/18	1800	150	300	150	8	610	610	1400	9	3-phase	200
HT 16/18	1800	200	300	260	16	710	650	1500	12	3-phase	270
HT 32/18	1800	200	600	260	32	710	930	1500	18	3-phase	350
HT 40/18	1800	300	350	350	40	810	710	1610	12	3-phase	380

[1] Notes on connection voltages please see page 39

HT 160/17 with special steel hood

Cooling fan

Automatic vapour vent flap

SINTERING
High-Temperature Top-Hat and Elevator Furnaces

High-temperature combi-plant unit **HT 1440/17 LTS** for debinding and sintering

- Integrated catalytic afterburner KNV 600
- Air preheating up to approx. 500 °C
- Furnace chamber: 1440 l
- T_{max} 1750 °C

High-Temperature Top-Hat and Elevator Furnaces

HT 400/17 LTS
with interchangeable table system

HT 64/17 LT with
stainless steel hood

Top-Hat Furnaces HT 64/17 LT - HT 1440/17 LTS

In order to meet the challenging requirements of productivity and temperature distribution, the high-temperature furnaces HT 64/17 LT - HT 1440/17 LT are used. The design of the furnaces is tailored to customer's needs.

For every problem we can offer a specific solution. Our product range comprises from top-hat furnaces with stationary table and interchangeable table systems up to fully automated debinding and sintering plants with afterburner system and integrated safety concepts for improving productivity and quality.

Standard Version

- Top-hat or elevator style
- T_{max} 1750 or 1800 °C
- Furnace sizes from 4 to 440 l
- High-quality molybdenum disilicide ($MoSi_2$) heating elements
- Electro-hydraulic hood drive for almost vibration-free movement
- Safe and tight hood closure due to labyrinth seal and additional sand cup
- Floor reinforcement with level stacking support to protect the fibre insulation and to carry heavy charges as standard from HT 16/16 upwards
- Temperature limiter for product and furnace protection
- Furnace chamber lined with high quality durable fibre material
- Special roof construction, with high durability
- Wear-free thermocouple, PtRh-Pt, type B

Combi-process system consisting of elevator-sintering furnace **HT 166/17 LBS**, debinding furnace **N 200/H** and integrated catalytic afterburner

SINTERING
High-Temperature Top-Hat and Elevator Furnaces

Extras **HT 64/17 LT or /LB - HT 1010/17 LT or /LB**

Electro-hydraulic hood drive as standard

- Interchangeable table system

  An interchangeable table system is particularly recommended for complex load structures which take a long time to charge. Depending on the customer's requirements a fully automated table exchange, e.g. at night or at weekend, can be programmed additionally.

- Cooling fan

  For cycle time acceleration specific fans are installed. The fan speed is preselected per segment.
  The controller is automatically switching on and off. Hence, different speeds can be applied e.g. for binder removal or cooling. Also, linear cooling can be used by setting the temperature gradient.

- Air preheating

  Air preheating can also be installed in our high-temperature furnaces (explanation see page 8). Hence, the furnace can also be used as a combi furnace for debinding and sintering in one process without unloading.

- Start-up circuit

  Due to a special circuit in the switchgear, the characteristics of heating up too fast up to 250 °C, typical for molybdenum disilicide heating elements, is eliminated. This extra is particularly recommended when firing ceramics which are sensitive in this temperature range.

Floor reinforcement for heavy loads as standard

- Customised furnace dimensions
- Stainless steel exhaust air hoods
- Catalytic or thermal afterburning systems (see page 28)
- Process documentation by temperature plotter or PC software

Cooling systems for shortening the cycle time

Technical Data of /LT (Lift-Top) and /LB (Lift-Bottom) furnaces are identical

Model	T_{max} °C	Inner dimensions in mm w	d	h	Volume in litres	Outer dimensions in mm* W	D	H	Connected power/kW	Connected voltage[1]	Weight in kg
HT 64/17L.	1750	400	400	400	64	950	1100	2350	18	3-phase	480
HT 166/17 L.	1750	550	550	550	166	1100	1250	2500	42	3-phase	1100
HT 276/17L.	1750	1000	500	550	276	2000	1400	2500	50	3-phase	1200
HT 400/17L.	1750	1200	600	550	400	2200	1500	2500	72	3-phase	1300

[1] Notes on connection voltages please see page 39

* All dimensions without transformer housing, hydraulic device and cover boxes

Model	T_{max} °C	Inner dimensions in mm w	d	h	Volume in litres	Outer dimensions in mm* W	D	H	Connected power/kW	Connected voltage[1]	Weight in kg
HT 1000/17	1750	1000	1000	1000	1000	1600	2100	2800	146	3-phase	1500
HT 1010/17LT	1750	2150	600	800	1032	3200	1300	3400	156	3-phase	2000

[1] Notes on connection voltages please see page 39

High-Temperature Top-Hat and Elevator Furnaces

Integrated production system consisting of 4 **HT 1010/17 LT** furnaces equipped with integrated catalytic afterburner systems for debinding and sintering spark plugs

Charging a top-hat furnace **HT 1010/17LT**

HT 1000/17 with 2 doors and 4-side heating for suspended sintering hanging ceramic tubes up to 1700 °C

Suspended with ceramic tubes

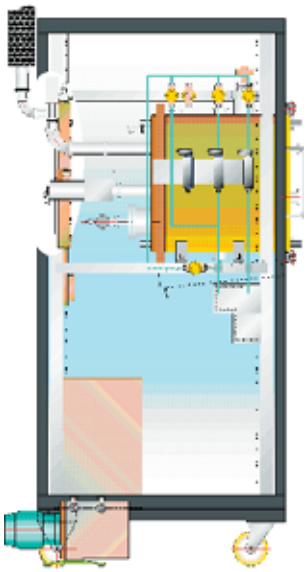
SINTERING
High-Temperature Furnaces for Vacuum and Defined Atmospheres

HTK 8

HTK 25

High-Temperature Furnaces HTK 8 - HTK 600
for vacuum and Protective Gas Operation

The HTK series is a modular system of high-temperature chamber furnaces for covering most applications in which vacuum or defined atmospheres are required. All models have a housing of double walled stainless steel with water cooling over the entire chamber. Due to the rectangular design and the compact size large quantities can be charged. The dimensions, the heating system, gas supply and vacuum area as well as accessories are tailored to the customer's specific requirements.



The following heat conducting materials are used:

- Graphite
- Molybdenum/tungsten
- $MoSi_2$
- CrFeAl

Standard Version

- Housing, heating module and controller are located in a housing (HTK 8 rolling cabinet frame)
- Gas supply, pump stand, measuring devices, PC, visualisation etc. are also integrated in the housing
- Temperature control up to 1800 °C via thermocouples (type K, S and B), above 1800 °C via radiation pyrometers
- Control through HiProSystems-Control with touch panel operation

Heating device	Insulation	T_{max}	Atmosphere*
Graphite Typ GR	Graphite fiber	3000 °C	Ar, N_2, CO Vacuum (10^{-4} mbar)
$MoSi_2$ Type KE	Ceramic fiber (Al_2O_3/SiO_2)	1800 °C 1400 °C 1250 °C	Air, N_2, Ar, He, O_2 Vacuum (0.1 mbar) H_2
Molybdenum/Tungsten Type M or W	Molybdenum/Tungsten radiating sheets	2500 °C	Ar, H_2, Hight vacuum (10^{-5} mbar)

* Other protective and reactive gases on request

Type Frontloader	Inner dimensions in mm w	 d	 h	Volume in litres	Outer dimensions in mm W	 D	 H	Connected power/kW	Connected voltage[1]	Weight in kg
HTK 8	150	200	150	5	700	900*	2000	25	1-phase	500
HTK 25	250	400	250	25	1500	1400	2050	60	3-phase	1500
HTK 80	400	500	400	80	1900	2100	2100	100	3-phase	2000
HTK 220	600	600	600	220	2250	2100	2400	160	3-phase	4000
HTK 400	800	800	600	400	2300	2500	2450	250	3-phase	5000
HTK 600	800	1200	600	600	2300	2500	2450	250	3-phase	5000

[1] Notes on connection voltages please see page 39

*Depending on the equipment plus separate switch board 700 x 900 x 2000 (WxDxH)

High-Temperature Furnaces for Vacuum and Defined Atmospheres

HTK 600

Cooling water supply

Extras

- Gas supply
  - Components for protective and reaction gases (e.g. N_2, Ar, H_2) as well as oxygen and air
  - Mass flow controller or rotameter
  - Automatically or manually activated valves
  - Safety equipment for operation with flammable gases in line with DIN EN 746-3

Graphite retort as option

- Vacuum pump stand
  - Complete pump stands
  - Rotary valve, membrane, turbo, oil diffusion, cryo pumps
  - Vacuum or rotary valves manually or electro-pneumatically operated
  - Dust filters, adsorption and cooling traps
  - Pressure measurement with piezo ceramic pressure sensors, Penning, Pirani etc. or pressure ranges from 1600 to 10^{-10} mbar
  - Pressure control

PLC fully automatic furnace control

- Measurement equipment
  - Pressure sensors (see above)
  - Humidity sensors
  - O_2 partial pressure probes (direct, also in vacuum)
- Graphite and molybdenum retorts
- Thermal or catalytic afterburners
- Oil tempering devices
- Cooling devices
- Gas leakage alarm devices
- Safety pressure tank for purging the vacuum chamber

DEBINDING AND SINTERING PLANTS WITH INTEGRATED AFTERBURNING SYSTEMS

Debinding and sintering plant with catalytic afterburning system

Catalytic and Thermal Afterburning Systems

For exhaust air cleaning, especially during debinding, Nabertherm offers afterburning systems tailored to the process. Catalytic systems for cracking organic compounds can be provided as well as thermal systems for higher exhaust volumes or anorganic waste gases.

PC Process visualisation

- Catalytic or thermal afterburning systems
- Customised size and design tailored to process conditions
- Catalytic afterburner including electrical heater for heating up the exhaust air to the reaction temperature
- A number of applications are already covered by standard solutions
- Sophisticated safety concepts for complex plants (e.g.protection against restarting if process is interrupted in critical segments, flooding the furnace chamber with nitrogen or air before restarting etc.)

Atmosphere Control

Certain processes have to be carried out in a defined atmosphere or require protective gases to support the process. We supply alternative proven solutions, from the gasing switchboard with pressure reducer and flow meter up to fully automated systems.

2-gas Switchboard

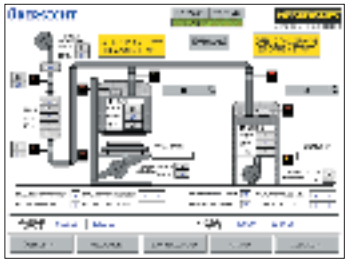
- Manual control or automated operation
- Operation with various protective gases
- Pressure reducers
- Solenoid inlet valves
- Process specific design

Plant Concepts

Bogie hearth furnace plant with integrated thermal afterburner

In addition to supplying a furnace, Nabertherm offers process and production technology solutions to improve your productivity and/or production capacity. Our experienced engineers can provide support for e.g.:

- Planning and designing furnace and exhaust systems
- Assembly and commissioning of the entire plant including construction of ductwork
- Accompanying emission measurements required by public institutions
- Material flow solutions for integrating upstream and downstream process steps
- Detailed visualisation of process monitoring and documentation to provide for quality relevant production data



Work flow diagram **HT 1440/17** with **KNV 600** (see page 22)

Roller conveyor in the furnace

Roller conveyors in the furnace and mobile charging device for heavy loads

DECORATING
Infrared Fast-Firing Kilns

IR 500/90

Infrared Fast-Firing Kilns IR 500/90 and IR 1000/90

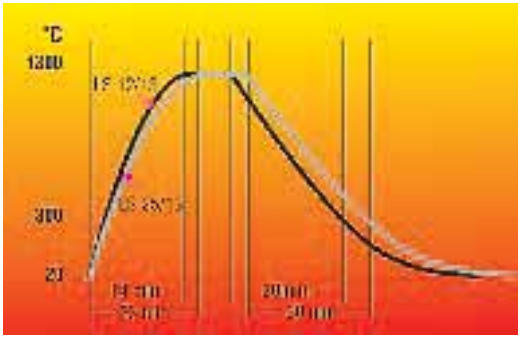
Fast-firing kilns with interchangeable table for glazing of glass and porcelain at max. temperatures of up to 900 °C. The infrared technology primarily heats the surface of the charged products. As a result, short heating-up and cooling-down cycles can be achieved. Hence, these kilns are very well suited for processing small batches. Additionally, the interchangeable table system improves productivity since one table can be charged already while the other is in the furnace.

- Heating with infrared heating elements in the ceiling and reflectors on the kiln floor
- Fibre insulation allows short cycles
- Depending on the application and temperature less than **3 hours cycle time** achievable (cold/cold)
- Interchangeable tables on sliding rollers very easy to operate manually
- Automatic ventilation vapour vent flap in the furnace roof
- Modern, functional design

Model	T_{max} °C	Inner dimensions in mm w	d	h	Volume in litres	Outer dimensions in mm W	D	H	Connected power/kW	Connected voltage[1]	Weight in kg
IR 500/90	900	1600	900	350	500	6000	1400	1300	36	3-phase	1100
IR 1000/90	900	3200	900	350	1000	12000	1400	1300	72	3-phase	2000

[1] Notes on connection voltages please see page 39

LABORATORY
Laboratory Fast-Firing Kilns



LS 12/13

Laboratory Fast-Firing Kilns LS 12/13 and LS 25/13

These models are ideal for simulating 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.

- Very compact design
- Charge support on ceramic support tubes
- Floor and roof heating
- 2-zone control, floor and roof controllable separately
- Integrated cooling fans, automatically programmable to shorten the cooling-down times
- Fan supported furnace 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 moving of the furnace

Model	T_{max} °C	Inner dimensions in mm w	d	h	Volumen in litres	Outer dimensions in mm W	D	H	Connected power/kW	Connected voltage[1]	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

[1] Notes on connection voltages please see page 39

LABORATORY
Chamber Furnaces with Brick and Fibre Insulation

LH 30/13

Parallel swivel door for opening while in operation

Laboratory Furnaces LH 15/12 - LH 120/14

These chamber furnaces are perfectly suited for simulating firing processes from production. The 5-side heating and the sturdy insulation with lightweight refractory bricks make these kilns a must for every laboratory.

Standard Version

- 5-side heating for an exceptionally good heat distribution uniformity
- Available for 1200, 1300 and 1400 °C
- Heating elements on support tubes provide for free heat radiation and a long service life
- Short heating-up times due to high connected power
- Vapour vent on side with bypass connection for exhaust pipe
- Self-supporting arch-shaped roof provides for high stability and optimum dust avoidance
- Door sealed brick-on-brick, professionally adjusted
- Quick-release door
- Infinitely variable air-inlet damper
- Multi-layer, fibre-free insulation made of lightweight refractory bricks and special rear insulation
- Stand included
- Floor heating elements protected by inlaid SiC plate providing level stacking support

LF 60/15 with fibre-insulation and with SiC heating rods

Extras

- Parallel swivel door, swivelling away from user, allows for opening during firing cycle
- Fibre insulation in place of brick insulation for shorter heating-up and cooling-down cycles
- 3-side heating with SiC rods instead of wire for faster heating-up times and max. temperatures of up to 1500 °C

Model	T_{max} °C	Inner dimensions in mm w	d	h	Volume in litres	Outer dimensions in mm W	D	H	Connected power/kW	Connected voltage[1]	Weight in kg
LH 15/12	1200	250	250	250	15	550	750	1170	5	3-phase*	150
LH 30/12	1200	320	320	320	30	620	820	1240	7	3-phase*	170
LH 60/12	1200	400	400	400	60	700	970	1320	8	3-phase	260
LH 120/12	1200	500	500	500	120	800	1070	1420	12	3-phase	340
LH 15/13	1300	250	250	250	15	550	750	1170	7	3-phase*	150
LH 30/13	1300	320	320	320	30	620	820	1240	8	3-phase*	170
LH 60/13	1300	400	400	400	60	700	970	1320	11	3-phase	260
LH 120/13	1300	500	500	500	120	800	1070	1420	15	3-phase	340
LH 15/14	1400	250	250	250	15	550	750	1170	8	3-phase*	150
LH 30/14	1400	320	320	320	30	620	820	1240	10	3-phase*	170
LH 60/14	1400	400	400	400	60	700	970	1320	12	3-phase	260
LH 120/14	1400	500	500	500	120	800	1070	1420	18	3-phase	340

[1] Notes on connection voltages please see page 39

*only 2 phases connected

High-Temperature Furnaces

HTC 08/16

LHT 04/17

High-Temperature Furnaces HTC 03/14 - LHT 08/18

These powerful laboratory bench-type furnaces are available for maximum temperatures from 1400 up to 1800 °C. The HTC series is suitable for temperatures up to 1600 °C. We recommend the LHT series for permanently high temperatures above 1550 °C up to 1800 °C.

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

- Double-wall housing with fan cooling for low external temperatures and high stability
- Kiln chamber with high quality fibre materials
- Vapour vent in the rear
- High quality fibre materials
- SiC rod-heating
- Easy handling of the heating element
- Flap-down door usable for charging

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

- Molybdenum disilicide heating elements used as heat source
- Parallel swivel door
- Vapour vent with ceramic tube in furnace roof

Parallel swivel door for opening during firing cycle

Model	T_{max} °C	Inner dimensions in mm w	d	h	Volume in litres	Outer dimensions in mm W	D	H	Connected power/kW	Connected voltage[1]	Weight in kg
HTC 03/14	1400	120	210	120	3	400	450	500	4.5	3-phase	40
HTC 08/14	1400	170	280	170	8	450	520	550	7.0	3-phase	50
HTC 03/15	1500	120	210	120	3	400	450	500	4.5	3-phase	40
HTC 08/15	1500	170	280	170	8	450	520	550	7.0	3-phase	50
HTC 03/16	1600	120	210	120	3	400	450	500	4.5	3-phase	40
HTC 08/16	1600	170	280	170	8	450	520	550	7.0	3-phase	50

[1] Notes on connection voltages please see page 39

Model	T_{max} °C	Inner dimensions in mm w	d	h	Volume in litres	Outer dimensions in mm W	D	H	Connected power/kW	Connected voltage[1]	Weight in kg	Heating-up-time to T_{max}*
LHT 02/16	1600	90	150	150	2	655	370	575	3.0	1-phase	75	30
LHT 04/16	1600	150	150	150	4	655	370	575	5.2	3-phase	85	25
LHT 08/16	1600	150	300	150	8	655	520	575	8.0	3-phase	100	25
LHT 02/17	1750	90	150	150	2	655	370	575	3.0	1-phase	75	60
LHT 04/17	1750	150	150	150	4	655	370	575	5.2	3-phase	85	40
LHT 08/17	1750	150	300	150	8	655	520	575	8.0	3-phase	100	40
LHT 02/18	1800	90	150	150	2	655	370	575	3.6	1-phase	75	75
LHT 04/18	1800	150	150	150	4	655	370	575	5.2	3-phase	85	60
LHT 08/18	1800	150	300	150	8	655	520	575	9.0	3-phase	100	60

[1] Notes on connection voltages please see page 39

*empty furnace

LABORATORY
Gradient Kilns

GR 1300

Kiln chamber of the **GR 1300/13** with six adjacent chambers

6-Zone Gradient Kiln GR 1300/13

The kiln chamber is divided into six equal control sections over its heated length of 1300 mm. Each of these zones is individually controlled. For temperatures up to 1300 °C a gradient of up to 400 °C can be achieved.

- Heated length: 1300 mm
- T_{max} 1300 °C
- Heating elements on support tubes providing for free heat radiation into the kiln chamber
- Charging from the top or front door
- Gas damper suspension of the lid
- Separate control of the 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
- 6-zone control
- Fibre blocks to separate the individual chambers as extra

Model	T_{max} °C	Inner dimensions in mm w	d	h	Outer dimensions in mm W	D	H	Connected power/kW	Connected voltage[1]	Weight in kg
GR1300/13	1300	1300	100	60	1660	740	1345	18	3-phase	300

[1] Notes on connection voltages please see page 39

ZZ 100-810/13

10-Zone Tube Kiln ZZ-F up to 1300 °C

The 10-zone tube kilns can be universally used. There is a high degree of flexibility designing the temperature profile. Homogenous temperature fields, temperature gradients, maximum temperatures etc. can be set. The ZZ can be operated as 1, 2, 3, up to 10-zone kiln. High quality fibre insulation with low thermal mass provides for excellent heat insulation, fast heating-up and cooling-down and low energy consumption.

- Heavy CrFeAl heating wire
- Face side insulation with optimised performance for setting long zones with homogenous temperature
- PtRh-Pt (type S) thermocouples

Model	T_{max} °C	Outer dimensions in mm W	D	H	Tube-Ø mm	Heated length/mm	Connected power/kW	Connected voltage[1]	Weight in kg
ZZ 40-360	1300	320	500	390	40	360	10 x 0.18	3-phase	30
ZZ 70-450	1300	320	650	390	70	450	10 x 0.36	3-phase	35
ZZ 100-810	1300	320	1020	390	100	810	10 x 0.90	3-phase	80
ZZ 150-1000	1300	520	1250	590	150	1000	10 x 1.40	3-phase	100
ZZ 200-1170	1300	580	1450	640	200	1170	10 x 1.44	3-phase	130

[1] Notes on connection voltages please see page 39

High-Temperature Furnaces for Vacuum and Defined Atmospheres

LHTG 100-200/20

LHTW 60-80

Graphite heating chamber

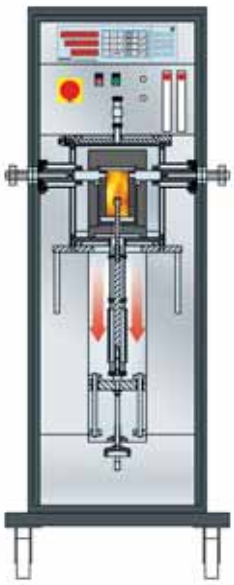
Molybdenum/Tungsten heating chamber

Laboratory Retort Furnaces LHTG for Operation under Vacuum and in Defined Atmospheres

The LHTG series is optimally suited for laboratory trials in defined atmosphere and under vacuum as a cost efficient solution. Due to their compact exterior dimensions and diverse application profile up to 2000 °C (W) or 3000 °C (/G) these furnaces are true all-rounders for ceramic processes.

Standard Version

- Graphite (LHTG) or tungsten insulation and heating elements
- Vacuum container with lid lock
- Lid and housing water-cooled
- Thermocouple, type C up to 2000 °C or pyrometer up to 3000 °C
- Gas supply for one gas (Ar) including rotameter and valves
- Vacuum pump for evacuation including pressure supply, pumping speed 4 m³/h, final pressure 0.1 mbar



Model	T_{max} °C	Effective space in mm Ø	Effective space in mm h	Volume[2] in litres	Outer dimensions in mm W	Outer dimensions in mm D	Outer dimensions in mm H	Weight in kg	Connected power/kW	Connected voltage[1]
LHTW 60-80	2000	60	80	0.22	800	1500	1800	500	12	3-phase*
LHTG 60-80	3000	60	80	0.22	800	1500	1800	500	20	3-phase*
LHTG 100-200	3000	100	200	1.57	850	1500	1800	650	40	3-phase*

[1] Notes on connection voltages please see page 39 [2] Further effective volumes available upon request *only 2 phases connected

LABORATORY
Tube Furnaces

Tube Furnace **HTRV 150-500/17**

Tube Furnace with Vakuum Flanges

Tube Furnaces HTRH and HTRV

Turn-key high-temperature tube furnaces in vertical (type HTRV) as well as horizontal (type HTRH) design can be supplied for temperatures up to 1800 °C. High quality insulation materials from vacuum shaped fibre boards provide for energy saving usage and high heating rates due to low stored heat and heat conductivity.

Standard Version

- Rectangular exterior housing with perforated sheet metal for convection cooling
- Vacuum shaped ceramic fibre boards as insulation
- $MoSi_2$ heating elements, hanging from ceiling, easy to exchange
- Control thermocouple type B
- Power unit with low voltage transformer and thyristors
- Temperature limiter

Model	T_{max} °C	Outer dimensions in mm W	D	H	Tube-Ø mm	Heated length/mm	Connected power/kW	Weight in kg
HTRH 40-100		420	390	510	47	100	2.2	45
HTRH 40-250		420	540	510	47	250	3.6	60
HTRH 40-500		420	790	510	47	500	8.0	90
HTRH 70-150		520	450	620	77	150	4.5	65
HTRH 70-300	1600	520	590	620	77	300	6.4	90
HTRH 70-600	or	520	890	620	77	600	8.0	120
HTRH 100-150	1700	520	450	620	110	150	4.8	65
HTRH 100-300	or	520	590	620	110	300	7.5	90
HTRH 100-600	1800	520	890	620	110	600	10.9	120
HTRH 150-300		570	590	670	150	300	8.0	140
HTRH 150-600		570	890	670	150	600	12.0	180
HTRH 200-300		620	590	720	200	300	10.0	140
HTRH 200-600		620	890	720	200	600	12.0	180

Model	T_{max} °C	Outer dimensions in mm W	D	H	Tube-Ø mm	Heated length/mm	Connected power/kW	Weight in kg
HTRV 40-100		425	425	365	40	100	2.0	30
HTRV 40-250		425	425	515	40	250	3.0	40
HTRV 40-500		425	425	765	40	500	6.0	65
HTRV 70-100	1600	425	425	365	70	100	3.0	30
HTRV 70-250	or	425	425	515	70	250	4.8	40
HTRV 70-500	1700	425	425	765	70	500	8.0	65
HTRV 100-250	or	455	455	515	100	250	6.4	45
HTRV 100-500	1800	455	455	765	100	500	10.4	70
HTRV 150-250		510	510	515	150	250	8.0	55
HTRV 150-500		510	510	765	150	500	12.0	80
HTRV 200-250		560	560	515	200	250	10.0	70
HTRV 200-500		560	560	765	200	500	18.5	95

Tube Furnaces

HTRH VS 150-600/17
with tube closed on one end and vacuum flange

Fibre plug with protective gas connection

Extras **HTRH** and **HTRV**

The tube furnaces can alternatively be equipped to suit the customer's application needs:

- Gas-tight high purity Al_2O_3 and Al_2O_3/SiO_2 working tube materials
- Water-cooled stainless steel flanges and gas supply facilities allow for process control under defined atmospheres
- Gas flow manually through a rotameter or automatically through a mass flow controller
- Complete vacuum pump stands available as an extension (rotary valve, turbo pumps)
- Radiation shield packages to minimise the gradient in the working tube
- Data recording and visualisation systems

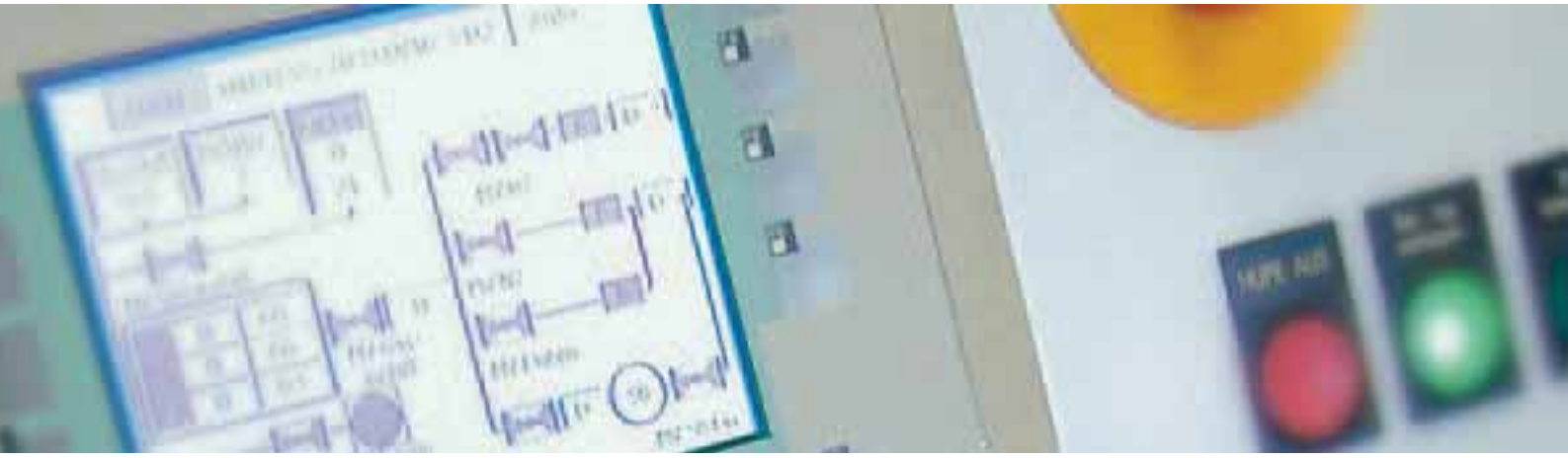
Vacuum/gas-tight flange VFW

Working pipe materials	
Al_2O_3 (99.7 %)	up to 1800 °C
SiC	up to 1700 °C
Mullit	up to 1600 °C
CrFeAlx	up to 1600 °C
Quartz glass	up to 1100 °C

T_{max} (vacuum)	1450 °C
T_{max} (protective gas)	1800 °C
Pipe diameter (external)	40-200 mm
Pipe length	up to 2000 mm
Gases	Ar, N_2, H_2, O_2, Air, CO etc.
Flow quantities (standard)	0-2000 l/h
Pressure range	1000 up to 10^{-5} mbar

Radiation shield package for reducing the temperature gradient in the working tube

PROCESS CONTROL AND DOCUMENTATION



C 270 as basic controller for furnaces

Based on more than 50 years of experience in design and construction of tailor-made switchgear and control systems taking care of handling, documentation and complex requirements, Nabertherm can also provide an individual solution tailored to your needs. Our standard solutions take care of most problems already at a fair price. Of course, we can accommodate your specific requirements.

C 42 with two programmable extra functions

Standard Controllers

Many customer requirements are already covered by our wide range of standard controllers. Adapted to the specific furnace model the controller reliably monitors your firing cycle. The standard controllers are developed and produced within the Nabertherm Group. When designing the controllers easy handling has top-priority. Technically, the units are tailored to the respective furnace models. From a simple controller with adjustable temperature up to a control unit with freely programmable parameters, storable programs and interface to a computer - we can meet your requirements.

P 320 as control unit for laboratory muffle furnaces

HiProSystems-Control

This professional control system for single and multi-zone furnaces is based on Siemens hardware and can be upgrated extensively. This sophisticated control system is used for example when

- more than two functions such as vapour vent flaps, cooling fans, automatic movements etc. are required and/or
- furnaces with more than one zone have to be controlled and/or
- special documentation is required and/or
- maintenance/service work e.g. telediagnostic service is necessary.

The HiProSystems-Control is also perfectly suited for controlling several furnaces or furnace groups. This central control unit is reducing the average investment per furnace accordingly.

Switchgear with HiProSystems-Control

Operator Interfaces and Documentation

Touchpanel H 1700

Firing cycle data and the extra functions activated are clearly displayed in a chart.

Touchpanel H 3700

All functions and process data are stored and displayed in clear-cut charts. The data can be read out through various interfaces (RS 232, RS 422/485, USB, Ethernet TCI/IP, MPI, Profibus) via PC or other programs used by the customer and can be further processed. There is the opportunity to store plan and actual values on a CF card to be read via an appropriate card reader.

H 3700

Control-Center NCC (PC-based)

The upgrate of the HiProSytems-Control into the NCC provides for additional interfaces, operating and service benefits such as:

- charge data can be read in via barcodes
- interface for connection to existing PPS systems
- internet connection for external operation and monitoring
- connection to mobile phone network for alarm via SMS, e.g. in case of break-down
- operation from various PC locations
- documentation according to DIN ISO 9000 ff.
- maximum operator convenience, mouse operation, large screen

Control-Center **NCC** user interface with display on PC

Documentation Alternatives:

- record of temperature/time profile according to DIN ISO 9000 ff. with a temperature recorder or with a data acquisition system
- record of temperature/time profile via a PC with the Nabertherm Software Controltherm MV.

Monitoring and Control of Furnace Groups

Management of the temperature/time profiles of up to 16 furnaces and remote control of the connected furnaces with the Controltherm MV software.

Data recording station with data diskette storage and graphic process display

Connected Voltages for Nabertherm Furnaces

1-phase: All furnaces can be supplied for 110 V - 240 V, 50 or 60 Hz.

3-phase: All furnaces can be supplied for 200 V - 240 V and/or 380 V - 480 V, 50 or 60 Hz.

Nabertherm
MORE THAN HEAT 30-3000 °C

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