Nabertherm

MORE THAN HEAT 30-3000 °C

Heat Treatment of Metals






Furnaces, Systems and Accessories for Industrial Applications

www.nabertherm.com

More than heat . . .

Made in Germany

Nabertherm with its over 300 employees world-wide has been developing and producing industrial furnaces and heat treatment systems for many different applications for over 50 years. 150000 customers in 100 countries are proof of the success of our company. Short delivery times are ensured thanks to our diverse range of products and wide variety of standard furnaces. Longstanding sales partners or our own sales companies in all important countries guarantee individual customer care and advice on site.

Setting standards in quality and reliability

Technical details such as our concept of freely radiating heating elements on ceramic support tubes which not only ensure high temperature accuracy and energy efficiency but also a long service life as a result, provide the crucial competitive edge. The product range stretches from standard furnace to state-of-the-art, flexible heat treatment systems for fully and semi-automatic operation. Complete heat technology production processes are realised through customised system solutions. The innovative Nabertherm control and automation technology enables complete control as well as monitoring and documentation of heat treatment processes.

Customer service and spare parts

Our experts in the customer service team are available for every question. We can solve most problems over the telephone. For larger systems we recommend our teleservice via modem. Of course our service technicians will also visit you on site. We are particularly proud of our world-wide spare parts service. We will reach you in no time anywhere in the world. Our R&D department carries out heat treatments for you in our research centre.

Experience in many fields of application

In addition to metal heat treatments Nabertherm offers a wide range of standard furnaces and systems for many different fields of application. The modular design of our products allows a solution to your problem in many areas without expensive modifications.

Nabertherm
MORE THAN HEAT 30-3000 °C

Contents

- Tempering
- Carburizing in powder
- Ageing
- Austenitising
- Boronising in powder
- Heating
- Annealing
- Hardening
- Homogenising
- Solution annealing
- Brazing under protective gas and in vacuum
- Nitriding in salt or powder
- Normalising
- Recrystallisation
- Preheating
- Protective gas and vacuum annealing
- Sintering under protective gas and in vacuum
- Tempering
- Drying
- Quenching and Tempering
- Preheating

NORMAL ATMOSPHERE without convection
Chamber furnaces

Universal bench-top chamber furnaces for annealing, hardening, preheating, etc. under normal atmosphere

- heating from two sides (top and bottom) with heating plates, up to 1100 °C
- heating from three sides (both sides and bottom) by freely radiating heating elements, up to 1280 °C
- improved furnace performance in type/R models for faster heat-up
- floor heating protected by conductive SiC plates
- parallel swivel door (protection from radiated heat)
- multi-layer insulation
- exhaust air vent
- even temperature distribution according to DIN 17052-1 to ±10 °C
- low energy consumption due to short heating times
- controller mounted on the side of the furnace, in larger models in a separate cabinet
- Controller C5, controllers for more demanding applications see page 38

N 11/H

Options:

- furnace ventilation and aeration, cooling fan, protective gas port, sealed housing, exhaust vent
- protective covering for side heating elements
- visual and audible signals
- charging aids, charging plates

Example: hardened tool

Model	T_{max} °C	Inner dimensions in mm w	d	h	Volume in l	Outer dimensions in mm W	D	H	Connected power/kW	Connection voltage[1]	Weight in kg
N 7	1100	230	250	120	7	450	500	465	3,0	1-phase	65
N 11	1100	230	350	140	11	450	600	505	3,6	1-phase	75
N 11/R	1100	230	350	140	11	450	600	505	5,5	3-phase*	75
N 17	1100	230	500	140	17	450	750	505	5,5	3-phase*	95
N 17/R	1100	250	500	140	17	450	750	505	7,0	3-phase*	95
N 7/H	1280	250	250	120	7	520	510	525	3,0	1-phase	75
N 11/H	1280	250	350	140	11	520	610	565	3,6	1-phase	90
N 11/HR	1280	250	350	140	11	520	610	565	5,5	3-phase*	90
N 17/H	1280	250	500	140	17	520	760	565	5,5	3-phase*	95
N 17/HR	1280	250	500	140	17	520	760	565	7,0	3-phase*	95

[1] Notes on connection voltages please see page 39

*only 2 phases connected

Complete heat treatment by Nabertherm

NORMAL ATMOSPHERE without convection
Chamber furnaces

Examples of special applications

Annealing furnace for charging with manipulator

Annealing furnace with charging apparatus

Annealing furnace with electro-hydraulic
lifting door and moveable stand

NORMAL ATMOSPHERE without convection
Chamber furnaces

N 41

Universal chamber furnaces on stand for annealing, hardening, preheating, etc.
under normal atmosphere

- heating from three sides (both sides and bottom) by means of freely radiating heating elements, up to 1200, 1280 (type /H) and 1300 °C (type /13)
- floor heating protected by heat-conducting SiC plates
- parallel swivel door moving downwards in models N 21, N 41 and N 61
- parallel swivel door moving upwards in models from N 81
- electro-hydraulic lifting door from N 761
- multi-layer insulation
- exhaust air vent
- even temperature distribution according to DIN 17052-1 to ±10 °C
- low energy consumption due to short heating times
- controller mounted on the side of the furnace, in larger models in a separate cabinet
- Controller C5, controllers for more demanding applications see page 38

Options:

- additional furnace ventilation and aeration, cooling fan, protective gas inlet, sealed housing, ventilation flue
- protective covering for side heating elements
- pneumatic or electro-hydraulic door opening
- stand frame on wheels
- visual and audible signals
- charging aids, charging plates
- special dimensions up to 15,000 litres and for loads up to 15 tonnes

Chamber furnace for preheating steel plates

Model	T_{max} °C	Inner dimensions in mm w	d	h	Volume in l	Outer dimensions in mm W	D	H	Connected power/kW	Connection voltage[1]	Weight in kg
N 21	1200	250	350	250	20	760	1170	1340	10	3-phase	210
N 41	1200	350	500	250	40	860	1370	1350	13	3-phase	300
N 61	1200	350	750	250	60	860	1620	1350	16	3-phase	500
N 81	1200	500	750	250	80	1140	1900	1790	20	3-phase	820
N 161	1200	550	750	400	160	1180	1930	1980	30	3-phase	910
N 321	1200	750	1100	400	320	1400	2270	2040	47	3-phase	1300
N 641	1200	1000	1300	500	640	1690	2670	2240	70	3-phase	2100
N 761	1200	800	1900	500	760	1550	2540	2650	75	3-phase	2400
N 1491	1200	1660	1200	750	1490	2430	1840	3150	110	3-phase	5400
N 21/H	1280	250	350	250	20	760	1170	1340	13	3-phase	210
N 41/H	1280	350	500	250	40	860	1370	1350	16	3-phase	300
N 61/H	1280	350	750	250	60	860	1620	1350	20	3-phase	500
N 21/13	1300	250	350	250	20	840	1220	1410	13	3-phase	240
N 41/13	1300	350	500	250	40	940	1420	1420	16	3-phase	350
N 61/13	1300	350	750	250	60	900	1670	1420	20	3-phase	550
N 81/13	1300	500	750	250	80	1220	1960	1840	22	3-phase	900
N 161/13	1300	550	750	400	160	1260	1990	2030	35	3-phase	1000
N 321/13	1300	750	1100	400	320	1480	2330	2090	60	3-phase	1500
N 641/13	1300	1000	1300	500	640	1770	2730	2290	80	3-phase	2500

[1] Notes on connection voltages please see page 39

Semi-automatic chamber furnace with guided charging device

NORMAL ATMOSPHERE without convection
Bogie hearth furnaces

Examples of special applications

13 m³ bogie hearth furnace for annealing large parts of up to 12 tonnes

Bogie hearth furnace with two electro-hydraulically lifting doors

NORMAL ATMOSPHERE without convection
Bogie hearth furnaces

Bogie hearth furnaces for all types of heat treatment

- temperatures up to 900 °C (type /G) and 1280 °C
- double-walled casing design with rear ventilation, therefore low outer wall temperatures
- heating from five sides (2 sides, door, rear wall, bogie)
- bogie heating protected by SiC plates
- even temperature distribution according to DIN 17052-1 to ±10 °C
- bogie with rubber tyres
- Controller 40, controllers for more demanding applications see page 38

Options:

- supporting grid made from heat-resistant cast steel for optimum charging conditions
- electro-hydraulic lifting door(s)
- electrically powered bogie
- fan cooling for fast purging and cooling
- control of exhaust air flaps for quick cooling
- furnace heat shield to minimise the radiation losses when the bogie is removed
- multiple zone control for optimum temperature distribution according to DIN 17052-1 to ± 5 °C
- alternative connected power supplies
- rails and flanged wheels for optimum charging
- fully automatic process control and documentation
- special sizes up to 20,000 litres and charge weights up to 20 tonnes
- temperatures up to 1340 and 1400 °C available

W 1500/H with bogie on rails and door stop on left

System with several furnaces with cross transfer car and centralised control

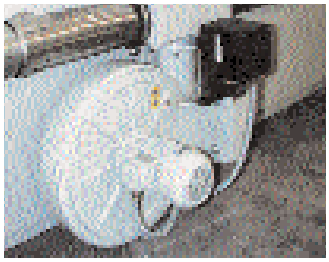
Model	T_{max} °C	Inner dimensions in mm w	d	h	Volume in l	Outer dimensions in mm W	D	H	Connected power/kW	Connection voltage[1]	Weight in kg
W 1000/G	900	800	1600	800	1000	1400	2350	1880	40	3-phase	3000
W 1500/G	900	900	1900	900	1500	1500	2650	2010	57	3-phase	3500
W 2200/G	900	1000	2200	1000	2200	1600	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
W10000/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

[1] Notes on connection voltages please see page 39

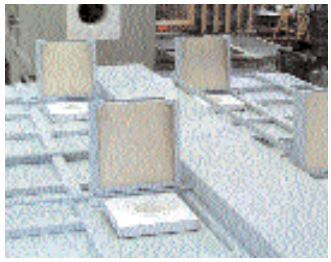
Accessoires for bogie hearth furnaces, optional

Cross-transfer system

PC control



Fan cooling



Automatic control of exhaust air flaps

NORMAL ATMOSPHERE without convection
Top-hat furnaces

H 250

Top-hat furnaces with powered hood

Semi-automatic top-hat furnaces for heat treatment under normal atmosphere

- max. temperature 1280 °C
- heating from five sides (hood from 4 sides, hearth)
- even temperature distribution according to DIN 17052-1 to ±10 °C
- hood driven hydro-electrically
- hearth heating elements protected by SiC plates
- easy charging from three sides
- Controller C 30 or C 40, controllers for more demanding applications see page 38

Options:

- fan cooling for fast purging and/or cooling
- control of exhaust air flaps for quick cooling
- multiple zone control for optimum temperature distribution according to DIN 17052-1 to ± 5 °C
- fully automatic process control and documentation
- exchangeable tables on rails for productive heat treatment
- special sizes up to 10,000 litres and charge weights up to 7 tonnes

Model	T_{max} °C	Inner dimensions in mm w	d	h	Volume in l	Outer dimensions in mm W	D	H	Connected power/kW	Connection voltage[1]	Weight in kg
H 125	1280	800	400	400	125	1330	1100	1900	12	3-phase	1250
H 250	1280	1000	500	500	250	1530	1200	2100	18	3-phase	1400
H 500	1280	1200	600	600	500	1730	1300	2200	36	3-phase	1800
H 1000	1280	1600	800	800	1000	2130	1500	2700	48	3-phase	2800

[1] Notes on connection voltages please see page 39

HG 3000

Top-hat furnaces for use with a crane

Top-hat furnaces for heat treatment under normal atmosphere with cover lift by crane, also suitable for annealing wire coils and bars

- max. temperature 900 °C
- cover movement via crane
- no base necessary
- table and hood heated (roof), both heating systems are controlled separately
- even temperature distribution according to DIN 17052-1 to ± 10 °C
- hearth heating elements protected by SiC plates
- easy charging from four sides
- three-zone control
- Controller 40, controllers for more demanding applications see page 38

Options:

- fan cooling for fast purging and cooling
- control of exhaust air flaps for quick cooling
- special sizes up to 15,000 litres and charge weights up to 15 tonnes

Model	T_{max} °C	Inner dimensions in mm w	d	h	Volume in l	Outer dimensions in mm W	D	H	Connected power/kW	Connection voltage[1]	Weight in kg
HG 750	900	2100	1200	300	756	2550	1800	1350	35	3-phase	1200
HG 1000	900	1750	1000	550	960	2200	1450	1600	33	3-phase	1500
HG 1500	900	2100	1250	550	1440	2550	1700	1600	44	3-phase	2000
HG 2200	900	2450	1500	550	2020	2900	1950	1600	55	3-phase	2500
HG 3000	900	3000	2200	400	2640	3500	2700	1450	75	3-phase	3400

[1] Notes on connection voltages please see page 39

NORMAL ATMOSPHERE with convection
Chamber furnaces

Convection chamber furnaces for all types of heat treatment with high temperature accuracy

- temperatures up to 450, 650 or 850 °C
- N 15/65HA as table model made from special steel, other models free-standing including stand
- optimum temperature distribution according to DIN 17052-1 to ± 2 °C
- horizontal air circulation
- high rate of circulation, therefore optimum temperature distribution
- charging on several levels with shelves
- air baffles for optimum air flow
- Controller C5, controllers for more demanding applications see page 38

N 15/65HA

Options:

- for repeated treatments: system of ventilation flaps with fan
- automatic door opening for quick cooling
- pneumatic lifting door
- vertical air circulation
- fan cooling for faster purging and cooling down
- controlled exhaust air flaps for quick cooling
- roller conveyor and cooling station
- alternative power supplies
- control of the air circulation velocity
- charging aids
- special sizes up to 10,000 litres and charge weights up to 10 tonnes

N 60/65HA

Model	T_{max} °C	Inner dimensions in mm w	d	h	Volume in l	Outer dimensions in mm W	D	H	Connected power/kW	Connection voltage[1]	Weight in kg
N 30/45HA	450	290	420	250	30	870	1170	1315	3.0	1-phase	195
N 60/45HA	450	350	500	400	60	930	1190	1400	3,6	1-phase	240
N 120/45HA	450	450	600	500	120	1030	1290	1500	7,0	3-phase*	310
N 250/45HA	450	600	750	670	250	1190	1505	1860	13	3-phase	610
N 500/45HA	450	750	1000	820	500	1340	1755	2010	19	3-phase	1030
N 15/65HA	650	300	350	150	15	500	880	440	2,7	1-phase	50
N 30/65HA	650	290	420	250	30	870	1170	1315	3,6	1-phase	195
N 60/65HA	650	350	500	400	60	930	1190	1400	6,6	1-phase	240
N 120/65HA	650	450	600	500	120	1030	1290	1500	9,6	3-phase	310
N 250/65HA	650	600	750	670	250	1190	1505	1860	19,0	3-phase	610
N 500/65HA	650	750	1000	820	500	1340	1755	2010	28,0	3-phase	1030
N 30/85HA	850	290	420	250	30	870	1170	1315	6,0	3-phase	195
N 60/85HA	850	350	500	400	60	930	1190	1400	9,6	3-phase	240
N 120/85HA	850	450	600	500	120	1030	1290	1500	13,6	3-phase	310
N 250/85HA	850	600	750	670	250	1190	1505	1860	21,0	3-phase	610
N 500/85HA	850	750	1000	820	500	1340	1755	2010	31,0	3-phase	1030

[1] Notes on connection voltages please see page 39

*only 2 phases connected

Air circulation furnace for preheating deep-drawing tools

Convection chamber furnace with horizontal air circulation

NORMAL ATMOSPHERE with convection
Low-temperature furnaces, electrically or gas heated

N 2000/25HA

Convection chamber furnaces under normal atmosphere for drying and preheating, artificial ageing of aluminium, tempering steel, core drying and preheating casting dies in foundries, curing resins and adhesives as well as drying lacquer (EN 1539). Use of baskets and pallets as well as mobile furnace racks, charging with stackers, charging or lift trucks is possible.

- temperatures up to 250 °C or 450 °C
- chamber furnaces with horizontal (type/HA) or vertical air circulation (type/A) available
- electrical heating by means of tubular heating elements in ducts
- ground-level charging without floor insulation
- optimum temperature distribution according to DIN 17052-1 to ± 5 °C
- high atmosphere change (variable)
- furnace sizes suitable for common charging systems
- Controller C5, controllers for more demanding applications see page 38

N 1500/25HA

Options:

- ground level with floor insulation with or without channels
- exhaust gas fan and safety equipment for evaporating solvents (design according to EN 1539)
- special sizes up to 20,000 litres and charge weights up to 20 tonnes
- indirect gas heating with radiant tubes

Model*	T_{max} °C	Inner dimensions in mm w	d	h	Volume in l	Outer dimensions in mm W	D	H	Connected power/kW	Connection voltage[1]
N 560 /25..	250	750	1000	750	500	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	500	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

* available with horizontal or vertical air circulation

Example:
horizontal = type./HA, e.g. N 2000/25HA
vertical = type./A, e.g. N 1500/25A

NORMAL ATMOSPHERE with convection
Low-temperature furnaces, electrically or gas heated

S 14500

Convection chest furnaces for heat treatment under normal atmosphere for the same applications as convection chamber furnaces, page 12

- temperatures up to 250 or 450 °C
- chest furnaces with horizontal air circulation
- electrical heating by means of tubular heating elements in ducts
- charging by crane
- optimum temperature distribution according to DIN 17052-1 to ± 5 °C
- high atmosphere change (variable)
- Controller C5, controllers for more demanding applications see page 38

Options:

- indirect gas heating with radiant tubes
- exhaust gas fan and safety equipment for evaporating solvents (design according to EN 1539)
- special sizes up to 20,000 litres and charge weights up to 20 tonnes

Electro-hydraulic powered furnace lid

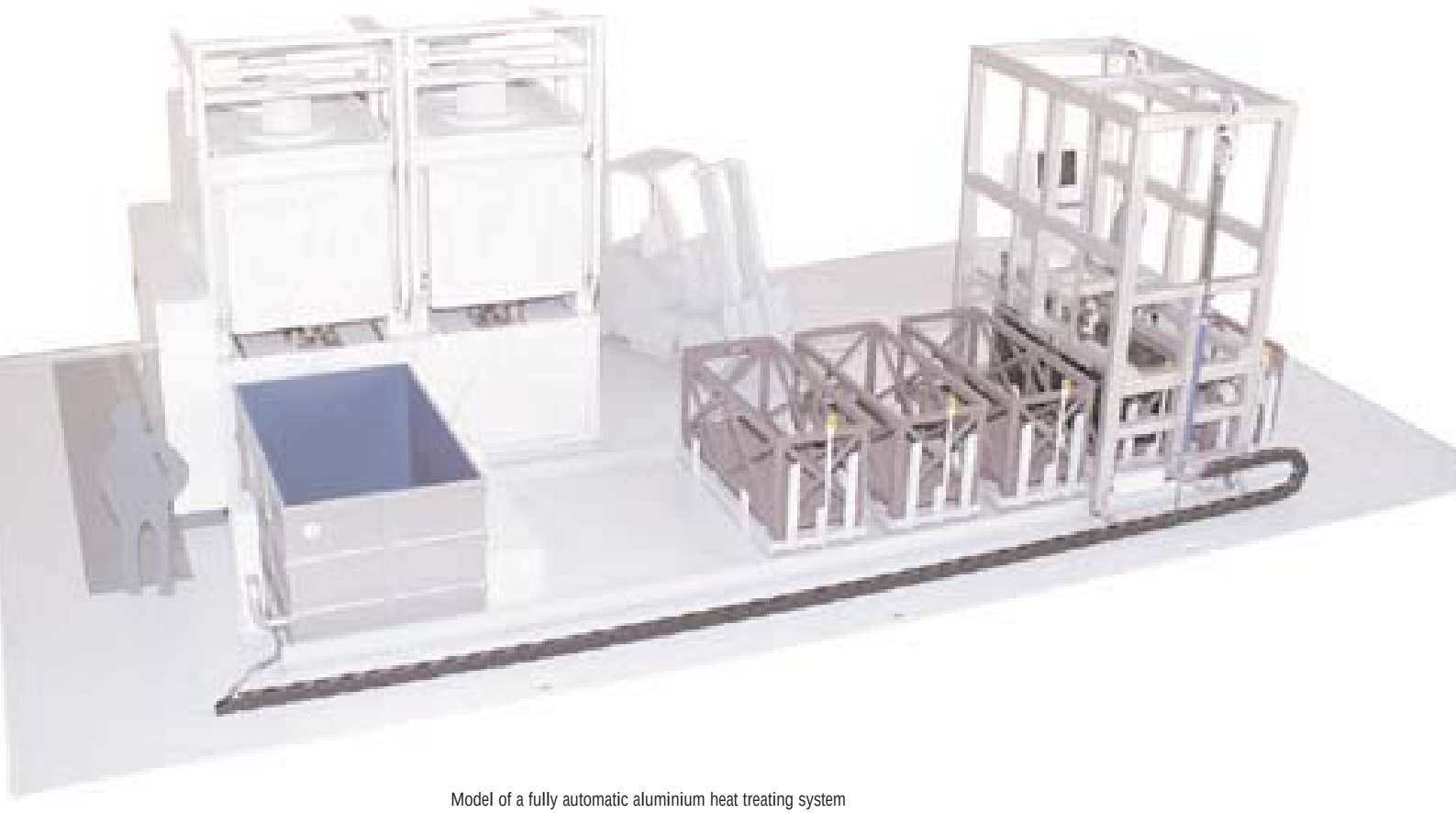
Model*	T_{max} °C	Inner dimensions in mm w	d	h	Volume in l	Outer dimensions in mm W	D	H	Connected power/kW	Connection voltage[1]
S 2000/25HA	250	1100	1500	1200	2000	1480	1930	1500	18	3-phase
S 4000/25HA	250	1500	2000	1200	4000	1880	2830	1500	42	3-phase
S 6750/25HA	250	1500	3000	1500	6750	1880	3480	2000	84	3-phase
S 2000/45HA	450	1100	1500	1200	2000	1480	1930	1500	18	3-phase
S 4000/45HA	450	1500	2000	1200	4000	1880	2830	1500	42	3-phase
S 6750/45HA	450	1500	3000	1500	6750	1880	3480	2000	84	3-phase

[1] Notes on connection voltages please see page 39

NORMAL ATMOSPHERE with convection
Bogie hearth furnaces

Manual, semi and fully automatic aluminium heat treatment systems. Convection bogie hearth furnaces for all types of heat treatment under normal atmosphere, with high temperature accuracy and optimum loading

- furnace volumes up to 3000 litres
- working temperatures for solution annealing up to 600 °C and artificial ageing up to 250 °C
- optimum temperature distribution according to DIN 17052-1 to ± 3 °C
- quench delay < 10 seconds in fully automatic operation
- hydraulically powered bogies and lifting doors
- no condensation from water vapour in the furnace due to frontal quenching bath
- individual concept design for any requirements



Model of a fully automatic aluminium heat treating system

NORMAL ATMOSPHERE with convection
Bogie hearth furnaces

Convection bogie hearth furnaces for all types of heat treatment under normal atmosphere, with high temperature accuracy and optimum charging possibility

- temperatures up to 650 or 850 °C
- heating of both sides and bogie
- optimum temperature distribution according to DIN 17052-1 to ± 7 °C
- vertical air circulation with roof mounted fan
- removable air baffles
- Controller 40, controllers for more demanding applications see page 38

Options:

- support grid made from heat-resisting cast steel
- electro-hydraulic lifting door
- horizontal air circulation fans in the rear wall (poss. also on the sides)
- electrical bogie drive
- fan cooling for fast purging and cooling
- control of exhaust air flaps for quick cooling
- multiple zone control or special convection system for optimum temperature distribution according to DIN 17052-1 to ± 3 °C
- rails and flange wheels for optimum charging
- fully automatic process control and documentation
- special sizes up to 20,000 litres and charge weights up to 20 tonnes

W 1500/85A with bogie on rails and electro-hydraulic lifting door

Model	T_{max} °C	Inner dimensions in mm w	d	h	Volume in l	Outer dimensions in mm W	D	H	Connected power/kW	Connection 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 2200/65A	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

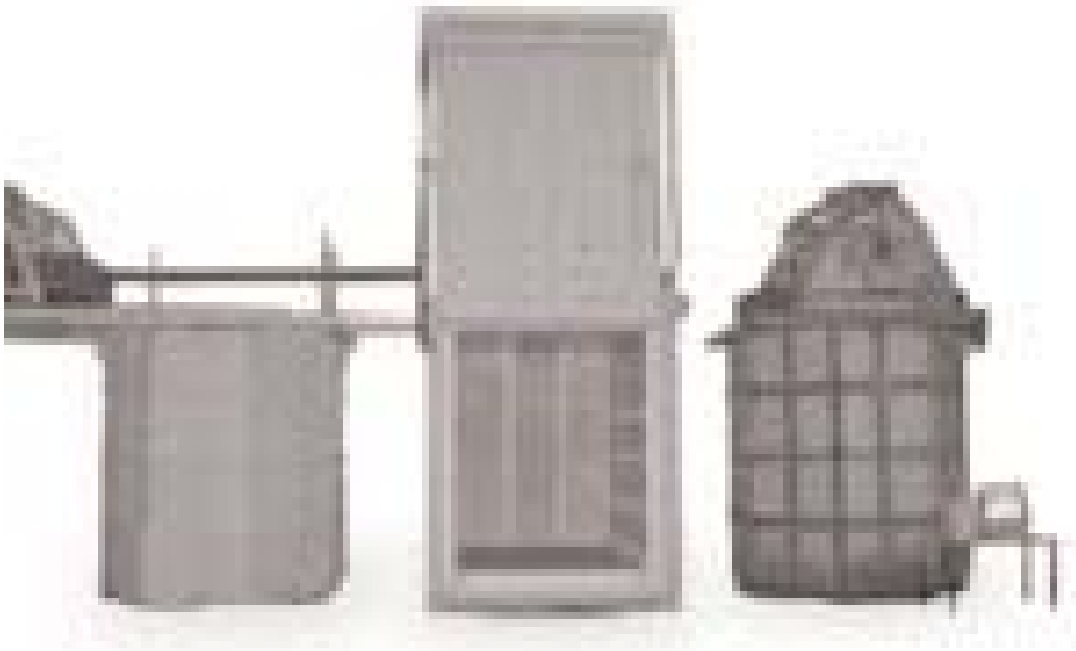
[1] Notes on connection voltages please see page 39

Convection bogie hearth furnace with box for annealing under protective gas (annealing box see page 37)

Convection bogie hearth furnace for annealing and tempering

NORMAL ATMOSPHERE with convection
Pit-type furnaces

Example of a system:
Pit-type/bogie hearth furnace system for semi-automatic solution annealing and artificial ageing of aluminium components, for maximum charge weights of 2.5 tons at a high temperature accuracy of ± 3 °C



Individual concept design for any requirements

7 m³ pit-type furnace for solution annealing

14 m³ bogie hearth furnace for artificial ageing

7 m³ pit-type furnace for solution annealing

8 m³ convection pit-type furnace with hydraulic apparatus for lifting cover for stress relieving of welded components with a temperature accuracy of ± 3 °C

NORMAL ATMOSPHERE with convection
Pit-type furnaces

Compact convection pit-type furnaces

Compact convection pit-type furnaces for heat treatment under normal atmosphere with air circulation

- temperatures up to 450, 650 or 850 °C
- air circulation fans in the bottom, high circulation rate
- square air heating chamber
- optimum temperature distribution according to DIN 17052-1 to ± 3 °C
- Controller C5, controllers for more demanding applications see page 38

Options:

- charging hoist with swivel arm and charge basket
- visual and audible signals
- fan for fast purging and cooling down

S 30/45A

Model	T_{max}	Inner dimensions of air cond. box in mm			Volume	Outer dimensions in mm			Connected	Connection	Weight
	°C	w	d	h	in l	W	D	H	power/kW	voltage[1]	in kg
S 30/45A	450	300	250	400	30	520	460	920	3,0	1-phase	130
S 60/45A	450	350	350	500	60	570	560	1020	3,6	1-phase	225
S 120/45A	450	450	450	600	120	670	660	1120	7,0	3-phase	280
S 250/45A	450	600	600	750	250	820	810	1350	13,0	3-phase	750
S 500/45A	450	750	750	900	500	970	960	1500	19,0	3-phase	980
S 30/65A	650	300	250	400	30	530	520	1020	3,6	1-phase	130
S 60/65A	650	350	350	500	60	580	620	1120	6,6	3-phase	225
S 120/65A	650	450	450	600	120	680	720	1220	9,6	3-phase	280
S 250/65A	650	600	600	750	250	830	870	1450	19,0	3-phase	750
S 500/65A	650	750	750	900	500	980	1020	1600	28,0	3-phase	980
S 30/85A	850	300	250	400	30	600	740	1000	6,0	3-phase	130
S 60/85A	850	350	350	500	60	710	840	1100	9,6	3-phase	225
S 120/85A	850	450	450	600	120	810	940	1200	13,6	3-phase	280
S 250/85A	850	600	600	750	250	960	1090	1350	21,0	3-phase	750
S 500/85A	850	750	750	900	500	1100	1240	1500	31,0	3-phase	980

[1] Notes on connection voltages please see page 39

Multi-purpose convection pit-type furnaces

Multi-purpose convection pit-type furnaces for heat treatment under normal atmosphere with optimum temperature accuracy

- temperatures up to 750 °C
- air circulation fans in the furnace lid, high circulation rate
- circular heating chamber
- all-round heating
- circulated air entry through bottom grating
- pneumatic or hydraulic lifting device for lid
- optimum temperature distribution according to DIN 17052-1 to ± 2 °C
- Controller C40, controllers for more demanding applications see page 38

Options:

- fan cooling for fast purging and cooling
- velocity control of the air circulation
- multiple zone control or special convection system for optimum temperature distribution for defined ventilation
- automatic process control and documentation
- special sizes up to 10,000 litres and charge weights up to 7 tonnes

S 100/A

Model	T_{max}	Inner dimensions of cond. cylinder in mm		Volume	Outer dimensions in mm			Connected	Connection	Weight
	°C	Ø in mm	h in mm	in l	W	D	H	power/kW	voltage[1]	in kg
S 100/A	750	450	600	100	1100	1200	1600	17,5	3-phase	1000
S 200/A	750	600	800	200	1200	1300	2050	28,5	3-phase	1300
S 300/A	750	600	1000	300	1200	1300	2250	39,5	3-phase	1500
S 500/A	750	800	1000	500	1400	1600	2400	52,5	3-phase	1600
S 600/A	750	800	1200	600	1400	1600	2600	62,5	3-phase	1800
S 800/A	750	1000	1000	800	1600	1800	2400	70,0	3-phase	1900
S 1000/A	750	1000	1300	1000	1600	1800	2700	90,0	3-phase	2200

[1] Notes on connection voltages please see page 39

PROTECTIVE GAS
Annealing system with annealing box

N 11/H-K

Protective gas annealing system, consisting of annealing furnace and annealing box with gassing for heat treatment under protective atmosphere, for non-oxidising annealing and cooling, and protective gas hardening of air hardening steels.

- chamber furnace from standard range, see page 5
- protective gas port for gas supply and discharge from the annealing box
- manual gassing equipment with pressure reducer and flow meter
- for protective gases such as nitrogen, argon or forming gas
- Controller C5, Controllers for more demanding applications see page 38
- box dimensions, see table below

Options:

- automatic gassing equipment, including pressure reducer, flow meter, solenoid valves, timer
- charge temperature measurement and control
- furnace ventilation, cooling fan
- charging aids, charging plate

Annealing with and without protective gas

Model	T_{max} °C	Inner dimensions of annealing box in mm w	d	h	Volume in l	Outer dimensions incl. furnace in mm W	D	H	Connected power/kW	Connection voltage[1]	Weight in kg
N 11/H-K	1280	200	300	110	7	520	610	565	3,6	3phase*	100
N 17/H-K	1280	200	450	110	10	520	760	565	5,5	3phase*	110
N 21-K	1200	200	300	150	9	760	1170	640	10,0	3phase	230
N 41-K	1200	250	350	180	18	860	1370	650	13,0	3phase	320
N 61-K	1200	280	500	200	28	860	1620	650	16,0	3phase	530
N 81-K	1200	400	500	200	40	1140	1900	1130	20,0	3phase	860
N 161-K	1200	450	550	250	62	1180	1930	1320	30,0	3phase	970
N 321-K	1200	650	900	250	146	1400	2270	1380	47,0	3phase	1420
N 641-K	1200	800	1100	300	265	1690	2670	1580	70,0	3phase	2300

[1] Notes on connection voltages please see page 39

*only 2 phases connected

Manual purging equipment with pressure reducer and flow meter

Bright annealed part

PROTECTIVE GAS
Annealing system with annealing box in convection furnace

N 60/65 HA-K

Protective gas annealing system, consisting of convection furnace and annealing box for heat treatment under protective gas atmosphere, for particularly high temperature accuracy and high heat transmission. For applications such as bright annealing and tempering, non-oxidising annealing and temper-hardening copper alloys

- convection chamber furnace standard range, see page 11
- oxidation-free annealing
- protective gas inlet and outlet to the annealing box
- high air circulation in the furnace chamber
- manual gassing equipment with pressure reducer and flow meter
- for protective gases such as nitrogen, argon or forming gas
- Controller C5, controllers for more demanding applications see page 38
- box dimensions, see table below

Options:

- automatic gassing equipment, including pressure reducer, flow meter, solenoid valves, timer
- charge temperature measurement and control
- furnace ventilation, cooling fan, charging aids

Model	T_{max} °C	Inner dimensions of annealing hood in mm w	d	h	Volume in l	Outer dimensions incl. furnace in mm W	D	H	Connected power/kW	Connection voltage[1]	Weight in kg
N 30/45HA-K	450	220	320	160	5	870	1170	1315	2,4	1-phase	205
N 60/45HA-K	450	270	420	260	28	930	1190	1400	3,2	1-phase	255
N 120/45HA-K	450	370	520	350	64	1030	1290	1500	6,4	3-phase	335
N 250/45HA-K	450	480	630	460	139	1190	1505	1860	12,0	3-phase	660
N 500/45HA-K	450	630	780	610	300	1340	1755	2010	18,0	3-phase	1105
N 30/65HA-K	650	220	320	160	5	870	1170	1315	3,2	1-phase	205
N 60/65HA-K	650	270	420	260	28	930	1190	1400	6,0	3-phase	255
N 120/65HA-K	650	370	520	350	64	1030	1290	1500	9,0	3-phase	335
N 250/65HA-K	650	480	630	460	139	1190	1505	1860	18,0	3-phase	660
N 500/65HA-K	650	630	780	610	300	1340	1755	2010	27,0	3-phase	1105
N 30/85HA-K	850	220	320	160	5	870	1170	1315	5,5	3-phase	205
N 60/85HA-K	850	270	420	260	28	930	1190	1400	9,0	3-phase	255
N 120/85HA-K	850	370	520	350	64	1030	1290	1500	13,0	3-phase	335
N 250/85HA-K	850	480	630	460	139	1190	1505	1860	20,0	3-phase	660
N 500/85HA-K	850	630	780	610	300	1340	1755	2010	30,0	3-phase	1105

[1] Notes on connection voltages please see page 39

Automatic gassing equipment with pressure reducer, flow meter, solenoid valves for low and high gas flows

Bogie hearth furnace with box for annealing under protective gas (annealing box see page 37)

PROTECTIVE GAS
Hardening system with annealing hood

N 11/H-H

Protective gas hardening system, consisting of hardening furnace and hood with gassing for heating under protective gas atmosphere and the subsequent gas or oil quenching, bright annealing and oxidation-free cooling, protective gas quenching of air hardening steels.

- chamber furnace from standard furnace range, see page 5
- hood for protective gas operation
- fast discharge for quenching
- protective gas inlet to the hood
- manual gassing equipment with pressure reducer and flow meter
- for all protective gases such as nitrogen, argon or forming gas
- Controller C5, controllers for more demanding applications see page 38

Options:

- automatic gassing equipment, including pressure reducer, flow meter, solenoid valves, timer
- charge temperature measurement and control
- furnace ventilation, cooling fan
- charging aids, charging plates

Model	T_{max} °C	Inner dimensions of annealing hood in mm w	d	h	Volume in l	Outer dimensions incl. furnace in mm W	D	H	Connected power/kW	Connection voltage[1]	Weight in kg
N 11/H-H	1280	160	350	80	4,5	450	600	505	3,6	1-phase	100
N 17/H-H	1280	160	420	80	5,4	450	750	505	5,5	3-phase*	110
N 41-H	1200	200	420	100	8,4	860	1370	650	13,0	3-phase	310

[1] Notes on connection voltages please see page 39

*only 2 phases connected

Annealing and hardening made easy - heat treatment for tool rooms and training centres

PROTECTIVE GAS
Powder system in box

Nitriding, carburising, boronising and bright annealing system, consisting of furnace and annealing box for the heat treatment in powder

- chamber furnace from standard range, see page 5
- freely radiating heating elements for optimum heat transmission box
- powder nitriding up to 550 °C
- boronising in powder up to 920 °C, gassing systems can be used manually or automatically
- pack carburizing up to 900 °C
- bright annealing with neutral carbon up to 1000 °C
- application temperature of annealing box up to 1100 °C
- exhaust air vent
- Controller C5, controllers for more demanding applications see page 38

N 11/H-P

Options:

- furnace ventilation and aeration, cooling fan, charging aids
- nitriding powder and activator for applications up to 550 °C in the box
- carburising powder for applications up to 900 °C in the box
- neutral compound for non-oxidising annealing in the hardening box up to 1000 °C re-usable

Model	T_{max} °C	Inner dimensions of annealing box in mm w	d	h	Volume in l	Outer dimensions incl. furnace in mm W	D	H	Connected power/kW	Connection voltage[1]	Weight in kg
N 11/H-P	1280	200	300	120	7	520	610	565	3,6	3-phase*	100
N 17/H-P	1280	200	450	120	10	520	760	565	5,5	3-phase*	110
N 21-P	1200	200	300	150	9	760	1170	640	10,0	3-phase	230
N 41-P	1200	250	350	180	18	860	1370	650	13,0	3-phase	320
N 61-P	1200	280	500	200	28	860	1620	650	16,0	3-phase	530
N 81-P	1200	400	500	200	40	1140	1900	1130	20,0	3-phase	860
N 161-P	1200	450	550	250	62	1180	1930	1320	30,0	3-phase	970
N 321-P	1200	650	900	250	146	1400	2270	1380	47,0	3-phase	1420
N 641-P	1200	800	1100	300	265	1690	2670	1580	70,0	3-phase	2300

[1] Notes on connection voltages please see page 39

*only 2 phases connected

Nitriding powder

Carburising powder

Powder boronising in a chamber furnace

Carburising in powder (pack carburising)

Anmealing compound

PROTECTIVE GAS
Convection chamber furnaces

N 120/65SHA

Protective gas convection chamber furnaces for heat treatment under protective atmosphere such as bright annealing and tempering, and annealing and hardening of copper alloys under protective gas

- temperatures up to 650 °C
- inert gas heat treatment
- optimum temperature distribution according to DIN 17052-1 to ± 5 °C
- manual gassing equipment with pressure reducer and flow meter
- for protective gases such as nitrogen, argon or forming
- horizontal air circulation
- charging on several levels with shelves
- Controller C5, controllers for more demanding applications see page 38

Options:

- automatic gassing equipment, including pressure reducer, flow meter, solenoid valves, timer
- fan cooling for fast purging and cooling
- alternative connection power
- process documentation
- charging aids

Automatic gassing panel

Model	T_{max} °C	Inner dimensions in mm w	d	h	Volume in l	Outer dimensions in mm W	D	H	Connected power/kW	Connection voltage[1]	Weight in kg
N 30/65SHA	650	300	400	250	30	870	1170	1315	3,2	1-phase	195
N 60/65SHA	650	350	500	350	60	930	1190	1400	6,0	1-phase	240
N 120/65SHA	650	450	600	450	120	1030	1290	1500	9,0	3-phase*	310
N 250/65SHA	650	600	750	600	250	1190	1505	1860	18,0	3-phase	610
N 500/65SHA	650	750	900	750	500	1340	1755	2010	27,0	3-phase	1030

[1] Notes on connection voltages please see page 39

*only 2 phases connected

Protective gas convection furnace for bright tempering and bright annealing in contract heat treatment

PROTECTION GAS-TIGHT
Box-type furnaces

Box-type furnaces without convection

Protective gas-tight box-type furnaces for heat treatment under controlled protective gas atmosphere with a low gas consumption. For applications such as bright annealing, tempering, brazing, and sintering powder metallurgical components (PM)

- temperatures up to 1100 °C
- gas-tight muffle with protective gas inlet and outlet for controlled atmospheres
- port for chamber temperature measurements
- for protective gases such as nitrogen, argon or forming gas
- water-cooled door seal with 'O'-ring
- heating of 2 sides and hearth
- Controller C5, controllers for more demanding applications see page 38

Options:

- manual gassing equipment with pressure reducer and flow meter
- automatic gassing equipment, including pressure reducer, flow meter, solenoid valves, timer
- exhaust flap control and cooling fan for rapid cooling of the muffle
- process documentation
- charge temperature measurement and control
- charging aids

N 41/M

Model	T_{max} °C	Inner dimensions in mm w	d	h	Volume in l	Outer dimensions in mm W	D	H	Connected power/kW	Connection voltage[1]	Weight in kg
N 21/M	1100	220	300	150	10	830	950	760	10	3-phase	290
N 41/M	1100	320	450	150	20	930	1100	760	13	3-phase	420
N 81/M	1100	450	700	150	50	1250	1550	900	20	3-phase	1000
N 161/M	1100	500	700	240	90	1300	1550	1050	30	3-phase	1110
N 321/M	1100	700	1050	240	180	1550	1900	1050	47	3-phase	1550

[1] Notes on connection voltages please see page 39

Box-type furnaces with air circulation

Protective gas-tight box-type furnaces with air circulation for the heat treatment of metals in a protective gas atmosphere, such as bright annealing, tempering, brazing, debinding and sintering PM parts

- temperatures up to 900 °C (optionally 1100 °C)
- as for N 21/M - N 321/M however additionally with:
- air circulation fan in the door for in optimal temperature accuracy according to DIN 17052-1 to ± 7 °C due to additional convection in the muffle
- water-cooled motor flange

N 41/MA

Model	T_{max} °C	Inner dimensions in mm w	d	h	Volume in l	Outer dimensions in mm W	D	H	Connected power/kW	Connection voltage[1]	Weight in kg
N 41/MA	900	320	450	150	20	930	1350	760	13	3-phase	450
N 81/MA	900	450	700	150	50	1250	1870	900	20	3-phase	1030
N 161/MA	900	500	700	240	90	1300	1870	1050	30	3-phase	1140
N 321/MA	900	700	1050	240	180	1550	2220	1050	47	3-phase	1580

[1] Notes on connection voltages please see page 39

Protective gas-tight box-type furnace with automatic gassing equipment and fast cooling system

PROTECTIVE GAS-TIGHT
Vertical retort furnace without convection

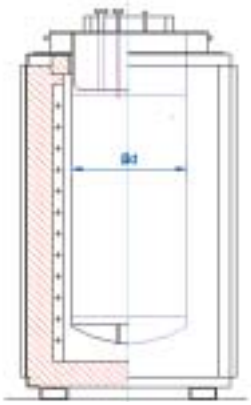
S 600/R

Vertical retort furnaces for protective gas heat treatment under controlled atmosphere. Applications such as bright annealing and tempering, brazing and sintering of powder metallurgical parts

- temperatures up to 1100 °C
- gas-tight annealing retort with protective gas inlet and outlet
- automatic gassing system for nitrogen, argon and forming gas
- water-cooled lid with 'O' ring seal
- heated on 4 sides
- optimum temperature distribution according to DIN 17052-1 to ± 7 °C in the chamber
- pneumatic or hydraulic apparatus for lifting cover
- Controller 40, controllers for more demanding applications see page 38

Options:

- exhaust flap control and fan for rapid cool down
- cooling station, spare retort
- alternative supply power
- charge temperature measurement and control
- process documentation
- special sizes up to 3,000 litres and charge weights up to 2 tonnes
- charging aids
- automatic gassing equipment, including pressure reducer, flow meter, solenoid valves, timer



Schematic arrangement of retort furnace without convection

Model	T_{max} °C	Annealing retort inner dimensions dia. in mm	H in mm	Volume in l	Outer dimensions in mm W	D	H	Connected power/kW	Connection voltage[1]	Weight in kg
S 100/R	1100	450	600	100	950	950	1200	16	3-phase	800
S 200/R	1100	600	800	200	1200	1200	1400	24	3-phase	1100
S 300/R	1100	600	1000	300	1200	1200	1600	35	3-phase	1300
S 500/R	1100	800	1000	500	1400	1400	1600	46	3-phase	1500
S 600/R	1100	800	1200	600	1400	1400	1800	54	3-phase	1600
S 800/R	1100	1000	1000	800	1600	1600	1600	70	3-phase	1700
S1000/R	1100	1000	1300	1000	1600	1600	1900	90	3-phase	1900

[1] Notes on connection voltages please see page 39

Vertical retort furnace for annealing in the automotive components

PROTECTIVE GAS-TIGHT
Vertical retort furnace with convection in the retort

S 800/RA

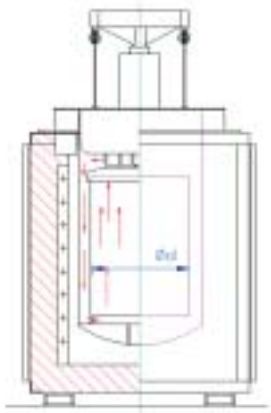
Protective gas convection retort pit-type furnaces for heat treatment of metals under protective gas atmosphere e.g. for bright annealing and tempering, powder boronising, brazing, debinding and sintering powder metallurgical parts (PM)

as for S 100/R - S 1000/R, see page 24, additionally with:

- integrated gas circulation with baffle cylinder and supporting grid
- optimum temperature distribution according to DIN 17052-1 to ± 3 °C
- automatic gassing system for nitrogen, argon, forming gas and hydrogen
- internal retort temperature control
- water-cooled motor flange
- water-cooled door seal with 'O' ring

Model	T_{max} °C	Annealing retort inner dimensions dia. in mm	H in mm	Volume in l	Outer dimensions in mm W	D	H	Connected power/kW	Connection voltage[1]	Weight in kg
S 500/RA	1100	800	1000	500	1400	1600	2400	46	3-phase	1500
S 600/RA	1100	800	1200	600	1400	1600	2600	52	3-phase	1600
S 800/RA	1100	1000	1000	800	1600	1800	2400	70	3-phase	1900
S1000/RA	1100	1000	1300	1000	1600	1800	2700	90	3-phase	2200

[1] Notes on connection voltages please see page 39



Schematic arrangement of the annealing retort with convection

Vertical retort furnace with convection and central control for powder boronising under reaction gas

VACUUM / PROTECTIVE GAS
Tube furnaces

Tube furnace for normal atmosphere

Tube furnaces for normal atmospheres or vacuum and protective gas operation are suitable for a number of heat treatment applications such as continuous annealing of wire and strip or non-continuous annealing, hardening and tempering of bars or small parts Rotary furnaces for drying and annealing powders for powder metallurgy

- temperatures up to 1800 °C
- length up to 3500 mm
- tube diameter up to 200 mm
- Ar, N_2, H_2 atmospheres or vacuum operation
- compact design
- process visualisation
- vertical or horizontal operation selectable depending on model
- hinged tube furnaces, rotary furnaces, multi-zone tube furnaces
- tubes available in steel, APM, quartz or ceramic
- optimum temperature distribution according to DIN 17052-1 to ± 1 °C
- Controller B 170, controllers for more demanding applications see page 38

Vertical tube furnace for protective gas annealing of small parts

Tube furnace with movable furnace chamber for vacuum and protective gas annealing

Protective gas tube furnace under hydrogen

Vacuum flange

Hinged tube furnace

Send for our laboratory applications brochure

VACUUM / PROTECTIVE GAS
Chamber furnaces

Vacuum / protective gas chamber furnaces up to 2,200 °C for heat treatment of metals, debinding and sintering powder metals (PM) and MIM components (metal injection moulding). Standard models are suitable for laboratory as well as production applications.

Available insulation and heating systems:

T_{max}	**Insulation**	**Heating system:**
1300 °C	ceramic fibre	CrFeAl heater
1600 °C	molybdenum	molybdenum heater
1800 °C	ceramic fibre	$MoSi_2$ heater
2200 °C	graphite fibre	graphite heater

- Ar, N_2, H_2 atmospheres or vacuum operation
- gassing system with flowmeter
- pressure range: 10^{-5} - 1000 mbar
- pressure control
- fast heating and cool
- H_2 operation with exhaust ignition gas and safety system
- vacuum pump stand
- Controller 40, controllers for more demanding applications see page 38

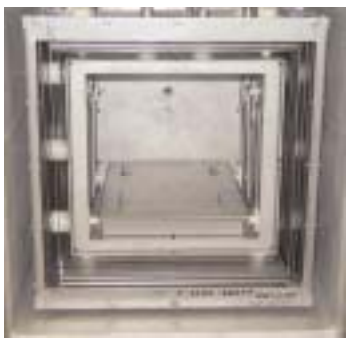
HTK 8

Model	T_{max} °C	Inner dimensions in mm w	d	h	Volume in l	Outer dimensions in mm W	D	H
HTK 8	1300-2200	150	200	150	4,5	800	1200 - 1400	2040 - 2500
HTK 25	1300-2200	250	400	250	25,0	1500	1500	2100
HTK 80	1300-2200	400	500	400	80,0	1700	2000	2300
HTK 220	1300-2200	600	600	600	220,0	2200	2200	2600

Graphite heating chamber for 2200 °C

Vacuum sintering furnace with molybdenum heating chamber up to 1600 °C for powder metals

Industrial vacuum furnace for annealing under hydrogen



Molybdenum heating chamber up to 1600 °C for high vacuum and PM use

VACUUM / PROTECTIVE GAS
Retort furnaces

WGO 100

Protective gas retort furnace with charging bogie for hydrogen annealing

Vacuum / protective gas retort furnaces for heat treatment of metals under vacuum, protective and reaction gas up to 1100 °C such as for bright annealing of metals, for hydrogen annealing and for debinding and sintering powder metals and MIM parts (metal injection moulding).

- temperatures up to 1100 °C
- hot wall furnace with external heating
- Ar, N_2, H_2 atmospheres or vacuum operation
- semi-monocoque heating elements
- heated gas outlet, heated door
- thermal afterburning by propane excess gas burner
- automatic valves, mass flow controller, flow meter, manual valves, gas circulation, gas baffle,
- radiation plate packages
- fast cooling system with fans
- sensors (O_2 partial pressure measurement, dew point, humidity etc.)
- process visualisation
- optimum temperature distribution according to DIN 17052-1 to ± 3 °C in the chamber
- charging systems
- controllers for demanding applications see page 38

Model	T_{max} °C	Retort inner diameter dia. in mm	Retort inner diameter t in mm	Outer dimensions in mm W	Outer dimensions in mm D	Outer dimensions in mm H	Cooling rate °C/h[2]	Heating rate °C/h	Connected power/kW	Connection voltage[1]	Weight in kg
WGO 40	1100	300	600	1000	1800	1800	150	500	12	3-phase	1000
WGO 100	1100	400	900	2300	2200	2200	150	500	40	3-phase	1600
WGO 220	1100	400	1200	2300	2200	2200	150	500	50	3-phase	2000

[1] Notes on connected voltage please see page 39
[2] with fast cooling system the charge (220 kg) can be cooled down to 100 °C in 5 h

N 71/MS

Vacuum / protective gas retort furnace for heat treatment of tools and high alloy steel components under vacuum, protective or reaction gas up to 1100 °C.

- components heated in the hardening chamber in the vacuum tight furnace at hardening temperature
- transporting the heating chamber out of the furnace and cooling the components under protective gas
- economical hardening, bright annealing, vacuum sintering and hard brazing with minimal distortion
- vacuum up to 5 x 10^{-2} bar possible
- oxidation-free heat treatment
- fast heating and cooling due to low thermal mass of the hardening chamber
- low energy consumption
- improved component quality
- environmentally-friendly system design as no cleaning required

Model	T_{max} °C	Retort inner dimensions dia. in mm	Retort inner dimensions t in mm	Furnace chamber dimensions in mm b	Furnace chamber dimensions in mm t	Furnace chamber dimensions in mm h	Litres	Outer dimensions in mm B	Outer dimensions in mm T	Outer dimensions in mm H	Connected power/kW	Connection voltage[1]	Weight in kg
N 71/MS	1100	280	650	200	420	100	8,4	800	2700	1600	16	3phase	800

[1] Notes on connected voltage please see page 39

VACUUM PROTECTIVE GAS
Top-hat (lift-off) furnaces

Vacuum / protective gas top-hat furnaces for heat treatment under protective and reaction gas, in vacuum and high vacuum up to 1.100 °C and for bright annealing, hydrogen annealing and debinding and sintering powder metals and MIM parts.

- maximum temperature in vacuum operation up to 900 °C, under protective gas up to 1100 °C
- Ar, N_2, H_2 atmospheres or vacuum operation
- free-standing cylindrical retort, heated externally
- heated gas outlet, heated door
- thermal afterburning by propane excess gas burner
- automatic valves, mass flow controller, flow meter, manual valves
- gas circulation, gas guide cylinder, radiation shield packages
- fast cooling system by fans
- sensors (O_2 partial pressure measurement, dew point, humidity etc.)
- high vacuum pump stand
- process visualisation
- optimum temperature distribution according to DIN 17052-1 to ± 3 °C
- controller for complex applications see page 38

HBO 100

Model	T_{max} °C	Inner retort dimensions dia. in mm	Inner retort dimensions h in mm	Outer dimensions in mm W	Outer dimensions in mm D	Outer dimensions in mm H	Cooling rate °C/h[2]	Heating rate °C/h	Connected power/kW	Connection voltage[1]	Weight in kg
HBO 40	1100	400	350	2200	1200	2300	150	600	20	3-phase	800
HBO 100	1100	500	500	2200	1200	2400	150	600	40	3-phase	1400
HBO 220	1100	600	800	2400	1600	2800	150	600	60	3-phase	1800
HBO 750	1100	800	1500	2800	4200	5500	150	300	120	3-phase	3000

[1] Notes on connection voltages please see page 39

Top-hat furnace for high vacuum operation

Top-hat furnace for protective gas and vacuum annealing of small parts

Neutral salt bath furnaces

WB 70

Holding furnaces for heat treatment of metals using neutral salt for fast and intensive heat transfer with high temperature accuracy. For operating temperatures between 150 and 500 °C. Austempering (bainitic hardening) with optimal toughness. Process annealing when electroeroding. Nitro blackening and tempering without the risk of cracks. Precise hardness and toughness.

- temperatures up to 500 °C
- optimum temperature distribution according to DIN 17052-1 to ± 2 °C in the heat transfer process
- control through the heat transfer temperature
- heating by immersion heating element
- charging basket and charging aid
- Controller C5, controllers for more demanding applications see page 38

Options:

- charging aid for fast and safe quenching
- visual and audible signals

Model	T_{max} °C	Inner dimensions in mm b	t	h	Volume in L	Outer dimensions in mm B	T	H	Connected power/kW	Connection voltage[1]	Weight in kg
WB 10	500	220	200	300	10	550	450	570	1,0	1-phase	60
WB 20	500	300	210	460	20	610	580	920	2,6	1-phase	110
WB 30	500	300	210	580	30	610	580	920	3,2	1-phase	140
WB 70	500	400	300	680	70	750	680	980	7,5	3-phase	240
WB 200	500	540	520	880	200	900	900	1200	18,0	3-phase	660
WB 400	500	730	720	980	400	1100	1100	1300	24,0	3-phase	1150

[1] Notes on connection voltages please see page 39

Stage hardening in practice

Salt-bath furnaces

Salt-bath furnaces for heat treatment of metals in neutral and carbonitriding baths, for nitriding after Tenifer treatment up to 600 °C, carburizing up to 950 °C or bright annealing up to 1000 °C

- temperatures up to 750 or 1000 °C
- bath temperature control
- all-round heating
- removable collar plate made of solid steel plate
- insulated swing-a-side lid
- optimum temperature distribution according to DIN 17052-1 to ± 3 °C
- temperature selection limiter in the furnace chamber to protect personnel and plant
- cascade Controller C 18

Pots

- type A: low carbon steel, CrNi plated and corundum coated for carburizing salts up to 950 °C, neutral and annealing salts up to 850 °C
- type B: high alloy CrNi steel for neutral and annealing salts up to 1000 °C

Option:

- lip extraction

TS 40/40

Model	T_{max} °C	Salt pot inner dimensions dia. in mm	h in mm	Volume in l	Outer dimensions in mm W	D	H	Connected power/kW	Connection voltage[1]	Weight in kg
TS 20/15	750	230	500	20	850	850	800	16	3-phase	650
TS 30/18	750	300	500	30	950	950	800	20	3-phase	700
TS 40/30	750	400	500	40	1050	1050	800	33	3-phase	750
TS 50/48	750	500	600	50	1150	1150	970	58	3-phase	1000
TS 60/63	750	610	800	60	1250	1250	1170	70	3-phase	1200
TS 70/72	750	700	1000	70	1350	1350	1370	80	3-phase	1500
TS 20/20	1000	230	500	20	850	850	800	21	3-phase	650
TS 30/30	1000	300	500	30	950	950	800	33	3-phase	700
TS 40/40	1000	400	500	40	1050	1050	800	44	3-phase	750
TS 50/60	1000	500	600	50	1150	1150	970	66	3-phase	1000
TS 60/72	1000	610	800	60	1250	1250	1170	80	3-phase	1200
TS 70/90	1000	700	1000	70	1350	1350	1370	100	3-phase	1500

[1] Notes on connection voltage please see page 39

Salt pot

Salt bath plant for solution heat treatment of aluminium components in the aircraft industry

Continuous belt furnaces

Continuous belt furnace for small parts

Belt, speed infinitely variable

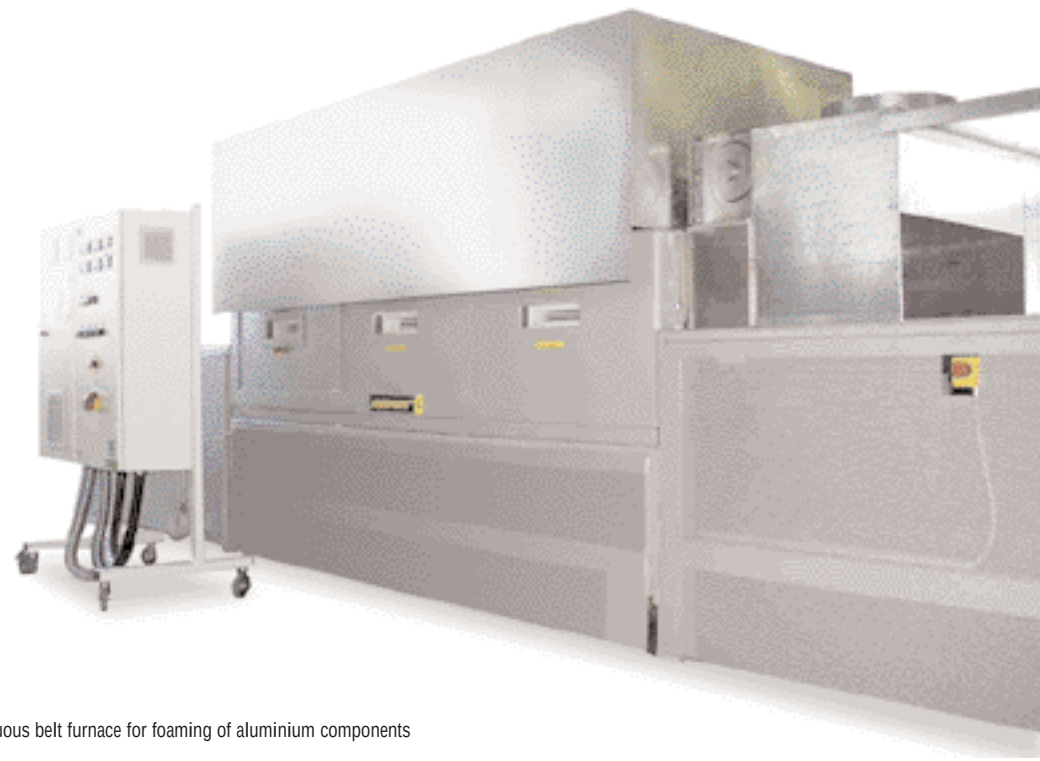
Cooling facility at discharge

Belt furnace for continuous heat treatment of bulk material and small parts under normal atmosphere, for the heat treatment of springs, deep-drawn and small parts

- temperatures up to 1000 °C
- convection operation up to 850 °C
- optimum temperature distribution according to DIN 17052-1 to ± 5 °C
- lengths up to 5 m
- multi-zone heating
- variable belt speed

Options:

- process documentation
- complete gassing system
- cooling facility for discharge section



Continuous belt furnace for foaming of aluminium components

Strand furnaces

Furnaces for continuous heat treatment
of wire and strip

- maximum temperature up to 1200 °C
- modular design, variable length
- small outer dimensions due to microporous insulation
- optimum temperature distribution due to multiple zone control
- protective gas or hydrogen gassing in muffle tubes
- heating elements in the roof which can be changed from the side
- possible to change heating elements during operation
- compact design
- process documentation optionally available

Strand furnace with two chambers for up to 24 muffle tubes

Model	T_{max} °C	Inner dimensions in mm w	d	h	Volume in l	Outer dimensions in mm W	D	H	Connected power/kW	Connection voltage[1]
D 20/S	1200	400	1000	50	20	900	1200	1350	9	3-phase
D 30/S	1200	600	1000	50	30	1100	1200	1350	12	3-phase
D 50/S	1200	200	3600	50	50	700	4000	1150	15	3-phase
D 60/S	1200	200	5600	50	60	700	6000	1350	36	3-phase
D 70/S	1200	350	3600	50	70	850	4000	1100	36	3-phase
D 110/S	1200	480	4600	50	110	980	5000	1450	36	3-phase
D 130/S	1200	650	3600	50	130	1150	4000	1150	60	3-phase
D 180/S	1200	480	7600	50	180	980	8000	1350	80	3-phase

[1] Notes on connection voltages please see page 39

Hinged furnaces for wire and strip for easily changing the muffle tubes

RS 50/500/11

15 m long wire treating furnace

Furnace with two tubes for annealing of strip

Complete heat treatment system

Compact hardening system KHS

- compact hardening system for small tools, dies and components, consists of hardening and tempering furnaces, cleaning and quenching tanks, space-saving - vertically arranged.
- optional: protective gas hardening box, aids for the heat treatment shop, etc.

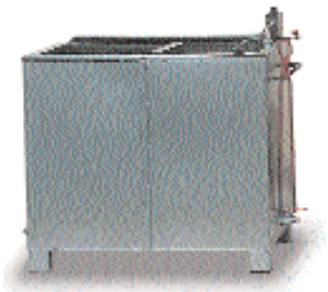
Complete solutions for the hardening shop

Multi-hardening system MHS

- hardening system for small tools, dies and components, consisting of hardening and tempering furnaces, work bench, cleaning and quenching tanks, cooling station.
- optional: protective gas hardening box, aids for the heat treatment shop, etc.

Industrial hardening system PHS

- industrial hardening system consisting of separate cleaning and quenching tanks, annealing and hardening furnace, martempering bath and tempering furnace



Cleaning and quenching tanks

Annealing and hardening furnace

Martempering bath

Tempering furnace

Cooling stations, quenching tanks and combined cleaning and quenching tanks

- available in various designs

Charging and conveying systems

Example: Charging trolley with annealing box

Charging trolley

Charging trolley suitable for furnace series N 21 - N 321

- adjustable height
- twin swivel castors with parking brake
- equipped with tray for carburising powder
- simple charging for loads up to 550 kg

Conveyer arrangements

- individual concept design for any requirements

Example: Convection furnace with cooling station and roller conveyor

Example: Charging trolley for heavy loads

Example: Roller conveyor in the convection furnace for annealing of rod and strip

Example: Transfer car for several bogies with parking stations

Equipment, tools and consumables for the heat treatment shop

Annealing box

- annealing box with and without protective gas inlet up to 1100 °C for models N 7 to N 1491 for annealing under protective gas or in powder (also see pages 18, 19 and 21)

Annealing hood

- annealing hood up to 1200 °C with protective gas inlets for models N 7 to N 41 for annealing and hardening under protective gas

Hearth plates

- hearth plates up to 1100 °C for protecting the furnace hearth for models N 7 to N 1491, edges on 3 sides

Hardening tongs

- hardening tongs in various shapes and sizes for annealing and hardening

Hardening foil

- foil for non-oxidising annealing and hardening of steels up to 1200 °C

Gloves

- heat-resistant gloves suitable for 600 or 900 °C

Hardening oil

- thermochemically stable hardening oil for bath temperatures of 50 - 150 °C for controlled quenching

Quench water additive and cleaning agents

- quench water additive for low-distortion hardening up to a water temperature of 70 °C
- cleaning agents for optimum cleaning, degreasing and corrosion protection

For further details please ask for our separate data sheet.

PROCESS CONTROL AND DOCUMENTATION

Nabertherm has many years experience in designing and constructing standard and customer-specific controllers and switchgear with different levels of operator control, efficiency and documentation requirements.
We have an individual and economic solution for your problem. This means that in addition to our tried and tested standard systems we can also meet your special requirements such as particular plant standards and equipment regulations.

C 5/S 5/B 170

These easy-to-use controllers are ideal for applications in which the furnace has to be heated up to a certain temperature and held at this temperature for variable periods. The integrated timer also allows an automatic start at a pre-programmed time.

C 30/C 40/P 320

Ideal for more demanding applications or more complex program cycles in which the furnace has to provide a temperature/time profile with heating ramps, hold times, set value changes etc. Different temperature/time profiles can be saved depending on the controller. A delayed start in real time (date and time) is possible. A digital interface for reading data and measured values is available.

Functions: One or two functions can be switched on and off depending on the temperature/time profile, at the end of the program an automatic flap can be opened or a ventilator switched on in a particular temperature range, acoustic signals or catalysers operated.

Multiple zone control: When there are high demands on the temperature distribution the C 40 can also be applied as the master of a multiple zone control. A slave controller per zone provides separate control for the desired temperature per heating zone.

Possibilities for documentation:

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

Management of several furnaces: Management of the temperature/time profiles of up to 16 furnaces and supervision of the connected controllers with the Controltherm MV.. software.

HiProSystems control system

based on Siemens hardware

Control systems for one or several furnaces. Equipped as standard with 8 connections for standard functions, can be extended as desired. This sophisticated control system is used for example if

- more than two functions such as ventilation flaps, cooling fans, automatic movements etc are required and/or
- increased demands are made on the documentation and/or
- maintenance/service work e.g. telediagnostic service is performed.

The HiProSystems control system is ideally suited for controlling several furnaces or furnace groups.
The investment required for the control system and switchgear then reduces correspondingly.

Alternative operator interfaces / documentation options:

- **H 1700 (touch panel)** The temperature/time program and the connected extra functions are presented clearly in a table. Messages are shown in plain text.
  Documentation as for C 40 etc.
- **H 3700 (touch panel)** All functions as well as the entire process are saved and presented clearly as a diagram. 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 processed further. There is the opportunity to save the set values and actual values on a CF card to be read via an appropriate card reader.

- **Control-Center HCC (PC-based)** The expansion of the HiPro control system to Nabertherm Control Center offers further interface, 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 the mobile phone network for notification via SMS, e.g. in the case of errors
  - operation from various PC locations
  - documentation according to DIN ISO 9000
  - maximum operator convenience, mouse operation, large screen

Cascade control

The ideal way to control the temperature directly on the charge is cascade control.
Here the temperature is measured both inside as well as outside the retort or muffle and give quick and exact control.
Cascade control is standard on salt-bath furnaces.

Mains voltages for Nabertherm furnaces

1-phase: All furnaces are available for 110 V - 240 V, 50 or 60 Hz.

3-phase: All furnaces are available for 200 V - 240 V or 380 V - 480 V, 50 or 60 Hz.

The whole world of Nabertherm: www.nabertherm.com

You can find all you want to know about us and our products under **www.nabertherm.com**

Apart from current information, trade fair and training dates there is also the opportunity to get in touch directly with your local contacts or nearest dealer world-wide.

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- **Laboratory/Dental**
- **Heat treatment of metals**
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