Nabertherm

MORE THAN HEAT 30-3000 °C

Foundry

Melting
Holding
Transporting
Core Drying
Thermal Decoring
Dewaxing
Heat Treatment
Annealing
Tempering
Preheating
Quenching
Energy Efficiency Technology
AMS 2750 E, NADCAP, CQI-9

www.nabertherm.com

Made in Germany

Made in Germany

Nabertherm with 400 employees worldwide have been developing and producing industrial furnaces for many different applications for over 60 years. As a manufacturer, Nabertherm offers the widest and deepest range of furnaces worldwide. 150,000 satisfied customers in more than 100 countries offer proof of our commitment to excellent design, quality and cost efficiency. Short delivery times are ensured due to our complete inhouse production and our wide variety of standard furnaces.

Setting Standards in Quality and Reliability

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

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

Global Sales and Service Network – Close to you

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

Large Customers Test Center

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

Customer Service and Spare Parts

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

Experience in Many Fields of Thermal Processing

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

Table of Contents

Which Furnace for which Process?

Melt

Melting

Gas-fired tilting furnaces
page 8

Gas-fired tilting furnaces with recuperative burner
page 14

Electrically heated tilting furnaces to 1400 °C
page 18

Electrically heated tilting furnaces to 1300 °C
page 10

Melting furnaces for heavy metals
page 26

Melting and Holding

Gas-fired bale-out furnaces
page 12

Gas-fired bale-out furnaces with recuperative burner
page 14

Gas-fired tilting furnaces with recuperative burner
page 14

Electrically heated bale-out furnaces
page 16

Electrically heated tilting furnaces to 1300 °C
page 10

Melting furnaces for heavy metals
page 26

Rotary table system for continuous pouring
page 27

Electrically heated laboratory melting furnaces
page 28

Holding, Transporting

Electrically heated bale-out furnaces
page 20

Transportable electrically heated bale-out furnaces
page 21

Electrically heated bath furnaces
page 27

Combi transport ladle for melting, holding and transporting, page 26

Other products:

Heat Treatment

Electrically heated air circulation chamber furnaces < 500 liters, page 32

Electrically heated or gas-fired air circulation chamber furnaces > 500 liters, page 34

Electrically heated or gas-fired air circulation bogie hearth furnaces, page 38

Electrically heated or gas-fired pit-type/top-loading furnaces with or without air circulation, page 41

Electrically heated bogie hearth furnaces
page 50

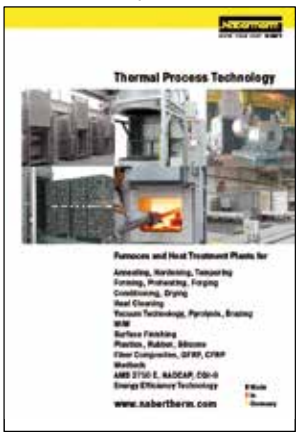
Gas-fired bogie hearth furnaces
page 53

Gas-fired chamber furnaces
page 54

Electrically or gas-fired continuous furnaces
page 58

Tempering plants
page 42

Other products:



Heat Treatment of Forms and Cast Pieces

Dewaxing, Thermal Decoring

- Gas-fired dewaxing furnaces page 49
- Electrically heated dewaxing furnaces page 48
- Electrically or gas-fired chamber dryers page 30
- Chamber dryers, including safety technology according to EN 1539, page 46
- Electrically heated air circulation chamber furnaces < 500 liters, page 32
- Electrically heated or gas-fired air circulation chamber furnaces > 500 liters, page 34
- Electrically heated or gas-fired air circulation bogie hearth furnaces, page 38

Pre-Heating, Drying

- Electrically heated or gas-fired rotary hearth furnaces page 56
- Electrically heated air circulation chamber furnaces < 500 liters, page 32
- Electrically heated or gas-fired air circulation chamber furnaces > 500 liters, page 34
- Electrically heated or gas-fired air circulation bogie-hearth furnaces, page 38
- Electrically heated or gas-fired pit-type/top-loading furnaces with or without air circulation, page 41
- Chamber dryers, including safety technology according to EN 1539, pages 30 + 46
- Electrically heated or gas-fired continuous furnaces page 58

Debinding, Sintering

Please order our "Advanced Materials" catalog which contains a large number of solutions for debinding and sintering!

Exhaust Gas Cleaning Systems, Energy Efficiency Concepts

- Catalytic afterburning systems page 55
- Thermal afterburning systems page 55
- Exhaust torch page 55
- Energy efficiency technology page 67

Alternative Melting Furnace Concepts

Alternative Heating Technologies

The application of alternative heating technologies depends on the requirements for melt quality, productivity and energy efficiency. In principle either electrically or gas-fired furnaces can be used. In this context, with respect to costs the local pricing for the alternative energy play a decisive role.

Gas Heating

Gas-fired furnaces are ideal for melting, particularly if equipped with exhaust gas discharge over the crucible edge. Side exhaust gas discharge is best if a high melt quality is required. However, a higher melt quality means a lower energy efficiency since a fuel-fired furnace with side exhaust gas discharge consumes approx. 20-25 % more energy than a furnace with an exhaust gas discharge over the crucible edge.

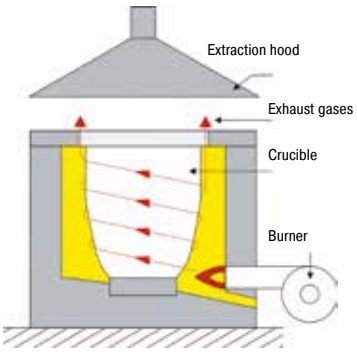
Fuel-fired furnaces provide for optimal energy efficiency in combination with highest melt quality due to their burner system that includes heat recovery via recuperator. The hot exhaust gases from the furnace preheat the combustion air for the burner via a heat exchanger. This system leads to savings of up to 25 % compared to conventional fuel-fired furnaces with a side exhaust gas discharge.

Electric Heating

If the melt quality and energy efficiency take priority, an electrically heated furnace is the best choice. The heating is controlled very steadily and precisely. The melt is not polluted through immissions from a fuel-fired heating. Electrically heated furnaces can achieve up to 85 % of the melting performance of fuel-fired furnaces with a side exhaust gas discharge. If the furnaces are used only for holding, we recommend the T.../10 models, which are very energy efficient due to their very good insulation and reduced connected load.

Alternative Exhaust Gas Systems

Exhaust Gas Discharge over the Crucible Edge



Exhaust gas discharge over the crucible edge

Exhaust gas discharge over the crucible edge is the standard design for our gas and oil-fired furnaces, except for the TB models for furnace temperatures of 1200 °C, since these furnaces are normally used as holding furnaces. Due to the high melting performance, the furnaces are perfectly suited for melting. This type of exhaust gas discharge is characterised as follows:

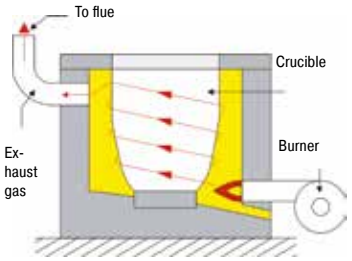
+ Very high melting performance, ideal for use as a melting furnace
+ Low power consumption since the crucible is not just heated from the outside but part of the heat also enters the crucible from above. Energy savings of up to 20 % compared to furnaces with a side exhaust gas discharge

- Limitations on the melt quality due to higher burn-off and increased hydrogen absorption by the melt from the exhaust gases
- Bath control not recommended

Side Exhaust Gas Discharge

a) without Recuperator Technology

The side exhaust gas discharge is available for all fuel-fired crucible furnaces. Although the melting performance is not as high as with an exhaust gas discharge over the crucible edge, it provides for better melt quality and, in combination with a bath control, is highly recommended for holding operation.



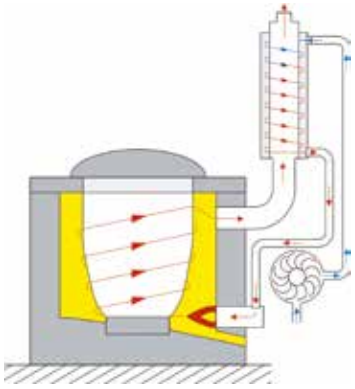
Side exhaust gas discharge

+ High melt quality due to low burn-off and reduced hydrogen inclusions in the melt
+ Swing lid-reduction of power consumption up to 50 % during holding with a closed swing lid
+ Operator exposed to less heat in the area above the crucible
+ Best melt quality if a bath control for precise temperature control is used

- Lower melting performance compared to furnaces with exhaust gas discharge over the crucible edge
- Power consumption during melting around 25 % higher compared to furnaces with exhaust gas discharge over the crucible edge

b) with Recuperator Technology

Fuel-fired furnaces with burner systems that include heat recovery via a recuperator provide for optimum energy efficiency in connection with a top melt quality. The combustion air for the burner is pre-heated with the hot exhaust gases from the furnace via heat exchanger. The system results in savings of up to 25 % compared to conventional fuel-fired furnaces with side exhaust gas discharge.


Side exhaust gas discharge with recuperator technology

Depending on the utilisation the relatively higher acquisition costs pay off already after a short period of time.

+ Burner systems with a recuperator system save around 25 % of the power compared to furnaces with a side exhaust gas discharge
+ High melt quality due to low burn-off and reduced hydrogen absorption in the melt
+ Reduced power consumption by up to 50 % during holding with a closed swing lid
+ Operator exposed to less heat in the area above the crucible
+ Best melt quality if a bath control for a precise temperature control is used

- Lower melting performance than furnaces with exhaust gas discharge over the crucible edge
- Power consumption during melting around 20-25 % higher than furnaces with exhaust gas discharge over the crucible edge

Decision Aid for Melting Furnaces

	Use	Productivity	Melt Quality	Energy Consumption	Noise Emissions
Models TB/KB Exhaust gas discharge over the crucible edge	Melting	++	-	o	-
Models TB/KB Side exhaust gas discharge	Melting + Holding	+	+	-	-
Models TBR Side exhaust gas discharge with recuperator	Melting + Holding	+	+	+	-
Models T/TF/K/KF Electrically heated with bath control	Melting + Holding	o	+++	++	+
Models T/TF/K/KF Electrically heated without bath control	Melting + Holding	o	++	++	+
Modelle T../10 Electrically heated with bath control	Holding	-	+++	+++	+
Models TC/KC Electrically heated via SiC rods	Melting + Holding	+	+	o	+

Tilting Furnaces KB
Gas-Fired, for Melting and Holding

Melting furnace plant consisting of two furnaces KB 360/12 with one work platform

Hydraulic system with flame resistant hydraulic fluid

Two-stage burner, mounted on furnace frame

The gas-fired or oil-heated tilting furnaces in the KB product lines provide for high melting output, making them ideal for melting operations. The use of high-quality insulation materials results in very low energy consumption. The two-stage burner can be configured for either gas or oil operation. Designed with an exhaust vent over the crucible edge, these models achieve very high melting rates and optimum energy efficiency.

- KB../12 with Tmax of 1200 °C for aluminum and zinc alloys
- KB../14 with Tmax of 1400 °C, suitable for copper alloys with a maximum melting bath temperature of 1300 °C (appropriate in some cases for aluminum)
- Fuel heating with gas or oil
- Two-stage output control: High load for melting operation, low load for holding operation with automatic switching between both modes
- Modern burner system with optimized flame guide: High efficiency provided by over-pressure operation to keep out entrained air
- Gas system consisting of pressure regulator, gas filter, manometer and solenoid valves
- Safe flame monitoring
- Burner technology with easy-to-service design, e.g. flame head can be removed from the rear when the burner is swung out
- Burner technology compliant with DIN 746, Part 2
- Designed for natural gas or liquid natural gas with 8.8 kWh/m³ - 25.9 kWh/m³
- Required gas input pressure: 50 mbar
- Operation with other fuels and/or with another gas input pressure possible
- High melting output powered by high-performance burners and high-quality insulation
- Crucible made of isostatically pressed clay-graphite
- Electro-hydraulic tilting system with flame resistant HFC hydraulic fluid
- Safe, uniform and precise pouring enabled by the optimum pivot point of the furnace and the manual operation of the slider valve

- Multi-layered insulation with lightweight refractory bricks provide the furnace chamber lining, 1400 °C models come with an additional wear-and-tear layer made of copper-resistant refractory concrete
- Emergency outlet for safe discharge of the melt in case of a crucible break
- Exhaust gas discharge over the crucible edge, resulting in approx. 20 % more melting output compared to side exhaust discharge, design without swing lid
- Exhaust gas vent options see page 6
- Over-temperature limiter for the furnace chamber with automatic reset to protect against over-temperature. The limit controller switches off the heating when the pre-set limit temperature has been reached and does not switch it on again until the temperature falls below the setting again.
- Furnace chamber control with temperature measurement behind the crucible, recommended when using as pre-melt furnace
- Information about temperature control see page 24
- Side-wall exhaust gas vent for KB.../12 models, see additional equipment

KB 400/12

Additional equipment

- Side exhaust gas discharge for melt and holding operation
  - Low burn-off provides for high quality melt
  - Low hydrogen absorption by the melt
  - Low heat exposure for the operator in the area above the crucible
  - Swing lid which, when closed during holding operation, saves up to 50 % energy
  - Approx. 20 % lower melting output than for exhaust gas venting over the crucible edge
- Insulated connecting piece (exhaust flue) for side-wall exhaust gas vent to a connected customer suction system
- Exhaust gas collection hood for furnaces featuring exhaust gas venting over the crucible edge
- Information about exhaust venting see page 6
- Work platform or platform for easier charging
- Crucible breakage monitoring with optical and acoustic signal (only for models KB ../12)
- SMS-message to one or more mobile phones in case of crucible breakage. One or more furnaces can be connected to the messaging device in parallel
- Bath control system
  - Furnace control via the bath temperature
  - Thermocouples in the furnace chamber and the melt
  - Improved melt quality ensured by a reduction in temperature overshoots
  - Integrated safety controller system that, in case of bath thermocouple breakage, continues to operate the furnace at a reduced output to prevent the melt from solidifying
- Information on other accessories see page 22

KB 240/12 for melting aluminum alloys

Energy Efficiency

Model	Tmax	Crucible	Capacity		Melting output[3]		Consumption holding lid closed	Consumption melting	Burner output	Outer dimensions in mm			Weight in
	°C		Kg Al	Kg Cu	Kg Al/h	Kg Cu/h	KWh/h	KWh/kg AL	kW	W	D	H	kg
KB 80/12	1200	TP 287	180	550	220[1]	-	10	1.3 - 1.5	300	2030	1700	1510	1800
KB 150/12	1200	TP 412	330	970	240[1]	-	11	1.3 - 1.5	300	2140	1900	1710	2200
KB 180/12	1200	TP 412 H	370	1200	260[1]	-	13	1.3 - 1.5	300	2140	1900	1810	2400
KB 240/12	1200	TP 587	570	-	400[1]	-	15	1.3 - 1.5	390	2650	2030	1810	2600
KB 360/12	1200	TBN 800	750	-	420[1]	-	17	1.3 - 1.5	450	2650	2080	1910	2900
KB 400/12	1200	TBN 1100	1000	-	450[1]	-	19	1.3 - 1.5	450	2650	2080	2080	3300
KB 40/14	1400	R 400/TP 982	120	400	-	330[2]	22	1.0 - 1.3	400	2070	1700	1770	2300
KB 60/14	1400	R 500	150	500	-	360[2]	25	1.0 - 1.3	400	2070	1900	1810	2500
KB 80/14	1400	R 600	180	600	-	380[2]	25	1.0 - 1.3	400	2070	1900	1910	2650

[1]At 700 °C
[2]At 1000 °C
[3]The stated melting outputs are maximum values. Daily operation comes up to roughly 80 %.

Insulated connecting piece for side-wall exhaust gas vent to a connected customer suction system

Tilting Furnaces K (Brick Insulation) and KF (Fiber Insulation)

Electrically Heated, for Melting and Holding

K 150/12

KF 240/12

Side wall insulation with fiber materials in KF models

The electrically heated tilting furnaces of the K and KF product lines are characterized by high melting performance with very temperature uniformity in the melt. Aluminum and brass can be melted in the 1200 °C version. The 1300 °C version can also be used to melt bronze alloys. For faster heating-up cycles in batch operation furnaces can be insulated with fiber resulting in lower heat storage (KF models).

- K, KF../12 with maximum furnace chamber temperature of 1200 °C for aluminum or brass. Maximum bath temperature, depending on the condition of the crucible, between 1050 °C and 1100 °C
- K, KF../13 with maximum furnace chamber temperature of 1300 °C also suitable for bronze alloys or brass, with a maximum melt temperature of 1200 °C
- Heating from three sides using electric heating elements, radiating freely on carrier tubes, simple exchange of individual heating elements
- Multi-step wiring of the heating elements for furnaces with more than 50 kW electrical rating
- Heating of furnaces up to 24 kW power rating controlled using long-lasting, noiseless solid-state-relays
- Heating of furnaces beyond 24 kW with contactors
- High melting performance with temperature uniformity in the melt
- Insulation constructed in multiple layers with lightweight refractory bricks on the hot face (K models)
- Insulation constructed in multiple layers with fiber material in the side walls and corner bricks to support heating elements (KF models)
- Crucible of clay-graphite up to K 240, isostatically pressed clay-graphite or SiC from K, KF 360 and up
- Electro-hydraulic tilting system with flame resistant HFC hydraulic fluid
- Safe, even, and precise pouring thanks to optimum pivot point in the furnace and manual throttling valve operation
- Emergency outlet for safe draining of the melt in case of crucible breakage
- No exhaust gas discharge needed
- Integrated safety system which continues to operate the furnace at reduced power in case of malfunction in the bath thermocouple, in order to prevent the freezing of the melt
- Over-temperature limiter in furnace chamber for protection against overheating. The limiter switches the heating off when the set limit temperature is reached, and only switches it back on after the temperature has fallen again
- Furnace chamber control with temperature measurement behind the crucible, recommended for melting
- Information on temperature regulation see page 24

Charging of transport ladle with K 360/12

3 x K 300/12 with work platform for melting of aluminum

Additional equipment

- Work platform for easy charging
- Crucible breakage monitor with visual and audible signal (only for models K, KF ../12)
- SMS-message to one or more mobile phones in case of crucible breakage. One or more furnaces can be connected to the messaging device in parallel
- Bath control with thermocouples in the furnace chamber and in the melt. The furnace temperature is controlled through the melt. Temperature overshoots are reduced, thus the quality of the melt is improved
- Heating system operated through thyristors in phase-angle mode provides for even load on the heating elements and results in longer service life
- Multi-step switching of the furnace heat (see page 23). In holding mode, a switch or the controller is used to turn off one heating section in order to reduce the electrical rating
- Higher electrical ratings to increase melting performance
- For information on other accessories see page 22

Model	Tmax	Crucible	Capacity		Outer dimensions in mm			Heating power	Weight in	Melting performance[3]		Holding lid closed/open
	°C		Kg Al	Kg Cu	W	D	H	in kW[4]	kg	kg/hr Al	kg/h Cu	kW
K, KF 10/12	1200	A 70	20	70	1510	1240	1040	16	750	32[1]	47[2]	3/7[1]
K, KF 20/12	1200	A 150	45	150	1660	1360	1060	20	940	42[1]	63[2]	3/7[1]
K, KF 40/12	1200	A 300	90	300	1740	1470	1140	26	1270	58[1]	84[2]	3/7[1]
K, KF 80/12	1200	TP 287	180	550	1800	1700	1180	50	1430	126[1]	190[2]	4/10[1]
K, KF 150/12	1200	TP 412	330	970	1870	1900	1460	60	1800	147[1]	220[2]	5/12[1]
K, KF 240/12	1200	TP 587	570	-	2010	2000	1460	80	2290	210[1]	-	8/17[1]
K, KF 300/12	1200	TP 587H	650	-	2010	2000	1560	80	2400	210[1]	-	9/18[1]
K, KF 360/12	1200	BUK 800	750	-	2120	2100	1550	100	2780	260[1]	-	11/20[1]
K, KF 400/12	1200	TBN 1100	1050	-	2120	2100	1700	126	3030	295[1]	-	12/22[1]
K, KF 10/13	1300	A 70	20	70	1510	1240	1040	16	800	32[1]	47[2]	5/8[2]
K, KF 20/13	1300	A 150	45	150	1660	1360	1060	20	1040	42[1]	63[2]	5/8[2]
K, KF 40/13	1300	A 300	90	300	1740	1470	1140	26	1350	58[1]	84[2]	5/8[2]
K, KF 80/13	1300	TP 287	180	550	1800	1700	1180	50	1600	126[1]	190[2]	6/11[2]

[1]At 700 °C [2]At 1000 °C

[3]The specified melting performances are maximum values. In practice, approx. 80 % are achieved.

[4]Depending on furnace design connected load might be higher

Bale-Out Furnaces TB

Gas-Fired, for Melting and Holding

TB 20/14

TB 240/12

Thermocouple for melting bath control

The gas-fired or oil-heated bale-out furnaces of the TB product lines provide for high melting output. The use of modern burner systems, optimized pressures and flame guide in the furnace as well as the processing of high-quality insulation materials result in very low energy consumption.

The TB ../12 models are largely used for melting and holding of aluminum and zinc alloys, for example in die-cast foundries. The side exhaust gas discharge provides for a high quality melt. The TB 10/14 to TB 40/14 models are mostly used for melting copper alloys in small foundries. This is why these furnaces are equipped with an exhaust gas vent over the crucible edge for high melting output and with a collar plate as a standard which can be swung to the side for pulling the crucible.

Energy Efficiency

- TB../12 with maximum furnace chamber temperature of 1200 °C for aluminum and zinc alloys
- TB../14 with maximum furnace chamber temperature of 1400 °C, suitable for copper alloys with a maximum melting bath temperature of 1300 °C (appropriate in some cases for aluminum)
- Fuel heating with gas or oil
- Two-stage output control: High load for melting operation, low load for holding operation with automatic switching between both modes
- Modern burner system with optimized flame guide: High efficiency provided by over-pressure operation to keep out entrained air
- Gas system consisting of pressure regulator, gas filter, manometer and solenoid valves
- Safe flame monitoring
- Burner technology with easy-to-service design, e.g. flame head can be removed from the rear when the burner is swung out
- Burner technology compliant with DIN 746, Part 2
- Designed for natural gas or liquid natural gas with 8.8 kWh/m³ - 25.9 kWh/m³
- Required gas input pressure 50 mbar
- Operation with other fuels and/or with another gas input pressure possible
- High melting output powered by high-performance burners and high-quality insulation
- Multi-layered insulation with lightweight refractory bricks provide the furnace chamber lining, 1400 °C models come with an additional wear-and-tear layer made of copper-resistant refractory concrete
- Emergency outlet for safe discharge of the melt in case of a crucible break

Emergency outlet for safe melt discharge in case of crucible break

- Exhaust gas discharge
  - Exhaust gas discharge over the crucible edge TB.../14 models, resulting in approx. 20% more melting output compared side exhaust discharge, design without swing lid
  - Side-wall exhaust gas vent for TB.../12 models (for description, see additional equipment)
  - Exhaust gas discharge options see page 6
- Crucible pulling device with swinging collar plate for models to TB 10/14 - TB 40/14
- Over-temperature limiter for the furnace chamber with automatic reset to protect against over-temperature. The limit controller switches off the heating when the pre-set limit temperature has been reached and does not switch it on again until the temperature falls below the setting again.
- Furnace chamber control with temperature measurement behind the crucible, recommended when using as pre-melt furnace
- Information about temperature control see page 24

TB 40/14 with crucible pulling device

Additional equipment

- Side exhaust gas discharge (for 1400 °C models)
  - Low burn-off provides for high quality melt
  - Low hydrogen absorption by the melt
  - Low heat exposure for the operator in the area above the crucible
  - Swing lid which saves energy when closed
  - Approx. 20% lower melting output than for exhaust gas venting over the crucible edge
- Insulated connecting piece (exhaust flue) for side-wall exhaust gas vent to a connected customer suction system
- Exhaust gas collection hood for furnaces featuring exhaust gas venting over the crucible edge
- Information about exhaust venting see page 6
- Work platform or platform for easier charging
- Crucible breakage monitoring with optical and acoustic signal (only for models KB ../12)
- SMS-message to one or more mobile phones in case of crucible breakage. One or more furnaces can be connected to the messaging device in parallel
- Bath control system (only for 1200 °C models)
  - Furnace control via the bath temperature
  - Thermocouples in the furnace chamber and the melt
  - Improved melt quality ensured by a reduction in temperature overshoots
  - Integrated safety controller system that, in case of bath thermocouple breakage, continues to operate the furnace at a reduced output to prevent the melt from solidifying
- Crucible pulling device with swinging collar plate for models to TB 20
- Information on other accessories see page 22

Model	Tmax	Crucible	Capacity		Melting output[3]		Consumption holding lid closed	Consumption melting	Burner output	Outer dimensions in mm			Weight in
	°C		Kg Al	Kg Cu	Kg Al/h	Kg Cu/h	kWh/h	kWh/kg	kW	W	D	H	kg
								AL					
TB 80/12	1200	BU 200	200	650	140[1]	-	10	1.3 - 1.5	180	1200	1870	1240	900
TB 100/12	1200	BU 250	250	830	140[1]	-	11	1.3 - 1.5	180	1310	1980	1380	1000
TB 110/12	1200	BU 300	300	1000	150[1]	-	13	1.3 - 1.5	210	1310	1980	1510	1200
TB 150/12	1200	BU 350	350	1150	220[1]	-	15	1.3 - 1.5	300	1310	1980	1550	1400
TB 180/12	1200	BU 500	500	1650	270[1]	-	17	1.3 - 1.5	300	1450	2140	1560	1700
TB 240/12	1200	BU 600	600	2000	330[1]	-	19	1.3 - 1.5	390	1490	2180	1700	1900
TB 360/12	1200	BN 800	800	-	350[1]	-	20	1.3 - 1.5	400	1590	2280	1800	2000
TB 400/12	1200	BN 900	900	-	350[1]	-	22	1.3 - 1.5	400	1590	2280	1900	2100
TB 500/12	1200	BU 1210	1200	-	350[1]	-	23	1.3 - 1.5	400	1690	2380	1850	2300
TB 600/12	1200	BU 1310	1300	-	420[1]	-	25	1.3 - 1.5	500	1690	2380	2000	2400
TB 650/12	1200	BU 1810	1400	-	420[1]	-	26	1.3 - 1.5	500	1760	2450	1630	2300
TB 700/12	1200	BU 1510	1500	-	420[1]	-	28	1.3 - 1.5	500	1690	2380	2120	2600
TB 800/12	1200	BU 1810	1800	-	440[1]	-	30	1.3 - 1.5	500	1760	2450	2100	2800
								Cu					
TB 10/14	1400	A 100	30	100	-	90[2]	22	1.0 - 1.3	210	980	1590	1190	1000
TB 20/14	1400	A 150	45	150	-	100[2]	22	1.0 - 1.3	210	1080	1870	1310	1250
TB 40/14	1400	A 400	120	400	-	300[2]	25	1.0 - 1.3	300	1210	2000	1460	1500
TB 60/14	1400	A 500	150	500	-	320[2]	25	1.0 - 1.3	320	1210	2000	1510	1600
TB 80/14	1400	A 600	180	600	-	320[2]	25	1.0 - 1.3	320	1260	2050	1540	1750

[1]At 700 °C [2]At 1000 °C

[3]The stated melting outputs are maximum values. Daily operation comes up to roughly 80 %.

Insulated connecting piece for side exhaust gas discharge for connection to an exhaust gas system

Crucible Furnaces TBR with Recuperative Burner

Gas-Fired, for Melting and Holding

TBR 110/11

Energy Efficiency

The fuel-heated melting furnaces in the TBR product line fitted with the side exhaust gas discharge provide for optimum energy utilization combined with highest quality melt. Fitted with a burner system including heat-recovery system using a recuperative burner, the energy efficiency of ordinary fuel-heated melting furnaces is significantly improved.

Depending on utilization the hot exhaust gases from the furnace are guided through a heat exchanger in order to preheat the combustion air for the burner. The system provides for energy savings of up to 25 % compared to ordinary fuel-heated furnaces with side exhaust gas discharge. The higher purchase costs are amortized within a short time.

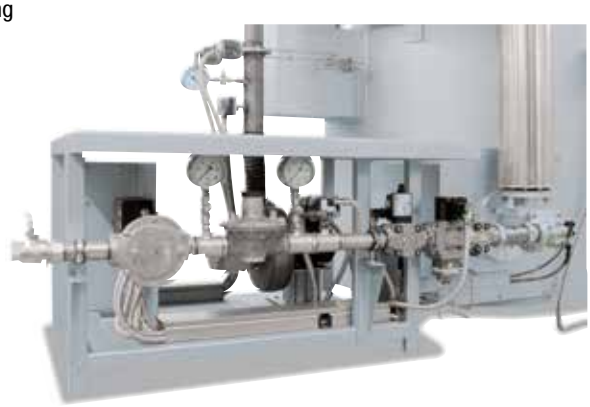
- Tmax 1100 °C for aluminum and zinc alloys
- Two-stage output control: High load for melting operation, low load for holding operation with automatic switching between both modes
- Modern burner system with optimized flame guide: High efficiency provided by over-pressure operation to keep out entrained air
- Heat exchanger in the exhaust gas duct to preheat the combustion air for the burners

- Energy savings of up to 25 % in comparison to other fuel-heated melting furnaces featuring side-wall exhaust gas vents
- Gas system consisting of pressure regulator, gas filter, manometer and solenoid valves
- Safe flame monitoring
- Burner technology with easy-to-service design, compliant with DIN 746, Part 2
- Designed for natural gas or liquid natural gas with 8.8 kWh/m³ - 25.9 kWh/m³
- Required gas input pressure 70 mbar

2 x TBR 100/11 in production

Production with 16 x TBR 100/11 and 2 x TBR 180/11

- Operation with other fuels and/or with another gas input pressure possible
- High melting output powered by high-performance burners and high-quality insulation
- Multi-layered insulation with lightweight refractory bricks provide the furnace chamber lining
- Emergency outlet for safe discharge of the melt in case of a crucible break
- Side exhaust gas discharge
  - Low burn-off provides for high quality melt
  - Low hydrogen absorption by the melt
  - Low heat exposure for the operator in the area above the crucible
- Over-temperature limiter for the furnace chamber with automatic reset to protect against over-temperature. The limit controller switches off the heating when the pre-set limit temperature has been reached and does not switch it on again until the temperature falls below the setting again.
- Furnace chamber control with temperature measurement behind the crucible
- Information about temperature control see page 24



Burner with gas supply system

Additional equipment

- Crucible made of clay graphite or SiC with higher heat conductivity
- Information about exhaust venting see page 6
- Work platform or platform for easier charging
- Crucible break monitoring with optical and acoustic signal
- Bath control system
  - Furnace control via the bath temperature
  - Thermocouples in the furnace chamber and the melt
  - Improved melt quality ensured by a reduction in temperature overshoots
  - Integrated safety controller system that, in case of bath thermocouple breakage, continues to operate the furnace at a reduced output to prevent the melt from solidifying
- Information on other accessories see page 22

Model	Tmax	Crucible	Capacity		Melting output[2]		Consumption holding lid closed	Consumption melting	Burner output
	°C		Kg Al	Kg Cu	Kg Al/h	Kg Cu/h	kWh/h	kWh/kg AL	kW
TBR 80/11	1100	BU 200	200	650	140[1]	-	8.0	1.0 - 1.1	180
TBR 100/11	1100	BU 250	250	830	140[1]	-	8.8	1.0 - 1.1	180
TBR 110/11	1100	BU 300	300	1000	150[1]	-	10.4	1.0 - 1.1	210
TBR 150/11	1100	BU 350	350	1150	220[1]	-	12.0	1.0 - 1.1	240
TBR 180/11	1100	BU 500	500	1650	270[1]	-	13.6	1.0 - 1.1	300
TBR 240/11	1100	BU 600	600	2000	330[1]	-	15.2	1.0 - 1.1	320
TBR 360/11	1100	BU 800	800	-	350[1]	-	16.0	1.0 - 1.1	320

[1]At 700 °C

[2]The stated melting outputs are maximum values. Daily operation comes up to roughly 80 %.

Heat exchanger in the exhaust gas duct

Bale-Out Furnaces T (Brick Insulation) and TF (Fiber Insulation)

Electrically Heated, for Melting and Holding

T 110/11

TF 150/11

Due to their high-grade insulation and optimized connected loads the models T and TF can be used both for melting and holding. They feature good melting output together with outstanding temperature uniformity in the melt. The 1100 °C version can be used for melting aluminum, the 1200 °C version for brass as well. The 1300 °C version can also be used for melting bronze alloys.

The T models are fitted with multi-layer insulation. The furnace chamber insulation with high-quality lightweight refractory bricks is recommended for holding operation. For rapid heat-up times in non-continuous operation, the TF models can also be used, which are lined with a fiber insulation with low heat retention capacity.

Four side heating for excellent temperature uniformity

- T, TF../11 with maximum furnace chamber temperature of 1100 °C for aluminum or zinc. Maximum melt temperatures, depending on the condition of the crucible, between 950 °C and 980 °C
- T, TF../12 with maximum furnace chamber temperature of 1200 °C also suitable for brass. Maximum melt temperatures, depending on the condition of the crucible, between 1050 °C and 1100 °C
- T, TF../13 with maximum furnace chamber temperature of 1300 °C, also suitable for bronze alloys. Maximum melt temperatures, depending on the condition of the crucible, between 1150 °C and 1200 °C
- Four-side heating using electric heating elements, freely radiating on carrier tubes
- Simple replacement of individual heating elements. In case of crucible breakage, only the defective heating elements on each level need to be replaced
- Heating of furnaces up to 60 kW power rating controlled using long-lasting, noiseless solid-state-relays
- Heating of furnaces beyond 60 kW with contactors
- High melting performance with temperature uniformity in the melt
- Insulation constructed in multiple layers with lightweight refractory bricks on the hot face (T models)
- Insulation constructed in multiple layers with fiber material in the side walls and corner bricks to support heating elements (TF models)
- Emergency outlet for safe draining of the melt in case of crucible breakage
- No exhaust gas discharge needed
- Integrated safety system which continues to operate the furnace at reduced power in case of malfunction in the bath thermocouple, in order to prevent the freezing of the melt
- Over-temperature limiter in furnace chamber for protection against overheating. The limiter switches the heating off when the set limit temperature is reached, and only switches it back on after the temperature has fallen again
- Furnace chamber control with temperature measurement behind the crucible, recommended for melting
- Crucible not included in the standard version
- For Information on temperature regulation see pages 24

Manual ladling from a T 80/10

Additional equipment

- Crucible of clay-graphite or SiC
- Work platform

T 800/11

K 150/12 and T 180/11 as premelting and holding system

- Crucible breakage monitor with visual and audible signal (not for 1300 °C models
- SMS-message to one or more mobile phones in case of crucible breakage. One or more furnaces can be connected to the messaging device in parallel
- Bath control with thermocouples in the furnace chamber and in the melt (not for 1300 °C models). The furnace temperature is controlled through the melt. Temperature overshoots are reduced, thus the quality of the melt is improved
- Heating system operated through thyristors in phase-angle mode assures an even charging of heating elements
- Multi-step switching of the furnace heat (see page 23). In holding mode, a switch or the controller is used to turn off one heating section in order to reduce the electrical rating
- Higher electrical ratings to increase melting performance
- For information on other accessories see page 22

Model	Tmax	Crucible	Capacity		Outer dimensions in mm			Heating power	Weight in	Melting performance[3]		Holding lid closed/open
	°C		Kg Al	Kg Cu	W	D	H	in kW[4]	kg	kg/hr Al	kg/h Cu	kW
T, TF 10/11	1100	A 70	20	-	860	860	790	16	400	32[1]	-	3/5[1]
T, TF 20/11	1100	A 150	45	-	940	940	790	20	460	42[1]	-	3/6[1]
T, TF 40/11	1100	A 300	90	-	1010	1010	880	26	580	58[1]	-	3/7[1]
T, TF 80/11	1100	BU 200	200		1110	1110	940	50	650	126[1]	-	4/9[1]
T, TF 110/11	1100	BU 300	300	-	1200	1200	1040	60	880	136[1]	-	5/10[1]
T, TF 150/11	1100	BU 350	350	-	1200	1200	1250	60	900	147[1]	-	5/10[1]
T, TF 180/11	1100	BU 500	500	-	1370	1370	1250	70	1080	168[1]	-	7/15[1]
T, TF 240/11	1100	BU 600	600	-	1370	1370	1350	80	1200	210[1]	-	7/15[1]
T, TF 360/11	1100	BN 800	800	-	1510	1510	1490	110	2000	200[1]	-	8/17[1]
T, TF 400/11	1100	BN 900	900	-	1510	1510	1590	110	2100	200[1]	-	10/20[1]
T, TF 500/11	1100	BN 1200	1200	-	1510	1510	1640	110	2450	200[1]	-	11/21[1]
T, TF 600/11	1100	BU 1310	1300	-	1615	1615	1730	110	2550	200[1]	-	13/23[1]
T, TF 650/11	1100	BP 1000	1400	-	1685	1685	1360	110	2400	240[1]	-	13/20[1]
T, TF 700/11	1100	BU 1510	1500	-	1615	1615	1850	140	2750	240[1]	-	13/23[1]
T, TF 800/11	1100	BU 1800	1800	-	1685	1685	1830	140	2800	240[1]	-	15/25[1]
T, TF 10/12	1200	A 70	20	70	860	860	770	16	440	32[1]	47[2]	5/8[2]
T, TF 20/12	1200	A 150	45	150	940	940	770	20	520	42[1]	63[2]	5/10[2]
T, TF 40/12	1200	A 300	90	300	1010	1010	860	26	600	58[1]	84[2]	5/12[2]
T, TF 80/12	1200	BU 200	200	650	1110	1110	930	50	760	126[1]	190[2]	5/15[2]
T, TF 10/13	1300	A 70	20	70	900	900	890	16	600	32[1]	47[2]	5/8[2]
T, TF 20/13	1300	A 150	45	150	980	980	890	20	640	42[1]	63[2]	5/10[2]
T, TF 40/13	1300	A 300	90	300	1050	1050	970	26	760	58[1]	84[2]	5/12[2]
T, TF 80/13	1300	BU 200	200	650	1150	1150	1030	50	960	126[1]	190[2]	5/15[2]

[1]At 700 °C
[2]At 1000 °C
[3]The specified melting performances are maximum values. In practice, approx. 80 % are achieved.
[4]Depending on furnace design connected load might be higher

Side-wall insulation made of fiber material for TF models

Emergency outlet for the safe draining of melt in case of crucible breakage

Tilting Furnace KC and Bale-Out Furnace TC

SiC-Rod-Heated, for Melting

KC 180/14

TC 80/14

Heated on both sides by high performance SiC rods

The electrically heated tilting and bale-out furnaces of the KC and TC product lines are characterized by a higher melting performance than achievable with wire heated melting furnaces. These furnaces are designed for permanent operation at working temperatures.

- Tmax 1450 °C, also suitable for bronze alloys with a maximum melt temperature of up to 1320 °C, subject to the condition of crucible
- Heating from two sides by generously dimensioned SiC rods, temperature uniformity
- Simple exchange of individual heating elements
- Heat operation by thyistors in phase-angle mode with performance control:
  The resistance of the SiC rods changes with temperature and age. Performance control ensures constant power of heating irrespective to the condition of the heating elements.
- High melting performance with temperature uniformity
- Insulation constructed in multiple layers with lightweight refractory bricks on the hot face
- SiC-Crucible
- Electro-hydraulic tilting system with flame resistant HFC hydraulic fluid (KC models)
- Safe, even, and precise pouring thanks to optimum pivot point in the furnace and manual throttling valve operation (KC models)
- Emergency outlet for safe draining of the melt in case of crucible breakage
- No exhaust gas discharge needed
- Over-temperature limiter in furnace chamber for protection against overheating. The limiter switches the heating off when the set limit temperature is reached, and only switches it back on after the temperature has fallen again
- Furnace chamber control with temperature measurement behind the crucible
- For Information on temperature regulation see page 24

KC 150/14

Switchgear with thyristors in phase angle operation for economic power consumption

Additional equipment

- Work platform for simplified loading
- For information on other accessories see page 22

Model	Tmax °C	Crucible	Capacity Kg Al	Kg Cu	Outer dimensions in mm W	D	H	Heating power in kW[4]	Weight in kg	Melting performance[3] kg/h Al	kg/h Cu
KC 20/14	1450	A 150	45	150	1710	1900	1050	36	1500	-	120[2]
KC 40/14	1450	A 300	90	300	1770	1900	1100	36	1600	-	120[2]
KC 80/14	1450	TCP 287	200	650	1880	1970	1160	48	1900	-	180[2]
KC 150/14	1450	TCP 412	300	1000	2000	2070	1300	66	2700	-	220[2]
KC 180/14	1450	TCP 412H	-	1000	2000	2070	1500	99	3000	-	230[2]
TC 20/14	1450	A 150	45	150	1200	1250	930	36	830	80[1]	120[2]
TC 40/14	1450	A 300	90	300	1260	1250	1020	36	950	80[1]	120[2]
TC 80/14	1450	BU 200	200	650	1360	1350	1080	48	1050	120[1]	180[2]
TC 150/14	1450	BU 300	300	1000	1450	1320	1300	66	1300	140[1]	220[2]

[2]At 1000 °C
[3]The specified melting performances are maximum values. In practice, approx. 80 % are achieved.
[4]Depending on furnace design connected load might be higher

Swing lid with good sealing to collar plate to avoid heat loss over the crucible opening

Bale-Out Furnaces T ../10
Electrically Heated, for Holding

T 150/10

Bale-out of T 650/10 with robot

The perfect insulation and the reduced electric connected loads provide for perfect energy efficiency and make the T ../10 models optimally suitable for holding operation. Due to the reduced connected load these furnaces are only suitable for melting to a limited extent. This is why they are mostly used in foundries with central pre-melting furnaces followed by transportation of the melt to the holding furnace.

- Tmax 1000 °C, ideally suited for the holding of aluminum
- Four-side heating using electric heating elements, freely radiating on carrier tubes
- Simple replacement of individual heating elements. In case of crucible breakage, only the defective heating elements on each level need to be replaced
- Heating of furnaces up to 60 kW power rating controlled using long-lasting, noiseless solid-state-relays
- Heating of furnaces beyond 60 kW with contactors
- Particularly good insulation constructed in multiple layers with lightweight refractory bricks on the hot face Emergency outlet for safe draining of the melt in case of crucible breakage
- No exhaust gas discharge needed
- Crucible not included in the standard version
- Integrated safety system which continues to operate the furnace at reduced power in case of malfunction in the bath thermocouple, in order to prevent the freezing of the melt
- Over-temperature limiter in furnace chamber for protection against overheating. The limiter switches the heating off when the set limit temperature is reached, and only switches it back on after the temperature has fallen again.
- Furnace chamber control with temperature measurement behind the crucible, recommended for melting
- For Information on temperature regulation see page 24

Additional equipment, see T, TF furnaces, page 17

Design of a holding furnace with bath control system containing thermocouples for the melt, the furnace chamber and the over-temperature limiter

Model	Tmax	Crucible	Capacity		Outer dimensions in mm			Heating power	Weight in	Melting performance[2]		Holding lid closed/open
	°C		Kg Al	Kg Cu	W	D	H	in kW[3]	kg	kg/hr Al	kg/h Cu	kW
T 80/10	1000	BU 200	200	-	1150	1150	1030	20	660			4/9[1]
T 110/10	1000	BU 300	300	-	1240	1240	1130	26	890			5/10[1]
T 150/10	1000	BU 350	350	-	1240	1240	1290	38	920			5/10[1]
T 180/10	1000	BU 500	500	-	1410	1410	1290	42	1120			7/15[1]
T 240/10	1000	BU 600	600	-	1410	1410	1390	50	1240			7/15[1]
T 360/10	1000	BN 800	800	-	1510	1510	1490	50	2000	holding only		8/17[1]
T 400/10	1000	BN 900	900	-	1510	1510	1590	50	2100			10/20[1]
T 500/10	1000	BU 1210	1200	-	1615	1615	1580	50	2450			11/21[1]
T 600/10	1000	BU 1310	1300	-	1615	1615	1730	50	2550			13/23[1]
T 650/10	1000	BP 1000	1400	-	1685	1685	1360	60	2400			13/20[1]
T 700/10	1000	BU 1510	1500	-	1615	1615	1850	60	2750			13/23[1]
T 800/10	1000	BU 1800	1800	-	1685	1685	1830	70	2800			15/25[1]

[1]At 700 °C
[2]The specified melting performances are maximum values. In practice, approx. 80 % are achieved.
[3]Depending on furnace design connected load might be higher

Transportable holding furnace TM 80/10

Transportable Bale-Out Furnaces TM

Electrically Heated, for Holding Aluminum

Energy Efficiency

The bale-out furnaces of the TM product lines were developed especially for use at different pouring locations. The cylindrical, very stable furnace housing, the very high-quality insulation and the meandering heating elements are the special features of this furnace family. The furnaces are designed to be transported by forklift truck and come with a plug-in connection to the control gear. With a forklift truck the furnace can be transported to the pre-melt furnace for filling. When additional switchgear and control boxes are used, the furnace can also be optionally used at different pouring locations.

- Tmax 1000 °C, ideal for holding of aluminum
- Cylindrical, highly stable furnace housing
- Slots under the furnace for safe forklift transportation of the furnace inside the foundry
- All-round heating provided by resistant meandering heating elements
- Switchgear and control box for plug-in connection
- Heating of furnaces up to 60 kW power rating controlled using long-lasting, noiseless solid-state-relays
- Heating of furnaces beyond 60 kW with contactors
- Especially good insulation, multi-layered with fiber material in the furnace chamber
- Emergency outlet for safe discharge of the melt in case of a crucible break
- No exhaust gas vent necessary
- Crucible in standard design not included
- Furnace chamber control with temperature measurement behind the crucible
- Over-temperature limiter in the furnace chamber to protect against over-temperature The limit controller switches off the heating when the pre-set limit temperature setting has been reached and does not switch it on again until the temperature falls below the setting again.
- For Information on temperature regulation see page 24

Additional equipment, see T, TF furnaces, page 15

Model	Tmax	Crucible		Capacity		Outer dimensions in mm			Heating power	Melting output[2]		Holding Lid closed/open
	°C	Ø	H	Kg Al	Kg Cu	W	D	H	in kW[3]	kg/h Al	kg/h Cu	kW
TM 80/10	1000	BU 200		200	-	1000	1100	950	21	only for holding		4/9[1]
TM 150/10	1000	875	600	350	-	1320	1440	1000	36			5/10[1]
TM 240/10	1000	BU 600		600	-	1220	1340	1300	42			7/15[1]

[1]At 700 °C
[2]The specified melting performances are maximum values. In practice, approx. 80 % are achieved.
[3]Depending on furnace design connected load might be higher

Slots under the furnace for the forklift forks

Meander heating elements

Plug socket on the furnace for the cable connection to the switchgear and control box

Accessories for Bale-Out and Tilting Furnaces

Crucible Pulling Feature with swinging collar plate

Crucible Pulling Feature with Swinging Collar Plate

In standard version, Nabertherm crucible furnaces are built with a collar plate fixed to the furnace. The bale-out is done manually or by robot. As additional equipment, the smaller models up to T 40 can be equipped with a swinging collar plate which allows crucible pulling. To pull the crucible, the collar plate is swung to the side, so that the operator has free access to the crucible from above.

Pneumatic lid opener

Pneumatic Lid Opener for Bale-Out Furnaces for Holding

The Crucible furnaces of the T.. product lines can be equipped with an optional pneumatic lid opener. The pneumatic lid opener is activated by depressing a foot pedal. Optionally, the pneumatic lid opener can be controlled and triggered by an external signal to fully automate the ladling process. The furnace lid swings to the side and the operator has free access to the crucible. This practical feature increases energy efficiency because the furnace is only open during charging and bale-out. Over 50 % energy savings can be realized with the pneumatic lid opener vs. an always open furnace (see tables for energy consumption for each model of melting furnace, page 7).

Charging funnel for ingots

Charging Funnel for Ingots

The charging funnel made of stainless steel 1.4301 (304) makes charging the furnace much easier, especially when melting ingots. Long ingots can also be charged extending over the crucible edge, and then sink, guided, into the crucible. Furnaces which are designed with a control system with night-time reduction can, for example, be filled in the evening and, on the following morning a complete melt is ready for use. The funnel is suitable for all melting furnaces, electrically heated or gas- with a side exhaust gas discharge.

Work platform for K 240/12

Work Platform for Loading for Bale-Out and Tilting Furnaces

For bale-out and tilting furnaces, customized work platforms for charging and servicing can be provided as additional equipment. This feature is used to simplify access to the furnace, particularly for larger furnace models. The operator has access to the top of the furnace to charge ingots or clean the melt.

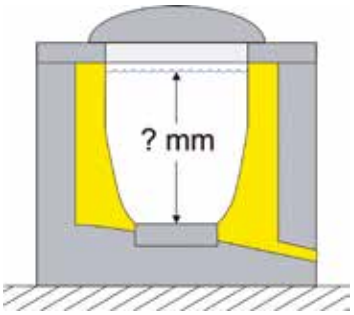
Crucible Breakage Alarm Device (up to T(B)../12)

Nabertherm melting furnaces are equipped with emergency outlet. In case of crucible breakage or leaking melt the crucible breakage alarm device will provide for a warning as soon as fluid metal emerges from the emergency outlet. The warning signal of the alarm is both optical, with an signal lamp, and acoustic, using a horn. As additional equipment it is possible to send an alarm as SMS-message to one or more mobile phones. One or more furnaces can be connected to the messaging device in parallel.

Crucible breakage alarm device under the emergency outlet of a melting furnace

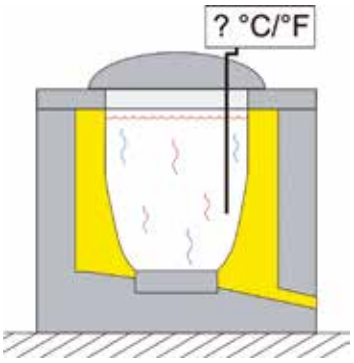
Filling Level Measurement by means of Optical Detection or Weight Loss

When crucible furnaces are used in continuous operation, it can be necessary to monitor the filling level of the crucible and provide for a signal when defined levels are reached. The signal can be either optical, acoustic, or a signal for automatic filling of the crucible. When the minimum level is reached, a signal to fill a crucible is given. On reaching the maximum level this process is stopped.
The measurement of fill level can either be done by using a scale under the furnace or by using a measurement probe to detect the fill level and which records the data very precisely independent from external influences.



Separate Bath Temperature Measurement Device

For melting furnaces with only furnace chamber temperature control, a separate bath temperature measurement device can be used to check the bath temperature. The measurement device is suitable for a temperature range from 0 to 1300 °C, and can be delivered with different dip pipe lengths (200, 380, 610 mm). Temperature measurement is carried out using a NiCr-Ni thermocouple. The submersion length of the pipe whould be 2/3 of the element length to achieve the most ideal reaction time. The average reaction time is 40 seconds. The thermocouple is suitable for all nonferrous metals except phosphor bronze.



Additional Equipment for All Electrically Heated Melting Furnaces

Multi-Step Switch for Reduction of Connected Rating

A multi-step switch switches off a part of the heating depending on the power of the corresponding furnace model. Generally, the furnace can be operated at full load for melting. If the furnace is only used in holding mode the connected rating of the furnace can be reduced by turning off a defined part of the heating capacity, resulting in a significant cost advantage. As an option, this function can be automatically switched depending on temperature.

Power Management for Reduction of the Electrical Connection Value

If several crucible furnaces are used the installation of an intelligent power management can be the right choice. Monitoring all furnaces the power management is continuously reconciling the switch-on times of the heating. This effectively prevents all furnaces from switching-on at the same time. The positive impact is that the total connected rating provided by the energy provider can be significantly reduced.

Switchgear Cooling with Fans or Air-Conditioning

The switchgear of our furnaces is designed for environment temperatures of up to 40 °C. To secure a failure-free and long lasting operation of the switchgear in case of higher temperatures they can be equipped with active fan cooling or even with an air-conditioner.

Multi-Step Switch

Control and Documentation Alternatives for Melting Furnaces

Eurotherm 3208 controller

Furnace Control with the Eurotherm 3208

In the basic model, Nabertherm melting furnaces are equipped with furnace chamber control using the Eurotherm 3208 controller. The temperature is measured in the furnace chamber behind the crucible. Two set values and a heat-up ramp rate may be entered. For example, the set values could be the pouring temperature and the lower idle temperature. Optionally, a 7-day digital timer can be fitted to automatically switch between the two temperatures and different switching times can be selected for each working day.

Work platform of K 360/12

Bath Control for Bale-Out and Tilting Crucible Furnaces (Cascade Control)

In the basic version, the bale-out and tilting crucible furnaces of the T.. and K.. product lines are equipped with with a thermocouple in the furnace chamber behind the crucible. To achieve fast heat-up times the temperature is set significantly higher than the desired bath temperature. Therefore, this control allows very fast heating-up times, but results in considerable temperature overshoots in the melt due to the indirect temperature measurement.

As an option these furnaces can be equipped with a bath control system, which is particularly well-suited for holding operations. A second thermocouple in the bath is used in addition to the furnace chamber thermocouple to measure the bath temperature. Both temperatures are reconciled by the controller. The bath temperature is the target parameter and the chamber temperature is the working tool. This control system significantly improves the melt quality because overshoots can be effectively prevented. As an alternative to the thermocouple in the melt, a thermocouple in a special pocket in the crucible wall can be used (a special crucible with pocket is required) which measures the temperature of the crucible wall. Of course, this indirect control is not as precise as a measurement in the melt. However, the thermocouple is positioned in a protected location.

Bath control with thermocouple in the melt

Bath Control with Controller Eurotherm 3504

All melting furnaces can be fitted with an optional bath control system. Instead of only being monitored by a thermocouple behind the crucible, the temperature is also measured in the melt, respectively in the pocket of the crucible wall, (see also description on page 23). Furnaces already in use can also be upgraded with a bath control system. An optional digital seven-day timer which automatically switches between two temperatures can also be added. The two alternate times can be selected for each working day. This allows the bath temperature, for example, to be lowered at night to save energy.

- Alternative operation modes with furnace chamber control of bath control via cascade
- Multi-line and plain text display
- Data entering by using function keys
- Programming the furnace operation with two set values (second temperature, e.g. for night-time temperature reduction)
- A separate, freely programmable preparation program, e.g. to dry the crucible. An external switch is used to switch over to the preparation program.

Compact controller Eurotherm 3504

Additional equipment

- Seven-day timer for switching between two temperatures (e.g. night-time reduction). Switching times can be separately selected for each working day.

Bath Controls with PLC and Touch Panel

The H 700 PLC features state-of-the-art bath control. It provides a combination of precise control, ease of operation and a wide variety of user applications and professional documentation. A touch panel using plain text provides a simple and clean user interface for programming and control.

Seven-day timer for switching between melting temperature and lowered temperature

- Furnace chamber control or alternatively bath control via cascade applicable
- Colored graphic display of all temperatures
- Touch panel provides a simple and clean user interface
- Seven day timer for temperature switching
- For each weekday, a program can be configured with 12 segments
- A separate, user-entered furnace preparation program that can be used to dry the crucible, etc. Access to the program is controlled by a key switch
- Customer can switch between different languages

Addtional equipment for H 700

- Manual Overriding of automatic control

  If a running program needs to be extended (for example, when working overtime to meet a customer‘s schedule), a key switch can be used to put the programmer into Manual mode in order to continue working at the present temperature. In the background, the original program is continued, and when the key switch is turned back to Program mode, the furnace resumes its currently scheduled set point.

H 700

- Documentation of melting process

  The H 700 controls can be upgraded with the Nabertherm Control Center package (NCC) on a personal computer. NCC controls provide for a professional documentation of the melting process among others, with the following features:

  - All relevant data, such as furnace chamber temperature, bath temperature, messages, etc. are always automatically stored as a daily file.
  - The switchgear is equipped with start and stop buttons. By pressing these buttons, the bath temperature is documented and stored as a file. For instance, customer batches can be monitored and archived separately.

  Additionally the Personal Computer can be used as user interface with all advantages of a PC.

Multi-Step Switch

Additional Equipment for all Controllers

- Temporary overriding of bath control to increase melting performance

  When an empty crucible is recharged, the values measured by the bath thermocouple do not correspond to the actual temperature of the solid metal. Using melt bath regulation in this case would reduce the power available to melt the metal. A pushbutton on the panel allows the operator to temporarily bypass normal control, and have the controller maintain a higher than normal chamber temperature to melt the metal faster. A user-set timer (up to 120 minutes) and set point allows the operator to optimize the time it takes to melt. When the timer elapses, the controller resumes its normal control mode.

Melting Furnaces in Customized Dimensions

K 240/12 with lifting platform for charging and pouring at different levels

Tilting Furnaces with Electrohydraulic Lifting Platforms

Depending on the material flow and space requirements in a foundry, the charging height and pouring height may need to be different for a tilting furnace. For instance, if loading is performed at ground level and the metal is poured into a machine at a higher level, then an optional electro-hydraulic lifting platform can adjust for the difference. The operation of the lifting platform is by means of a 2 hand operation with a manual throttling valve. It can also be interlocked with other machinery and be motor driven operated.

Electrically heated combi transport ladle TRP 240/S for melting, holding, and transport

Combi Transport Ladle for Melting, Holding, and Transporting

Especially in smaller foundries or in foundries with narrow space availability, our TRP 240/S combi transport pan is available. It combines a melting furnace and a transport ladle in one unit. Its electrical connected rating allows the furnace to be used for melting.

- Tmax 900 °C for melting and holding of aluminum
- Electrically heated
- Connection between switchgear and furnace pluggable
- Customer must provide plant crane
- Comfortable planetary gearbox
- Simple handling and precise pouring
- Optimally arranged heating modules resulting in very long crucible standing times

Model	Tmax °C	Crucible	Melting performance kg Al/hr	Outer dimensions in mm W	D	H	Heating power in kW[1]
TRP 240/S	900	TP 587/TP 587 SF	200	2230	1430	1210	69

[1]Depending on furnace design connected load might be higher

K 240/11 for melting of lead

Melting Furnaces for Heavy Metals

Our melting furnaces in the K, KF, T, and TF product lines can be upgraded with adapted electrical heating for melting of heavy metals like lead and zinc. The furnace is equipped with a special crucible, in most cases a steel crucible. The melting power is tailored to the type of metal to ensure optimum utilization of the furnace.

Steel crucible with special suspension brackets for high charge weight

Rotary Table System for Continuous Pouring

For continuous processes, multiple crucible furnaces can be combined on a rotary table system. For example, when using three furnaces with a rotation in 120° steps, loading takes place at the first space, de-gassing at the second space, and bale-out at the third. This ensures a continuous supply of liquid metal at the pouring location. The rotary table is designed with an emergency drain below in case of crucible breakage.

Rotary table system with 3 x T 150/11

Bath Furnaces, Electrically Heated, for Holding

The B 120 - B 500 bath furnaces (without crucibles) have been especially developed for stationary holding operation in die-cast foundries with removal of the melt by a bale-out robot. The tub of the furnace is lined with special long-life brick. The multi-layered backing insulation is designed for lowest electric connected load. The furnace tub is divided into three interconnected chambers. The heating proceeds from the lid into the center chamber. The bale-out openings are dimensioned to enable the robot to be optimally used. In holding operation bath furnaces, when used properly, provide better energy efficiency than crucible bale-out furnaces.

B 500

Model	Tmax °C	Capacity Kg Al	Outer dimensions in mm W	D	H	Weight in kg	Bale-out opening mm	Heating power in kW[1]	Holding/ kW
B 120	1000	300	1900	1150	1160	1900	300 x 300	11	2
B 250	1000	600	2030	1280	1200	2450	380 x 380	14	3
B 500	1000	1200	2350	1450	1240	3700	430 x 430	20	5

[1]Depending on furnace design connected load might be higher

Magnesium Melting Furnaces

For a variety of projects, Nabertherm has supplied melting furnaces to be upgraded by the customer for the melting of magnesium. Nabertherm supplied the furnace with all necessary control systems and the steel crucible. The furnaces were completed by the customer with the safety devices, pump systems for bale-out, and protective-gas systems. We are capable of implementing furnace systems to provide for a crucible volume of 1500 liters of magnesium.

Tilting furnaces for magnesium K 1500/75 S with 1500 liters crucible volume

Laboratory Melting Furnaces
Electrically Heated

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

KC 2/15

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

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

KC 2/15

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

Additional equipment

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

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

[1]Heating only between two phases
[2]Outer dimensions of furnace, transformer in separate housing (500 x 570 x 300 mm)
[3]Switchgear and controller mounted in a floor standing cabinet
[4]Depending on furnace design connected load might be higher

Cleaning Furnace for Riser Tubes

Electrically Heated

SRO 170/1000/11

Furnace SRO 170/1000/11 with suspended pipe

SRO 170/1000/11

Riser tubes for low-pressure melting furnaces must be cleaned in regular intervals. To remove deposits the pipe must be removed from the furnace and heated. In comparison to applying an open flame to heat the pipe, the SRO 170/1000/11 furnace offers the advantages of very uniform tube heating. The quality of the heat treatment is clearly better and the life-time of the risers can be extended when cleaned regularly. The heated rising tube can be removed from the furnace hot and returned to the low-pressure melting furnace.

The furnace is charged from above using a crane provided by the customer. Located in the lower section of the furnace is a steel catch drawer which is filled with sand or sizing compound. The rising tube hangs in the receptacle with a crane eye and the deposits drip into the drawer. Designed as a drawer, it can be easily pulled out, emptied and filled again.

- Tmax. 1100 °C
- Charging opening with collar plate and swing lid on the furnace. Charging of the rising tube using the customer crane
- Max. dimensions of the rising tube: L: 1000 mm, outer dimension 90 mm with single-side flange with an outer diameter of 115 mm
- Heated length: 1000 mm
- Charge receptacle with crane eye for holding smaller risers
- Steel catch draw, filled by the customer with sand, which collects deposits
- Steel collector designed as a drawer
- Furnace on rollers
- Switchgear and control equipment fastened directly to the furnace

Additional equipment

- Design for other riser dimesions on request
- Switchgear on rollers

To be pulled with crane eye for riser tubes with flange

Model	Tmax °C	Outer dimensions in mm W	D	H	Outer tube-Ø/ mm	Heated length/mm	Heating power in kW[1]	Electrical connection
SRO 170/1000/11	1100	590	640	1700	90	1000	12,0	3-phase

[1]Depending on furnace design connected load might be higher

Chamber Dryer
Electrically Heated or Gas-Fired

Standard models

Motor-driven rotary rack with baskets for moving the charge during heat treatment

The chamber dryers of the KTR range can be used for complex drying processes and heat treatment of charges of normal weight and packing density to an application temperature of 260 °C. The high-performance air circulation enables optimum temperature uniformity throughout the usable space. A wide range of accessories allow the furnace to be modified to meet specific process requirements. The design for the heat treatment of flammable materials in conformance with EN 1539 is available for all sizes.

- Tmax 260 °C
- Electrically heated (via a heating register with integrated chrome steel heating elements) or gas-fired (direct gas heating including injection of the hot air into the intake duct)
- Temperature uniformity up to ΔT 6 K according to DIN 17052-1 (for design wihout track cutouts) see page 60

Charging cart with pull-out trays

KTR 1500 with charging cart

KTR 21640/S with chamber lightning and drive-in tracks with insulated plugs which provide for an optimal temperature uniformity

- High-quality mineral wool insulation provides for outer temperatures of < 20 °C above room temperature
- High air exchange for fast drying processes
- Double-wing door for furnaces KTR 3100 and larger
- Over-temperature limiter with manual reset for thermal protection class 2 in accordance with EN 60519-2 as temperature limiter to protect the dryer and load
- Incl. floor insulation

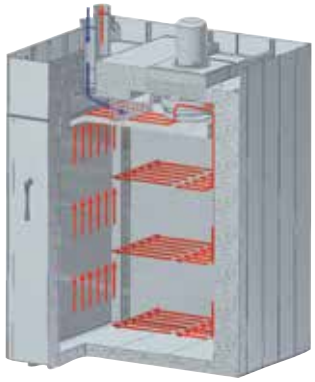
Additional equipment

- Entry ramp for pallet trucks or track cutouts for charging cart
- Optimal air circulation for individual charges by means of adjustable air outlets
- Fan system for faster cooling with manual or motor-driven control
- Programmed opening and closing of exhaust air flaps
- Observation window and furnace chamber lighting
- Safety technology according to EN 1539 for charges containing solvents see page 42
- Charging cart with or without rack system
- Design for clean room heat treatment processes
- Process control and documentation with Controltherm MV software package see page 64

KTR 3100/S for curing of composites in vacuum bags incl. pump and necessary connections in the oven chamber

Model	Tmax	Inner dimensions in mm			Volume	Outer dimensions in mm			Heating	Electrical
	°C	w	d	h	in l	W	D	H	power in kW[1]	connection*
KTR 1500	260	1000	1000	1500	1500	1930	1430	2315	21.0	3-phase
KTR 3100	260	1250	1250	2000	3100	2160	1680	2880	30.0	3-phase
KTR 4500	260	1500	1500	2000	4500	2410	1930	2880	48.0	3-phase
KTR 6125	260	1750	1750	2000	6125	2660	2180	3000	50.0	3-phase
KTR 8000	260	2000	2000	2000	8000	2910	2430	3000	59.0	3-phase

[1]Depending on furnace design connected load might be higher



Air circulation in the chamber dryer

Air Circulation Chamber Furnaces < 675 Liters
Electrically Heated

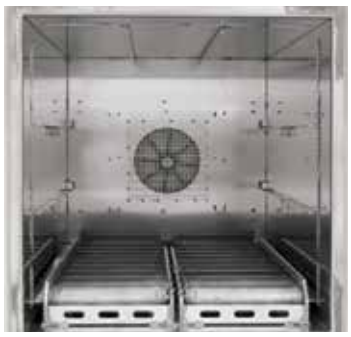
N 60/45HAS with additional door for charging of long parts which ride out of the open door

N 250/65HA with gas supply system

N 15/65HA as table-top model

The very good temperature uniformity of these chamber furnaces with air circulation provides for ideal process conditiones for annealing, curing, solution annealing, artificial ageing, preheating, or soft annealing and brazing. The furnaces are equipped with a suitable annealing box for soft annealing of copper or tempering of titanium, and also for annealing of steel under non-flammable protective or reaction gases. The modular furnace design allows for adaptation to specific process requirements with appropriate accessories.

- Tmax 450 °C, 650 °C, or 850 °C
- Heating from bottom, sides and top
- Stainless steel air-baffle box in the furnace for optimum air circulation
- Swing door hinged on the right side
- Base frame included in the delivery, N 15/65 HA designed as table-top model
- Horizontal air circulation
- Temperature uniformity up to ΔT 8 K according to DIN 17052-1 (model N 15/65 HA up to ΔT 14 K) see page 60
- Optimum air distribution enabled by high flow speeds
- One removable tray and rails for two additional trays included in the scope of delivery (N 15/65 HA without removable tray)



Roller conveyor in furnace N 250/85HA

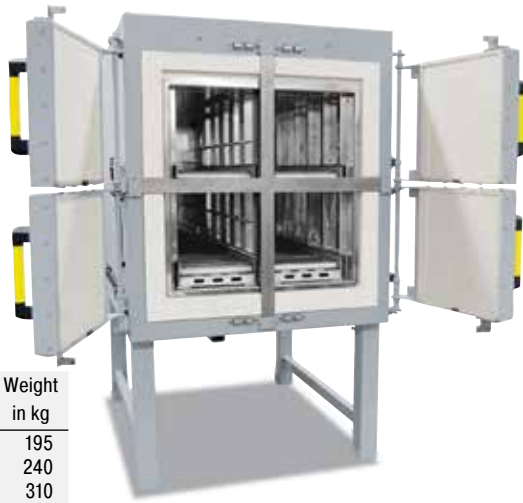
Additional equipment (not for model N 15/65HA)

- Optimization of the temperature uniformity up to +/- 3 °C according to DIN 17052-1 see page 60
- Fan cooling to accelerate the cooling process
- Motorized exhaust air flaps
- Manual lift door
- Pneumatic lift door
- Adjustable air circulation for sensitive components
- Additional removable trays
- Roller conveyor in furnace chamber for heavy charges
- Annealing boxes

N 250/65HA with quenching bath

N 120/85HAS with charging basket

- Feed and charging aids
- Designed for Tmax 950 °C
- Process control and documentation with Controltherm MV software package see page 64



Air circulation furnace N 500/HAS with four compartments, each with roller conveyor and individual door

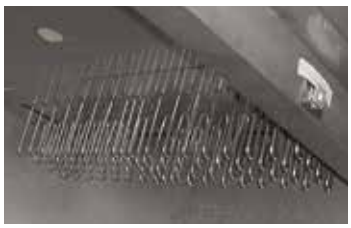
Model	Tmax	Inner dimensions in mm			Volume	Outer dimensions in mm			Heating	Electrical	Weight
	°C	w	d	h	in l	W	D	H	power in kW[3]	connection	in kg
N 30/45 HA	450	290	420	260	30	607 + 255	1175	1315	3.6	single-phase	195
N 60/45 HA	450	350	500	350	60	667 + 255	1250	1400	6.6	3-phase	240
N 120/45 HA	450	450	600	450	120	767 + 255	1350	1500	9.6	3-phase	310
N 250/45 HA	450	600	750	600	250	1002 + 255	1636	1860	19.0	3-phase	610
N 500/45 HA	450	750	1000	750	500	1152 + 255	1886	2010	28.0	3-phase	1030
N 675/45 HA	450	750	1200	750	675	1152 + 255	2100	2010	28.0	3-phase	1350
N 15/65 HA[1]	650	295	340	170	15	470	845	460	2.7	single-phase	55
N 30/65 HA	650	290	420	260	30	607 + 255	1175	1315	6.0	3-phase[2]	195
N 60/65 HA	650	350	500	350	60	667 + 255	1250	1400	9.6	3-phase	240
N 120/65 HA	650	450	600	450	120	767 + 255	1350	1500	13.6	3-phase	310
N 250/65 HA	650	600	750	600	250	1002 + 255	1636	1860	21.0	3-phase	610
N 500/65 HA	650	750	1000	750	500	1152 + 255	1886	2010	31.0	3-phase	1030
N 675/65 HA	650	750	1200	750	675	1152 + 255	2100	2010	31.0	3-phase	1350
N 30/85 HA	850	290	420	260	30	607 + 255	1175	1315	6.0	3-phase[2]	195
N 60/85 HA	850	350	500	350	60	667 + 255	1250	1400	9.6	3-phase	240
N 120/85 HA	850	450	600	450	120	767 + 255	1350	1500	13.6	3-phase	310
N 250/85 HA	850	600	750	600	250	1002 + 255	1636	1860	21.0	3-phase	610
N 500/85 HA	850	750	1000	750	500	1152 + 255	1886	2010	31.0	3-phase	1030
N 675/85 HA	850	750	1200	750	675	1152 + 255	2100	2010	31.0	3-phase	1350

[1]Table-top model
[2]Heating only beetween two phases
[3]Depending on furnace design connected load might be higher

Air Circulation Chamber Furnaces > 560 Liters
Electrically Heated or Gas-Fired

N 3920/26HAS

N 1500/85HA with electric charging system for heavy loads



Enclosed heater coils on electrically heated models

Gas burner positioned along the furnace side

These air circulation chamber furnaces are available for maximum operating temperatures of 260 °C, 450 °C, 600 °C or 850 °C and are perfectly suited for demanding processes. Due to their robust and solid design even heavy loads can be heat treated. These furnaces are suited for use with baskets, pallets, and charging trolley. The charging can be carried out with fork lift, pallet truck, or charging trolley. The basic furnace is standing on the shop floor without floor insulation. Charging can be simplified by roller conveyors, if necessary also motorized. All furnaces are available with electric or gas heating.

Standard version for models up to 600 °C (850 °C models see page 36)

- Tmax 260 °C, 450 °C or 600 °C
- Electrically heated or gas-fired
- Electric heating by means of heater coils
- Direct gas heating or upon request with indirect gas heating with radiation tube, e.g. for heat treatment of aluminum
- Optimal air circulation for your charge by means of adjustable air outlets
- Horizontal air flow (type ../HA)
- High air exchange for perfect heat transfer
- Ground level charging without floor insulation for 260 °C models
- Temperature uniformity up to ΔT 10 K according to DIN 17052-1 see page 60
- Furnace chamber lined with alloy 1.4301 (DIN)
- High quality mineral wool insulation provides for low outer temperatures
- Inside unlocking device for furnaces with walk-in chambers
- Furnace sizes suitable for common charging systems, such as pallets, baskets, etc.
- Double-wing door for furnaces with an internal width of more than 1500 mm (260 °C and 450 °C models). Furnaces for higher temperatures and with smaller sizes are equipped with a single-wing door.

N 2520/60HA with roller conveyor inside and in front of the furnace

N 1500/85HA with lift door and work piece holders in the furnace

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

Additional equippment for models up to 600 °C

- Optional floor insulation provides for improved temperature uniformity for 260 °C models
- Entry ramps or track cutouts for floor-level charging cart of models with bottom insulation (not for 600 °C models)
- Furnace positioned on base frame provides for ergonomic charging height
- Electro-hydraulic lift door
- Fan system for faster cooling with manual or motor-driven control
- Motor-driven control of air inlet and exhaust air flaps for better ventilation of the furnace chamber
- Observation window and/or furnace chamber lighting (not for 600 °C models)
- Optimization of the temperature uniformity up to +/- 3 °C according to DIN 17052-1 see page 60
- Safety technology according to EN 1539 for charges containing solvents (not for 600 °C models) see page 46
- Charging systems or roller conveyors, also electrically driven provide for easy charging
- Catalytic or thermal exhaust gas cleaning systems
- Process control and documentation with Controltherm MV software package see page 64

Pull-out drawers for heavy loads

Track cutouts for pallet truck or charging cart

Air Circulation Chamber Furnaces > 560 Liters
Electrically Heated or Gas-Fired

Air circulation chamber furnace N 140000/26AS for curing of composites in vacuum bags incl. pump and necessary connections in the furnace chamber

Air circulation furnace N 790/65HAS, adjustable in height, for integration in a heat treatment plant

Standard version for models 850 °C

- Tmax 850 °C
- Electrically heated or gas-fired
- Electric heating with heating elements on supports tubes
- Direct gas heating into the outlet of the air circulation fan
- Optimal air circulation for your charge by means of adjustable air outlets
- Horizontal air-flow (type ../HA)
- High air exchange provides for perfect heat transfer
- Base frame with 900 mm charging height
- Temperature uniformity up to ΔT 10 K according to DIN 17052-1 see page 60
- Air baffles made of 1.4828 (DIN)
- Multi-layer insulation with fiber plates (not classified according to EU directive 67/548) provides for low outer temperatures
- Furnaces sizes perfectly suited to accommodate common charging systems, e.g. like pallets or pallet boxes
- Over-temperature limiter with manual reset for thermal protection class 2 in accordance with EN 60519-2 as temperature limiter to protect the furnace and load

N 670/65HAS with quenching tank

Additional equipment for models 850 °C

- Electro-hydraulic lift door
- Fan system for faster cooling with manual or motor-driven control
- Motor-driven air inlet and control of exhaust air flaps for better ventilation of the furnace chamber
- Optimization of the temperature uniformity up to +/- 3 °C according to DIN 17052-1 see page 60
- Base frame for customized charging height
- Charging systems or roller conveyors, also electrically driven provide for easy charging
- Designed for Tmax 950 °C
- Process control and documentation with Controltherm MV software package see page 64

N 12000/25AS

N 24500/20HAS

Model	Tmax	Inner dimensions in mm			Volume	Outer dimensions in mm			Circulation	Heating	Electrical
	°C	w	d	h	in l	W	D	H	rate m³/h	power in kW[3]	connection
N 560/26HA	260	750	1000	750	560	1450	1865	2220	900	13.0	3-phase
N 1000/26HA	260	1000	1000	1000	1000	1930	1900	1600	3600	18.0	3-phase
N 1500/26HA	260	1500	1000	1000	1500	2380	1900	1600	3600	22.0	3-phase
N 1500/26HA1	260	1000	1500	1000	1500	1880	2400	1600	3600	22.0	3-phase
N 2000/26HA	260	1500	1100	1200	2000	2380	2000	1800	6400	22.0	3-phase
N 2000/26HA1	260	1100	1500	1200	2000	1980	2400	1800	6400	22.0	3-phase
N 2010/26HA	260	1000	1000	2000	2000	1880	1900	2720	7200	30.0	3-phase
N 2880/26HA	260	1200	1200	2000	2880	2080	2100	2720	9000	54.0	3-phase
N 4000/26HA	260	1500	2200	1200	4000	2380	3110	1800	9000	47.0	3-phase
N 4000/26HA1	260	2200	1500	1200	4000	3080	2410	1800	9000	47.0	3-phase
N 4010/26HA	260	1000	2000	2000	4000	1880	2900	2720	9000	54.0	3-phase
N 4500/26HA	260	1500	1500	2000	4500	2380	2400	2720	12800	54.0	3-phase
N 5600/26HA	260	1500	2500	1500	5600	2110	3180	2340	9000	69.0	3-phase
N 6750/26HA	260	1500	3000	1500	6750	2110	3680	2340	19200	98.0	3-phase
N 7200/26HA	260	2000	1500	2400	7200	2610	2410	3000	18000	93.0	3-phase
N 10000/26HA	260	2000	2500	2000	10000	2610	3180	2840	25600	106.0	3-phase
N 560/45HA(E[1])	450	750	1000	750	560	1450	1865	2220	900	13.0[1]/ 19.0	3-phase
N 1000/45HA(E[1])	450	1000	1000	1000	1000	1930	1900	1600	3600	18.0[1]/ 40.0	3-phase
N 1500/45HA(E[1])	450	1500	1000	1000	2380	1900	1600	1320	3600	22.0[1]/ 40.0	3-phase
N 1500/45HA1(E[1])	450	1000	1500	1000	1500	1880	2400	1600	3600	22.0[1]/ 40.0	3-phase
N 2000/45HA(E[1])	450	1500	1100	1200	2000	2380	2000	1800	6400	22.0[1]/ 46.0	3-phase
N 2000/45HA1(E[1])	450	1100	1500	1200	2000	1980	2400	1800	6400	22.0[1]/ 46.0	3-phase
N 2010/45HA(E[1])	450	1000	1000	2000	2000	1880	1900	2720	7200	30.0[1]/ 54.0	3-phase
N 2880/45HA(E[1])	450	1200	1200	2000	2880	2080	2100	2720	9000	54.0[1]/ 66.0	3-phase
N 4000/45HA(E[1])	450	1500	2200	1200	4000	2380	3110	1800	9000	47.0[1]/ 65.0	3-phase
N 4000/45HA1(E[1])	450	2200	1500	1200	4000	3080	2410	1800	9000	47.0[1]/ 65.0	3-phase
N 4010/45HA(E[1])	450	1000	2000	2000	4000	1880	2900	2720	9000	54.0[1]/ 66.0	3-phase
N 4500/45HA(E[1])	450	1500	1500	2000	4500	2380	2400	2720	12800	54.0[1]/ 66.0	3-phase
N 5600/45HA(E[1])	450	1500	2500	1500	5600	2110	3180	2340	9000	69.0[1]/ 93.0	3-phase
N 6750/45HA(E[1])	450	1500	3000	1500	6750	2110	3680	2340	19200	98.0[1]/116.0	3-phase
N 7200/45HA(E[1])	450	2000	1500	2400	7200	2610	2410	3000	18000	93.0[1]/117.0	3-phase
N 10000/45HA(E[1])	450	2000	2500	2000	10000	2610	3180	2840	25600	106.0[1]/130.0	3-phase
N 1000/60HA	600	1000	1000	1000	1000	1930	1900	1600	3600	40.0	3-phase
N 1500/60HA	600	1500	1000	1000	1500	2380	1900	1600	3600	40.0	3-phase
N 1500/60HA1	600	1000	1500	1000	1500	1930	2400	1600	3600	40.0	3-phase
N 2000/60HA	600	1500	1100	1200	2000	2380	2000	1800	6400	46.0	3-phase
N 2000/60HA1	600	1100	1500	1200	2000	1980	2400	1800	6400	46.0	3-phase
N 4000/60HA	600	1500	2200	1200	4000	2380	3110	1800	9000	65.0	3-phase
N 4000/60HA1	600	2200	1500	1200	4000	3080	2410	1800	9000	65.0	3-phase
N 1000/85HA	850	1000	1000	1000	1000	2100	2000	1900	3400	46.0	3-phase
N 1500/85HA	850	1500	1000	1000	1500	2600	2000	1900	6400	46.0	3-phase
N 1500/85HA1	850	1000	1500	1000	1500	2100	2600	1900	6400	46.0	3-phase
N 2000/85HA	850	1500	1100	1200	2000	2600	2100	2100	9000	64.0	3-phase
N 2000/85HA1	850	1100	1500	1200	2000	2200	2800	2100	9000	64.0	3-phase
N 4000/85HA	850	1500	2200	1200	4000	2600	3400	2100	12600	97.0	3-phase

[1]Reduced connected power for plastics applications
[3]Depending on furnace design connected load might be higher

N 3968/80HAS for heat treatment of cutting tools

N 4010/45HA with track cutouts, chamber lighting and observation window

Air Circulation Bogie Hearth Furnaces
Electrically Heated or Gas-Fired

Air circulation bogie hearth furnace W 5290/85 AS with annealing box for heat treatment of coils under protective gas

W 4000/60AS with charging basket made of 1.4828

The air circulation bogie hearth furnaces W 1000/60A - W 8300/85A are used when heavy charges weighing up to more than 25 t have to be heat-treated. They are ideal for processes such as solution annealing, artificial ageing, annealing or soft annealing, for which a high degree of temperature uniformity is crucial. The high-performance air circulation assures that the temperature uniformity achieved throughout the work space is outstanding. A broad selection of additional equipment enables these furnaces to be optimally adapted to suit specific processes.

Cooling fan for accelerated cooling

- Tmax 600 °C or 850 °C
- Dual shell housing with rear ventilation provides for low shell temperatures for the 850 °C models
- Swing door hinged on the right side
- Heating from chrome steel heating elements for the 600 °C models
- Heating from three sides (both side walls and the trolley) for the 850 °C models
- High-performance air circulation fan with vertical circulation
- Temperature uniformity up to ΔT 10 K according to DIN 17052-1 see page 60
- Bottom heating protected by SiC tiles on the bogie providing level stacking surface for the 850 °C models

Charge support in an air circulation bogie hearth furnace for 850 °C

- Furnace chamber fitted with inner sheets made of stainless steel 1.4301 for 600 °C models and of 1.4828 for 850 °C models
- Insulation structured with high-quality mineral wool for 600 °C models
- Insulation made of high-quality, non-classified fiber material for 850 °C models
- Bogies with flanged wheels running on rails for easy and precise movement of heavy loads

Air circulation bogie hearth furnace for heat-treating coils

- Electric chain-driven bogie in combination with rail operation for smooth movement of heavy loads from model W 4800
- Over-temperature limiter with manual reset for thermal protection class 2 in accordance with EN 60519-2 as temperature limiter to protect the furnace and load

Additional equipment

- Direct gas heating or upon request with indirect gas heating with radiation tube
- Electric chain-driven bogie in combination with rail operation for smooth movement of heavy loads up to Model W 4000
- Optimization of the temperature uniformity up +/- 3 °C according to DIN 17052-1 see page 60
- Bogie running on steel wheels with gear rack drive, no rails in front of the furnace necessary
- Different possibilities for an extension to a bogie hearth furnace system:
  - Additional bogies
  - Bogie transfer system with parking rails to exchange bogies running on rails or to connect multiples furnaces
  - Motor-driven bogies and cross-traversal system
  - Fully automatic control of the bogie exchange
- Electro-hydraulic lift door
- Motor-driven exhaust air flaps, adjustable via the program
- Uncontrolled or controlled cooling system with frequency-controlled cooling fan and motor-driven exhaust air flap
- Multi-zone control adapted to the particular furnace model provides for optimum temperature uniformity in the 850 °C models
- Commissioning of the furnace with test firing and temperature uniformity measurement (also with load) for the purpose of process optimization
- Designed for Tmax 950 °C, fan blade driven indirectly via a belt to protect the air recirculation motor against over-heating
- Process documentation and control with Controltherm MV software package, NTLog and NTGraph for the basic furnace or Nabertherm Control Center (NCC) for monitoring, documentation and control see page 64

W 10430/85AS

W 13920/60AS4 with floor grid for heavy loads

Model	Tmax	Inner dimensions in mm			Volume	Outer dimensions in mm			Heating power	Electrical
	°C	w	d	h	in l	W	D	H	in kW[1]	connection
W 1000/.. A		800	1600	800	1000	1800	2390	2305	50.0	3-phase
W 1600/.. A		1000	1600	1000	1600	2000	2390	2535	50.0	3-phase
W 2200/.. A		1000	2250	1000	2200	2000	3040	2535	95.0	3-phase
W 3300/.. A	600	1200	2250	1200	3300	2200	3040	2745	95.0	3-phase
W 4000/.. A	or	1500	2250	1200	4000	2500	3040	2780	120.0	3-phase
W 4800/.. A	850	1200	3300	1200	4800	2200	4090	2780	120.0	3-phase
W 6000/.. A		1500	3300	1200	6000	2500	4090	2900	156.0	3-phase
W 6600/.. A		1200	4600	1200	6600	2200	5390	2770	152.0	3-phase
W 7500/.. A		1400	3850	1400	7500	2400	4640	2980	154.0	3-phase
W 8300/.. A		1500	4600	1200	8300	2500	5390	2780	203.0	3-phase

[1]Depending on furnace design connected load might be higher

Air Circulation Pit-Type Furnaces

Electrically Heated or Gas-Fired

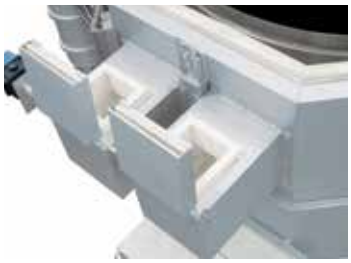
S 1780/60AS

S 1000/85A

S 100/60A - S 1000/85A

Due to their robust design, these pit-type furnaces with air circulation are particularly useful for a professional heat treatment demanding optimum temperature uniformity. Production processes such as tempering, solution annealing, artificial ageing, and soft annealing can be realized with these pit-type furnaces.

- Tmax 600 °C or 850 °C
- Useful for heavy charge weights
- Air circulation fans in the furnace lid, high circulation rate
- Heating chamber with air baffle cylinder
- Heating elements on all wall surfaces
- Distribution of air flow through grid at the furnace floor
- Pneumatic or hydraulic lifting device
- Temperature uniformity up to ΔT 6 K according to DIN 17052-1 see page 60



Motor-driven air-inlet and axhaust air flaps

Additional equipment

- Integral fan for fast cooling
- Optimization of the temperature uniformity up to +/- 2 °C according to DIN 17052-1 see page 60
- Variable rpm converter control of the air circulation velocity for sensitive parts
- Multiple zone control or special air circulation system for optimum temperature uniformity tailored to the charge
- Charge weights up to 7 tons
- Designed for Tmax 950 °C, fan blade driven indirectly via a belt to protect the air recirculation motor against overheating
- Process control and documentation with Controltherm MV software package see page 64

2 x S 5600/75 AS in production

Model	Tmax	Inner dimensions cond. cylinder		Volume	Max. charging weight	Outer dimensions in mm			Heating power	Electrical	Weight
	°C	ø in mm	h in mm	in l	in kg/m²	W	D	H	in kW[1]	connection	in kg
S 100/..A		450	600	100	1500	1100	1200	1600	17.5	3-phase	1000
S 200/..A		600	800	200	1500	1200	1300	2050	28.5	3-phase	1300
S 300/..A	600	600	1000	300	1500	1200	1300	2250	39.5	3-phase	1500
S 500/..A	or	800	1000	500	1500	1400	1600	2400	52.5	3-phase	1600
S 600/..A	850	800	1200	600	1500	1400	1600	2600	62.5	3-phase	1800
S 800/..A		1000	1000	800	1500	1600	1800	2400	70.0	3-phase	1900
S 1000/..A		1000	1300	1000	1500	1600	1800	2700	90.0	3-phase	2200

[1]Depending on furnace design connected load might be higher

Pit-Type and Top-Loading Furnaces with or without Air Circulation

Electrically Heated or Gas-Fired

Our top-loading furnaces are perfectly suited for the heat treatment of longer or heavier components. The furnace is usually charged with a factory crane. Due to their high-performance air recirculation system, the furnaces provide for excellent temperature uniformity up to a maximum temperature of 850 °C. The top-loading furnaces for the temperature range up to 1280 °C provide for very good temperature uniformity due to their five-side heating. Alternatively, these furnaces can also be provided with gas heating. Customized dimensions are designed and produced to accomodate the size and weight of the components to be treated.

S 5120/GS1, furnace chamber divided in two sections, split cover

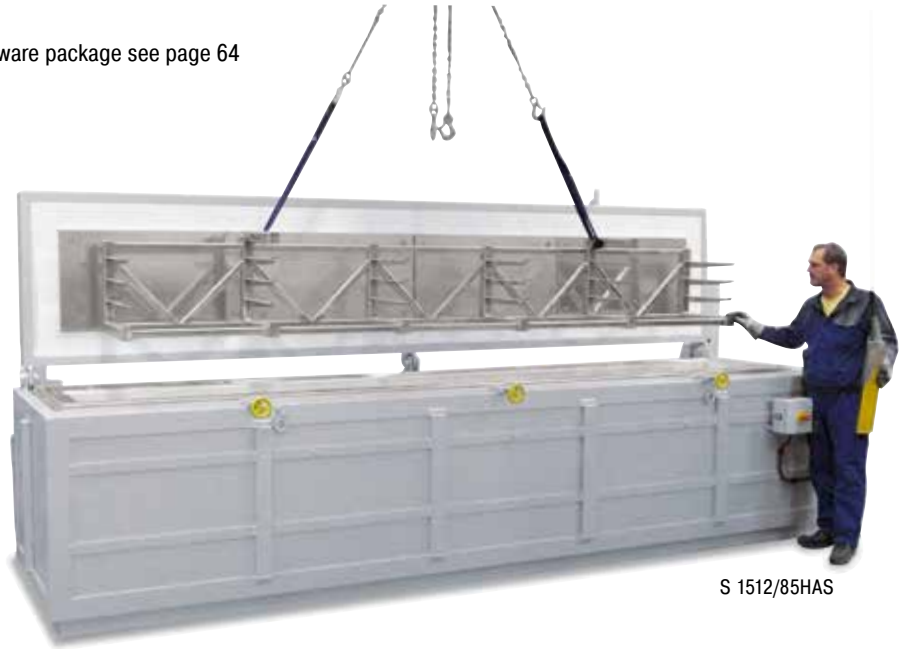
- Tmax 260 °C, 450 °C, 600 °C or 850 °C for furnaces with air recirculation
- Tmax 900 °C or 1280 °C for furnaces with radiant heating
- Electrically heated or gas-fired
- Heating from both long sides for furnaces with air recirculation
- Heating from all four sides and the floor with SiC plates in the floor as level stacking support for models to 900 °C or 1280 °C
- High-quality insulation, adapted to the specific maximum temperature
- Electrohydraulic opening system of the lid with two-hand operation
- Closable air supply vents in the lower area of the furnace chamber
- Closable exhaust air vents in the lid
- Over-temperature limiter with manual reset for thermal protection class 2 in accordance with EN 60519-2 as temperature limiter to protect the furnace and load

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

Additional equipment

- Motor-driven exhaust air flaps for faster cooling
- Controlled fan cooling with motor-driven exhaust air flaps
- Multi-zone control of the heating provides for optimum temperature uniformity
- Furnace chamber can be devided in length for short workparts, partitions can be controlled separately
- Designed for Tmax 950 °C, fan blade driven indirectly via a belt to protect the air recirculation motor against over-heating
- Process control and documentation with Controltherm MV software package see page 64

S 4100/S for sintering of high parts



S 1512/85HAS

Tempering Plants for Steel and NE-Metals

Fully automatic tempering system for aluminum with 2 pit furnaces, water bath, and 6 parking places

Removal of the charge basket from solution annealing and transfer to water bath

Fully Automatic Tempering System with Air Circulation Pit-Furnace S 1780/65 AS for Solution Annealing, Water Bath, Lift Conveyor and Pit Furnace S 3180/26AS for Artificial Aging

This tempering system is available for the tempering of aluminum parts with a quenching time of 30 seconds. All functional processes are fully automated. Both, the solution annealing and the artificial aging furnaces are designed as pit furnaces.

To save time, the conveyor unit picks-up the lid of the solution annealing furnace after solution annealing, along with the attached load basket and transports it to the water bath. The lid is then unlinked and conveyed back to the solution annealing furnace. After quenching, the basket is parked in a free spot.

The subsequent artificial aging process also takes place in a pit furnace. Due to the longer period needed for artificial aging, the artificial aging furnace is equipped for the introduction of two baskets, while the solution annealing furnace can only handle one.

PC interface for central operation

The entire heat treatment, including all movements, is fully automated. The PLC controls handle all movement and locking processes. The system automatically detects occupied parking spaces and furnaces and starts the programmed processes according to priority. Charge documentation takes place on an ongoing basis, that is, the loaded basket is documented from the time it is loaded into a parking place until removal after the end of the process.

Systems design

- Pit furnace S 1780/65 AS for solution annealing of one basket, Tmax 650 °C, volume 1780 liters
- Pit furnace S 3180/26 AS for artificial aging of two baskets, Tmax 260 °C, volume 3180 liters
- Water bath with powerful circulation and heating, along with control of the water temperature
- Linear lift conveyor for all movement processes
- PLC controls with Nabertherm Control Center (NCC) for temperature regulation, control of all movements, and parallel batch documentation
- 6 parking spots with automatic occupancy detection, loading with forklift
- Safety fence around the entire system

Fully automated tempering system with two chamber furnaces, quench bath, conveyor system, and parking spots for four charge baskets

Fully Automated Heat Treatment Plant with Air Circulation Bogie Hearth Furnace W 2780/60 AS for Solution Annealing, W 2780/26 AS for Artificial Aging, Lift Conveyor, and Heated Water Bath

This tempering system is available for the tempering of T6 aluminum alloys with a quenching time of 10 seconds. All functional processes are fully automated. Both the solution annealing furnace and the artificial aging furnace are mounted on a platform and are designed as bogie hearth furnaces. After solution annealing, the conveyor unit positions itself in front of the furnace, the door opens, the bogie moves out, and the basket is automatically picked-up by the lift conveyor. The bogie moves back into the furnace and the load is quenched in the water bath underneath.

After the quenching process, the basket is lifted back out of the water bath, drips off, and is conveyed to the artificial aging furnace. After artificial aging, the lift conveyor transports the basket to a free parking spot.

The entire heat treatment, including all movements, is fully automated. The PLC controls handle all movement and locking processes. The system automatically detects occupied parking spaces and furnaces and starts the programmed processes according to priority. Charge documentation takes place on an ongoing basis, that it, the loaded basket is documented from its process start in the parking space until removal after the end of the process.

System Design

- Bogie hearth furnace W 2780/60 AS for solution annealing, Tmax 600 °C, volume 2780 liters
- Bogie hearth furnace W 2780/26 AS for artificial aging, Tmax 260 °C, volume 2780 liters
- Water bath with powerful circulation and heating, along with control of the water temperature
- Linear lift conveyor for all movement processes
- PLC controls with Nabertherm Control Center (NCC) for temperature regulation, control of all movements, and parallel batch documentation
- 5 parking spots with automatic occupancy detection, loading with forklift
- Safety fence around the entire system

Heat Treatment Plants for Steel and NE-Metals

Bogie hearth furnace W 7440/26 AS for solution annealing and water bath WB 24000/S for quenching

2 x S 3570/65 AS for solution annealing

Manual Heat Treatment Plant with Two Air Circulation Pit Furnaces S 3570/65 AS for Solution Annealing, Water Bath, Bogie Hearth Furnace W 7440/26 AS for Artificial Aging

This tempering system was built for the tempering of aluminum parts for automaotive industry. The movement processes are performed manually using the customer's crane. These solution annealing furnaces are designed as pit furnaces, while the artificial aging furnace is a bogie hearth furnace.

Solution annealing of the components takes place in two pit furnaces with 3570 liter furnace chambers. After the solution annealing process is concluded, the lid of the furnace is opened pneumatically, the basket is removed using the crane, and it is placed into the water bath. For better quench results, the water bath is equipped with a powerful circulation pump.

After quenching, the operator uses the crane to move the load onto the bogie of furnace W 7440/26 AS for artificial aging. The bogie hearth furnace is equipped with a chain-driven bogie which is moved out of the furnace electrically. The furnace is dimensioned to accept the loads from both solution annealing furnaces.

Water bath with powerful circulation pump

The furnace has PLC controls for temperature measurement and charge documentation. Every load can be assigned a name or a charge number, which is then stored along with the date.

System Design

- 2 pit furnaces S 3570/65 AS for solution annealing of one basket each, Tmax 650 °C, volume 3570 liters
- Bogie hearth furnace W 7440/26 AS for artificial aging of two baskets, Tmax 260 °C, volume 7440 liters
- Water bath with powerful circulation and heating, along with control of the water temperature
- PLC controls with Nabertherm Control Center (NCC) for charge documentation

Annealing system with lift-top furnace H 4263/12S and water bath

Quench and temper system with drop-bottom furnace FS 2200/60AS and quench bath

Air Circulation Chamber Furnaces/Ovens with Safety Technology for Solvent-Containing Charges According to EN 1539 or NFPA 68

Ship-lock type furnace N 560/26HACLS with safety technology, front charging and rear unloading

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

Exhaust port and powerful exhaust fan mounted on the furnace

Guide-in tracks for furnaces with bottom insulation

Safety Technology for Air Circulation Chamber Furnaces

Certain processes release and vaporize solvents or other flammable vapors. The concentration of these vapors must be kept below a certain limit to prevent ignition. European Norm EN 1539 and NFPA 68 in the USA prescribe the required safety equipment for these processes.

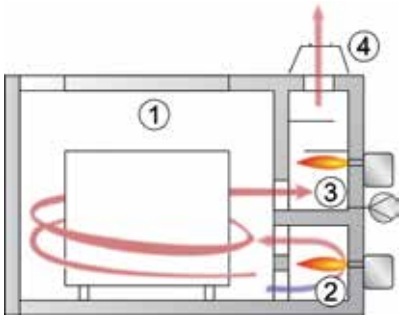
For these applications and processes, all air circulation furnaces of the KTR and N ..HACLS product lines are suited with safety technology for protection of a potentional ignition in the furnace chamber.

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

- Furnace sizes between 120 and 10000 liters
- Powerful exhaust fan capable of maintaining underpressure in the furnace
- Defined and monitored air circulation flow and exhaust air
- Visual and audible emergency signals
- Over-temperature limiter with manual reset for thermal protection class 2 in accordance with EN 60519-2 as temperature limiter to protect the furnace and load

Chamber Furnaces for Heat Cleaning

Gas-Fired with Integrated Thermal Afterburner



1 Furnace chamber
2 Gas heater of the furnace chamber
3 Thermal afterburner
4 Exhaust hood

NBCL 2300

The chamber furnaces in the model series NBCL are used for heat cleaning of components. An optimum temperature uniformity is not a priority for these processes. Examples are heat cleaning of electric motors, coated surfaces of steel components or the nozzles of plastic injection molding machines.

The furnaces are gas-fired and have an integrated thermal afterburner system which is also gas-fired. The pre-set, low-oxygen respectively reducing atmosphere in the furnace effectively prevents spontaneous combustion at the workpiece and subsequent damage as a result of over-temperature.

The generated exhaust gases are guided from the furnace chamber into the thermal afterburner where they are incinerated. Depending on the type of exhaust gas involved complete incineration is possible.

For safe operation, the furnace door locks after program start and cannot be opened again until the temperature has dropped below 180 °C at the process end. In case of a burner flame malfunction or gas shortage the process is aborted. In addition, the control system is equipped with an over-temperature limiter with manual reset that is set by the customer at a safe cut-off temperature to switch off the furnace if the limit is exceeded.

The furnaces are not suitable for components and coatings that contain solvents or a high concentration of water. These models must also not be used for charges with low flash points such as wood, paper or wax.

NBCL 1300

- Tmax 500 °C
- Standard sizes with furnace chambers up to 2500 liters
- Furnace housing with equipped for safe transport with forklift
- Furnace chamber size dimensioned to hold standard lattice boxes
- Furnace chamber insulation made of non-classified fiber material, floor and rear wall insulated with lightweight refractory bricks
- High performance, atmospheric burner fueled by liquified gas or natural gas
- Completely automated temperature controls
- Integrated thermal afterburner for exhaust gas cleaning

Gas burners for furnace heating and thermal afterburner

Model	Tmax	Inner dimensions in mm			Outer dimensions in mm			Burner rating furnace chamber	Burner ratingTNV
	°C	w	d	h	W	D	H	in kW	in kW
NBCL 1300	500	1200	900	1000	2160	2310	2450	50	100
NBCL 2300	500	1200	1200	1600	2160	2605	3050	100	100
NBCL 2500	500	1200	1600	1300	2160	3000	2750	100	100

Dewaxing Furnaces

Electrically Heated (N../WAX) or Gas-Fired (NB../WAX)

N 150/WAX

N 660/WAX

Grid bottom

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

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

Standard equipment N../WAX, electrically heated

- Chamber furnace with wide-opening swinging door
- Tmax 850 °C
- Four side heating with freely radiating heating elements on ceramic carrier tubes
- Heated drainage in floor, controlled by a separate controller up to a maximum of 200 °C, to reliably prevent freezing of the draining wax - Release of furnace heating only possible after drain temperature is reached, to prevent clogging
- Stainless steel floor pan with grid bottom for level loading
- Rugged self-supporting, vaulted arch construction
- Exhaust gas vent in furnace ceiling for connection with ductwork (starting with N 440 manual exhaust air flap)
- Air inlet openings for reliable air exchange
- Dual shell furnace housing for low exterior temperatures
- Removable base included in delivery (fixed base for models N 440 and larger)
- First over-temperature limiter which must be set below the ignition point of the wax and prevents the wax from igniting during dewaxing. It is customers responsibility to set the required time interwal for dewaxing. After this time has elapsed the over-temperature limiter will be deactivated to make sure that the furnace can continue with the sintering process.
- Second over-temperature limiter with manual reset for thermal protection class 2 in accordance with EN 60519-2 as temperature limiter to protect the furnace and load

Drain pan in floor

NB 1000/WAX

Gas-fired NB 660/WAX

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

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

Drawer for collection of liquid wax

Standard equipment NB../WAX, directly gas-fired

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

Additional equipment for N and NB

- Catalytic or thermal afterburning systems see page 55

Gas burner for NB 660/WAX model.

Model	Tmax	Inner dimensions in mm			Volume	Outer dimensions in mm			Max. drain-off volume	Heating power	Electrical	Weight
	°C	w	d	h	in l	W	D	H	in l	in kW[1]	connection	in kg
NB 660/WAX	850	550	700	780	300	860	1340	1750	20	36.0	-	430
NB 1000/WAX	850	600	1100	1000	650	1000	1820	1820	25	105.0	3-phase	850
N 100/WAX	850	400	530	460	100	660	1045	1430	5	7.5	3-phase	340
N 150/WAX	850	450	530	590	150	710	1045	1560	8	9.5	3-phase	360
N 200/WAX	850	500	530	720	200	760	1045	1690	10	11.5	3-phase	440
N 300/WAX	850	550	700	780	300	810	1215	1750	15	15.5	3-phase	480
N 440/WAX	850	600	750	1000	450	1010	1440	1815	17	20.5	3-phase	885
N 660/WAX	850	700	850	1100	650	1120	1540	1925	20	26.5	3-phase	1000
N 1000/WAX	850	800	1000	1250	1000	1290	1730	1830	25	40.5	3-phase	1870
N 1500/WAX	850	900	1200	1400	1500	1390	1930	1990	35	57.5	3-phase	2570
N 2200/WAX	850	1000	1400	1600	2200	1490	2130	2190	50	75.5	3-phase	3170

[1]Depending on furnace design connected load might be higher

Bogie Hearth Furnaces
Electrically Heated

W 2200/S with exchangeable table system

W 7500 with bogie, separated in three parts

Meander shaped heating elements for short process times

W 1000/G - W 10000

For annealing and hardening of larger parts, for example heavy cast parts or tool steel dies to temperatures between 800 °C and 1100 °C, we recommend our bogie hearth furnaces with radiation heating. The bogie can be loaded outside the furnace. When the design includes an electro-hydraulic lift door and a motorized bogie, the furnace can be opened while hot and the load can be removed for cooling or quenching. When several bogies are used together with a second door or bogie transfer system, one bogie can be loaded outside the furnace while the other bogie is in the furnace. This shortens process times and the residual energy of the furnace can be used when the new charge is heated.

- Tmax 900 °C or 1280 °C
- Dual shell housing with rear ventilation, provides low shell temperatures
- Swing door hinged on the right side
- Heating from five sides (four sides and bogie) provides for a optimum temperature uniformity
- Bogie heating receives power via blade contacts when driven in
- Heating elements mounted on support tubes provide for free radiation and long service life
- Bottom heating protected by SiC tiles on the bogie providing level stacking surface
- Multi-layer insulation consisting of lightweight refractory bricks backed by microporus silica insulation
- Self-supporting and long-life ceiling construction with bricks laid in arched construction
- Bogies with flanged wheels running on rails for easy and precise movement of heavy loads
- Adjustable air inlet damper
- Manual exhaust air flap on the furnace roof

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

Additional equipment

- Fiber insulation also in combination with meander shaped heating for short heating times
- Electric chain-driven bogie in combination with rail operation for smooth movement of heavy loads
- Bogie running on steel wheels with gear rack drive, no rails in front of the furnace necessary
- Different possibilities for an extension to a bogie hearth furnace system:
  - Additional bogies
  - Bogie transfer system with parking rails to exchange bogies running on rails or to connect multiples furnaces
  - Motor-driven bogies and cross-traversal system
  - Fully automatic control of the bogie exchange
- Electro-hydraulic lift door
- Motor-driven exhaust air flap, switchable via the program
- Uncontrolled or controlled cooling system with frequency-controlled cooling fan and motor-driven exhaust air flap
- Multi-zone control adapted to the particular furnace provides model for optimal the temperature uniformity
- Commissioning of the furnace with test firing and temperature uniformity measurement (also with load) for the purpose of process optimization
- Process documentation and control with Controltherm MV software package, NTLog and NTGraph for the basic furnace or Nabertherm Control Center (NCC) for monitoring, documentation and control see page 64

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

Bogie hearth furnace with gas supply system

Furnace system with W 17000 in work in progress

W 8250/S

Bogie Hearth Furnaces
Electrically Heated

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

Bogie hearth furnace W 6340S

Model	Tmax	Inner dimensions in mm			Volume	Outer dimensions in mm			Heating	Electrical	Weight
	°C	w	d	h	in l	W	D	H	power in kW[1]	connection	in kg
W 1000/G	900	800	1600	800	1000	1470	2410	1915	40	3-phase	3000
W 1500/G	900	900	1900	900	1500	1570	2710	2030	57	3-phase	3500
W 2200/G	900	1000	2200	1000	2200	1670	3010	2140	75	3-phase	4500
W 3300/G	900	1000	2800	1200	3300	1670	3610	2355	110	3-phase	5300
W 5000/G	900	1000	3600	1400	5000	1670	4410	2555	140	3-phase	7300
W 7500/G	900	1000	5400	1400	7500	1670	6210	2555	185	3-phase	10300
W 10000/G	900	1000	7100	1400	10000	1670	7910	2555	235	3-phase	12500
W 1000	1280	800	1600	800	1000	1470	2410	1915	57	3-phase	3000
W 1500	1280	900	1900	900	1500	1570	2710	2030	75	3-phase	3500
W 2200	1280	1000	2200	1000	2200	1670	3010	2140	110	3-phase	4000
W 3300	1280	1000	2800	1200	3300	1670	3610	2355	140	3-phase	5300
W 5000	1280	1000	3600	1400	5000	1670	4410	2555	185	3-phase	7500
W 7500	1280	1000	5400	1400	7500	1670	6210	2555	235	3-phase	9100
W 10000	1280	1000	7100	1400	10000	1670	7910	2555	300	3-phase	11000

[1]Depending on furnace design connected load might be higher

Gas-Fired Bogie Hearth Furnaces up to 1400 °C for Firing or Sintering in Air or under Reducing Atmosphere

Combi furnace system consisting of one gas-fired furnace WB 11000HS and two additional bogies incl. bogie transfer system and incl. necessary park rails

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

- Tmax up to 1400 °C, depending on furnace design
- Powerful, sturdy high-speed burner with pulse control and special flame control in the furnace chamber provide for optimum temperature uniformity
- Operation with city gas, natural gas or liquified gas
- Fully automatic PLC control of the temperature as well as monitoring of the burner function
- Reduction-resistant fiber insulation with low heat storage provides for short heating and cooling times
- Dual shell housing provides for low outside temperatures
- Exhaust hood with fittings for further discharge of the exhaust gases
- Over-temperature limiter with manual reset for thermal protection class 2 in accordance with EN 60519-2 as temperature limiter to protect the furnace and load

Bogie hearth furnace WB 14880S

Additional equipment

- Automatic lambda control to set the furnace atmosphere
- Exhaust air and exhaust gas piping
- Recuperator burners utilizing part of the waste heat in the exhaust tract to preheat the combustion air and considerably contribute to energy saving
- Thermal or catalytic exhaust cleaning systems
- Process documentation and control with Controltherm MV software package, NTLog and NTGraph for the basic furnace or Nabertherm Control Center (NCC) for monitoring, documentation and control see page 64
- Other additional equipment for bogie hearth furnaces see pages 51

Furnace chamber with eight high-speed burners

Chamber Furnaces
Gas-Fired

NB 2880/S

NB 4330/S

Certain heat treatment processes require a gas-fired chamber furnace. Short heating times due to the high power are a convincing argument. The chamber furnaces with powerful atmospheric gas burners cover a wide variety of these processes. In the basic version the burners are manually ignited once at the start of the process. The automatic control system then takes over control of the temperature curve. At program end, the burners are automatically switched off. Depending on the process, the furnaces can be equipped with automatically controlled fan burners and safety technology for debinding. Depending on the model, these furnaces can be upgraded with fully automatic fan burners and additional accessories.

NB 2304/S with integrated thermal afterburner for hot cleaning of painted parts

- Tmax 1300 °C
- Powerful, atmospheric burners for operation with liquified gas or natural gas
- Special positioning of the gas burners with flame guide top-down provides for optimum temperature uniformity
- Fully automatic temperature control
- Gas fittings with flame control and safety valve in accordance with DVGW (German Technical and Scientific Association for Gas and Water)
- Multi-layer, reduction-proof insulation with light-weight refractory bricks and special back-up insulation result in low gas consumption
- Self-supporting and rugged ceiling, bricks laid in arched construction or as fiber insulation
- Dual shell housing, side panels made of stainless steel (NB 300), for low outside temperatures
- Solid, double-walled door
- Exhaust hood with 150 mm (NB 300) and 200 mm (NB 440, NB 600) diameter connection
- Over-temperature limiter with manual reset for thermal protection class 2 in accordance with EN 60519-2 as temperature limiter to protect the furnace and load

Compact burners for standard models up to NB 600

Additional equipment

- Fan burner with fully automatic control
- Exhaust air and exhaust gas piping
- Thermal or catalytic exhaust cleaning systems
- Recuperator technology for heat recovery see page 67
- Process documentation and control with Controltherm MV software package, NTLog and NTGraph for the basic furnace or Nabertherm Control Center (NCC) for monitoring, documentation and control see page 64

Catalytic and Thermal Afterburning Systems, Exhaust Gas Washer

Catalytic afterburning system independent from furnace model for refitting on existing plants

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

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

Exhaust gas washer to clean generated process gases by washing out

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

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

Chamber furnace N 150/14 with catalytic afterburning system

Catalytic afterburning systems (KNV)

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

Thermal afterburning systems (TNV)

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

Thermal afterburning system

Rotary Hearth Furnaces up to 1300 °C with and without Air Circulation

Electrically Heated or Gas-Fired

Rotary hearth furnace DH 3020/1480/450/11, movable on rails, for preheating of molds for two forges

Gear rim drive under the furnace

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

Exhaust hood above charging opening

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

The rotary hearth furnaces are specifically designed for the required throughput and charge dimensions. They are heated electrically or alternativelly gas-fired by means of powerfull gas burners. Subject to the temperature range these furnaces are equipped with or without air circulation.

- Tmax 1100 °C, 1200 °C or 1300 °C without air circulation
- Tmax 260 °C, 600 °C or 850 °C with air circulation
- Wire heating elements in the furnaces ceiling for furnaces up to 1200 °C
- SiC heating rods in the furnace ceiling for furnaces up to 1300 °C
- Gas heating as an alternative to electrical heating
- Models for 650 °C and 850 °C with powerful air circulation for better heat transfer onto the charge and to optimize the temperature uniformity
- Very compact design compared with continuous furnaces
- Designed for continuous operation at one working temperature
- Table diameter up to 3000 mm
- Hearth movement in defined segments
- Low-vibration movement of the rotary hearth
- Parallel swivel door
- Motor-driven or rotational motion initiated by foot switch
- Furnace floor can be lowered using a forklift truck for maintenance purposes

Rotary hearth furnace DH 1200/-/300/11

Pre-heating of steel rings for forging

Additional equipment

- Exhaust hood above the door opening for discharge of the warm exhaust air when door is open
- Pneumatic drive of the parallel swivel door
- Charging aids for ease of loading and unloading
- Multi-zone control for adjustable thermal profile during the cycle
- Protective gas connections
- Process control and documentation with Controltherm MV software package see page 64

Furnace floor can be lowered for maintenance purposes

Model	Tmax	Inner dimensions in mm			Volume	Outer dimensions in mm			Heating	Electrical	Weight
	°C	Ø Outer	Ø Inner	h	in l	W	D	H	power in kW[1]	connection	in kg
DH 1200/-/300/11	1100	1200	0	300	340	2200	2200	2500	54.0	3-phase	1000
DH 1500/800/250/11	1100	1500	800	250	630	2400	2300	2450	21.0	3-phase	1500
DH 3020/1480/450/11	1100	3022	1480	450	2500	4000	4000	2500	98.0	3-phase	3500

[1]Depending on furnace design connected load might be higher

Continuous Furnaces
Electrically Heated
or Gas-Fired

Continuous furnace D 700/10000/300/45S
with chain conveyor for 950 °C, gas-fired

Service window

Continuous furnaces are the right choice for processes with fixed cycle times such as drying or pre-heating, curing or degassing, etc.. The furnaces are available for various temperatures up to a maximum of 1000 °C. The furnace design depends on the required throughput, the process requirements for heat treatment and the required cycle time. The conveyor technology (e.g. belt, rollers) is tailored to the required working temperature and the geometry of the charge. The conveyor speed and the number of control zones are defined by the process specifications.

Alternative furnace design subject to process specifications:

Conveyor concepts
- Conveyor belt
- Metal conveyor belt with adjusted mesh gauges
- Drive chain
- Roller conveyors
- Pusher-type furnace

Discharge of D 650/S

Continuous belt furnace for bulk
materials in baskets

Roller conveyor furnace N 650/45 AS for
heat treatment of heavy workparts

Conveyor plant D 1600/3100/1200/55,
consisting of annealing furnace, cooling station
and conveyor system

Visualization of process data on the PC

Drop bottom for quenching within
5 seconds

Heating systems
- Electric heating, radiant or convection
- Direct or indirect gas-firing
- Infrared heating
- Heating with the use of external heat sources

Temperature cycles
- Control of working temperature across the whole length of the furnace, such as for drying or pre-heating
- Automatic control of a process curve applying defined heat-up, dwell and cooling time
- Control of a temperature curve including a final quenching of the charge

Process atmosphere
- In air
- In non-flammable protective or reactive gases such as nitrogen, argon or forming gas
- In flammable protective or reactive gases such as hydrogen incl. the necessary safety technology

Basic configuration criteria
- Conveyor speed
- Temperature uniformity
- Operating temperature
- Process curve
- Charge space width
- Charge weights
- Cycle time or throughput
- Length of charge and discharge zone
- Generated exhaust gases
- Specific industry standards such as AMS, CQI-9, FDA etc.
- Other individual customer requirements

Continuous belt furnace for bulk charges
incl. water bath for quenching

Temperature Uniformity and System Accuracy

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

Specification of Temperature Uniformity in Δ K in the Standard Furnace

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

Holding frame for measurement of temperature uniformity

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

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

System Accuracy

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

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

Temperature Uniformity in the Work Space incl. Protocol

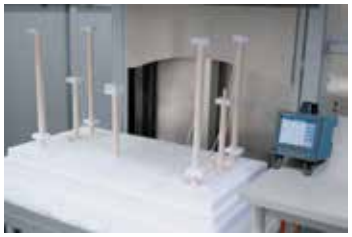
In standard furnaces a temperature uniformity is guaranteed as ΔT without measurement of temperature uniformity. However, as additional feature, a temperature uniformity measurement at a reference temperature in the work space compliant with DIN 17052-1 can be ordered. Depending on the furnace model,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

For the configuration of furnace and control system to meet specific industry standards such as AMS 2750 E, CQI-9, or FDA, Nabertherm offers adapted solutions. See our catalog „Thermal Process Technology“

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

AMS 2750 E, NADCAP, CQI-9

Standards such as the AMS 2750 E (Aerospace Material Specifications) are applicable for the industrial processing of high-quality materials. They define industry-specific requirements for heat treatment. Today, the AMS 2750 E and derivative standards such as AMS 2770 for the heat treatment of aluminum are the guidlines for the aerospace industry. After the introduction of the CQI-9, the automotive industry has also committed to submit heat treatment processes to stricter rules. These standards describe in detail the requirements applicable to thermal processing plants.



Measurement set-up in a high-temperature furnace

- Temperature uniformity in the work space (TUS)
- Instrumentation (definition of measurement and control systems)
- Calibration of the measurement system (IT) from the controller via the measurement line to the thermocouple.
- Inspections of system accuracy (SAT)
- Documentation of the inspection cycles

Norm compliance is necessary to ensure that the required quality standard of the manufactured components can also be reproduced in series. For this reason, extensive and repeated inspections as well as controls of the instrumentation, including the relevant documentation, are required.

Furnace Class and Instrumentation Requirements of the AMS 2750 E

Depending on the quality requirements of heat treatment job the customer specifies instrumentation type and the temperature uniformity class. The instrumentation type describes the necessary combination of the applied control, recording media as well as thermocouples. The temperature uniformity of the furnace and the class of the selected instrumentation are defined based on the required furnace class. The higher the requirements are set for the furnace class the more precise the instrumentation must be.

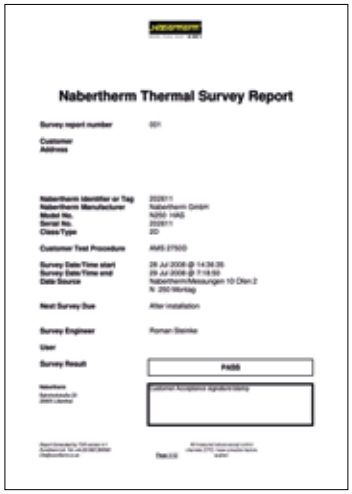
Measurement set-up in an annealing furnace

Instrumentation	Type				
	A	B	C	D	E
Each control zone has a thermocouple connected to the controller	x	x	x	x	x
Recording of the temperature measured by the control thermo-couple	x	x	x	x	
Sensors for recording the coldest and hottest spots	x		x		
Each control zone has a charge thermocouple with recording system	x	x			
Each control zone has an over-temperature protection unit	x	x	x	x	

Furnace class	Temperature uniformity	
	°C	°F
1	+/- 3	+/- 5
2	+/- 6	+/- 10
3	+/- 8	+/- 15
4	+/- 10	+/- 20
5	+/- 14	+/- 25
6	+/- 24	+/- 50

Regular Inspections

The furnace or the heat treatment plant must be designed so that the requirements of the AMS 2750 E can be met and be reproduced. The standard also requires the inspection intervals for the instrumentation (SAT = System Accuracy Test) and the temperature uniformity of the furnace (TUS = Temperature Uniformity Survey). The SAT/TUS tests must be performed by the customer with measuring devices and sensors which operate independently of the furnace instrumentation.



Nabertherm Thermal Survey Report

Nabertherm Services

The suitable furnace model for the corresponding heat treatment can be designed based on the process, the charge, the required furnace class and the type of instrumentation. Depending on the required specs, alternative solutions can be offered.

- Furnace designs, which meet standards, following customer specifications regarding furnace class and instrumentation, incl. gauge connections for repeated customer inspections at regular intervals. No consideration of requirements with respect to documentation
- Data recording devices (e.g., temperature recorder) for TUS and/or SAT measurements see page 68
- Data recording, visualization, time management via the Nabertherm Control Center (NCC), based on Siemens WinCC software see page 60
- Commissioning at site, incl. the first TUS and SAT inspection
- Connection of existing furnace systems to meet norm requirements
- Documentation of the complete process chain in line with the corresponding norm

AMS 2750 E, NADCAP, CQI-9

Implementation of AMS 2750 E

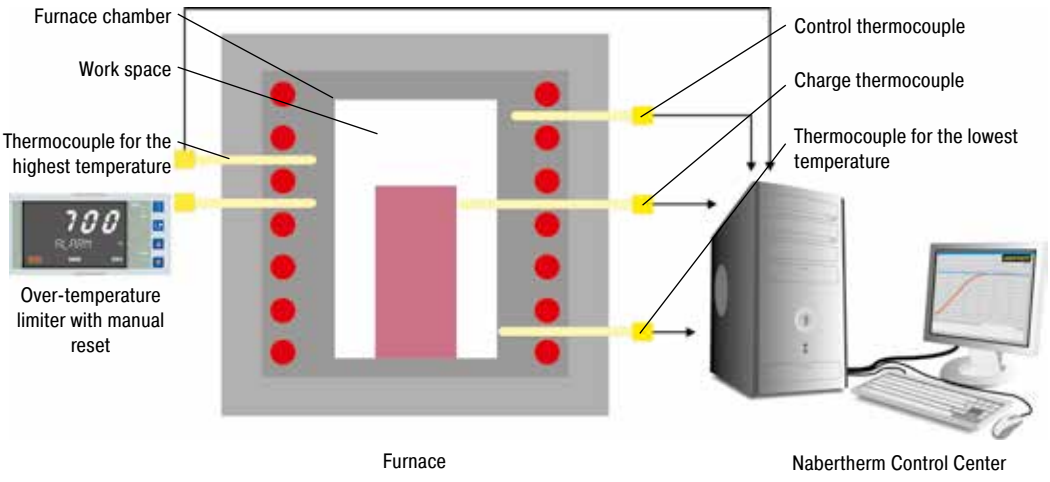
Basically, two different systems are available for control and documentation, a proven Nabertherm system solution or instrumentation using Eurotherm controllers/temperature recorders. The Nabertherm AMS package is a convenient solution that includes the Nabertherm Control Center for control, visualization, and documentation of the processes and test requirements based on PLC control.

Instrumentation with Nabertherm Control Center (NCC) for Control, Visualization, and Documentation based on a Siemens PLC Controls

The attractive feature of the instrumentation with Nabertherm Control Center in combination with PLC controls of the furnace is the convenient data input and visualization. The software programming is structured in a way that both the user and the auditor can navigate it without difficulty.

In daily use, the following product characteristics stand out:

- Very easy to navigate and straight-forward presentation of all the data in plain text on the PC
- Automatic saving of the charge documentation at the end of the program
- Administration of the calibration cycles in the NCC
- Results of the measurement distance calibration are entered in the NCC
- Schedule management of the required testing cycles including a reminder function. The testing cycles for TUS (Temperature Uniformity Survey) and SAT (System Accuracy Test) are entered in days and monitored by the system and the operator or tester is informed in time about up-coming tests. The values of the tests are entered directly into NCC and saved as PDF files on the PC. There are no additional tasks involved in documenting the tests.
- Option of transferring the measurement data to a customer's server



Example of a design with Type A Nabertherm Control Center

The Nabertherm Control Center can be extended to enable a complete documentation of the heat treatment process apart from just the furnace data. For example, when heat-treating aluminum, in addition to the furnace, the temperatures in the quenching basin or a separate cooling medium can also be documented.

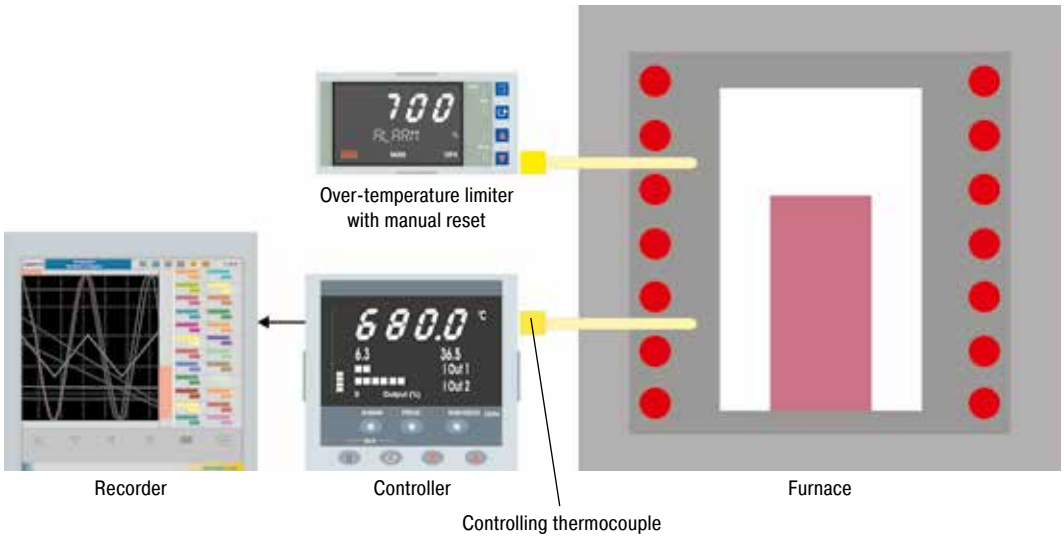
Instrumentation for TUS Measurements as a Separate Model

The TUS standard requires that the temperature uniformity of the furnace be tested with a TUS measurement at regular intervals. This measurement must be performed by an independent measurement system and not by the instrumentation used for process control. The testing intervals are filed in the NCC in days. The system reminds in time that a test must be performed.

This test can be performed either using an independent temperature recorder (see page 64) with the customer's calibrated testing thermocouples or using the Nabertherm TUS module that is connected to the Nabertherm Control Center as a separate module.

The TUS module has its own PLC which converts the measurement results of the testing thermocouples. The evaluation, including an easy-to-navigate and simply log function, is then performed via the furnace's Nabertherm Control Center.

TUS module with ports for 16 thermocouples and PROFIBUS connection to the Nabertherm Control Center



Example of a design containing Type D Eurotherm instrumentation

Alternative Instrumentation with Temperature Controllers and Recorders from Eurotherm

As an alternative to instrumentation with the Nabertherm Control Center (NCC) and PLC controls, instrumentation with controllers and temperature recorders is also available. The temperature recorder has a log function that must be configured manually. The data can be saved to a USB stick and be evaluated, formatted, and printed on a separate PC. Besides the temperature recorder, which is integrated into the standard instrumentation, a separate recorder for the TUS measurements is needed (see page 64).

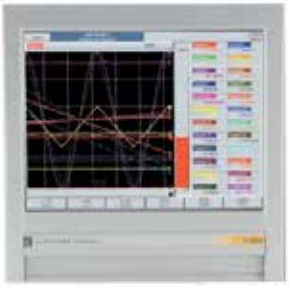
N 12012/26 HAS1 according to AMS 2750 E

Process Control and Documentation

PC for HiProSystems control in a separate cabinet

H 1700 with colored, tabular depiction of the data

H 3700 with colored graphic presentation of data



Temperature recorder

HiProSystems Control and Documentation

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

Alternative User Interfaces

Touch panel H 500/H 700

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

Touch panel H 1700

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

Touch panel H 3700

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

For Control, Visualisation and Documentation

Nabertherm Control Center NCC

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

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

For Documentation

Nabertherm Documentation Center NDC and data recording via NTLog

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

Temperature Recorder

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

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

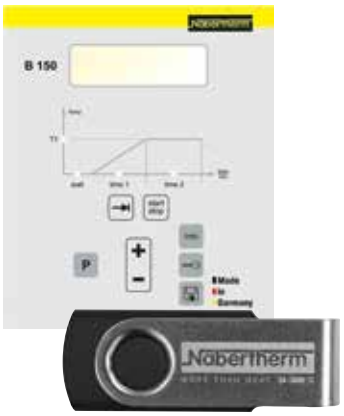
Documentation of Nabertherm Controller – Extension Module NTLog/NTGraph Basic

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

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

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

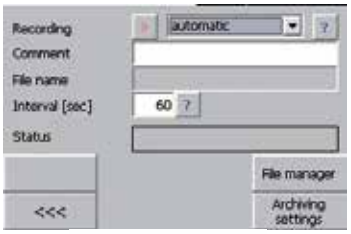
For protection against accidental data manipulation the generated data records contain checksums. A retrofit of NTLog Basic on existing controllers can be done with a retrofit kit including a manual.



NTLog Basic for data recording of Nabertherm Controllers

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

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

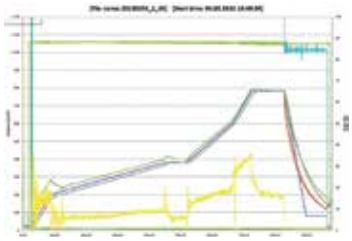


NTLog Comfort for data recording of a Siemens PLC

Process Data from NTLog

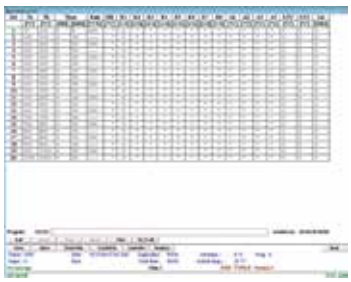
The process data from NTLog can be presented either using the customer‘s own spreadsheet program (e.g. MS Excel) or NTGraph. With NTGraph Nabertherm provides for a user-friendly tool free of charge for the visualization of the data generated by NTLog. Prerequisite for its use is the installation of the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

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

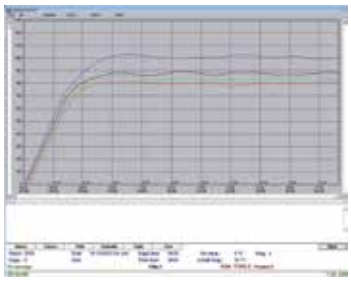


NTGraph, a freeware for the easy-to-read analysis of recorded data using MS Excel

Controltherm MV Software for Control, Visualisation and Documentation



Data input in table format if used together with Nabertherm controllers



Graphical display of set and actual temperature curve

Controltherm MV Software for Control, Visualisation and Documentation

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

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

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

Features

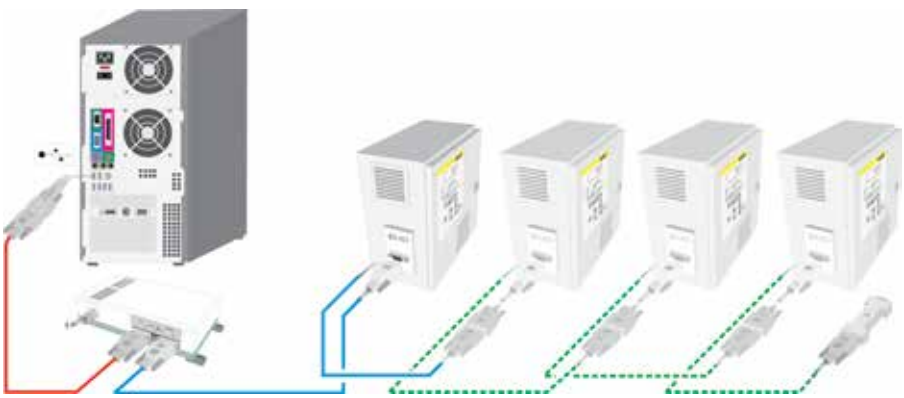
- Simple installation without specific knowledge
- Suitable for PC with operating system Microsoft Windows 7 (32 Bit), Vista (32 Bit), XP with SP3, 2000, NT4.0, Me, 98
- All Nabertherm controllers with interface connectable
- Manipulation protected storage of temperature curves of up to one, four, eight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

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

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

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

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



Extendable for connection of up to 16 furnaces

Energy Efficiency Technology

In face of rising energy prices and stricter environmental regulations there is increasing demand for heat treatment plants with greater energy efficiency.

Depending on the furnace size and the process there is always a certain amount of potential energy which can be recovered from the waste heat and re-used. This is especially true for large furnace systems or long process times which allow for huge energy savings that the additional investment has a short pay-back time. The thermal energy from finished charges can also be used to pre-heat cold charges which is also an efficient way of saving energy.

The following examples outline engineering alternatives for heat recovery:

Heat Exchangers
The principle of the counterflow heat exchanger is to use the hot exhaust gas coming from the furnace to pre-heat the cold fresh air channelled into the furnace. In many cases, there is no need anymore for a separate fresh air preheating unit. Such a system is recommended if the process requires continuous air exchange in the furnace chamber, such as when tempering silicone, or during drying processes that are covered by the EN 1539 industrial standard.

Counterflow heat exchanger for the air circulation chamber furnace N 2560/26 ACLS

Recuperator Burners
Large gas-heated heat-treatment furnaces are especially advantageous for the installation of recuperator burners. Recuperator burners also use hot exhaust gas; to pre-heat the combustion air. Depending on the furnace model and the process, substantial energy savings of as much as 25% can be realized by using recuperator burners so that there is a short pay-back time for the additional purchase costs.

Recuperator burner for aluminum melting furnace 16 x TBR 110/12 and 2 x TBR 180/12

Heat Transfer Chambers
Heat transfer chambers, which can also be described as cooling/heating chambers, offer two enormous advantages. For one, they help save energy, and for another, using a heat transfer chamber increases productivity.

The load is removed from the furnace while it is still hot and placed in the heat transfer chamber. The chamber also has room for a new, cold charge. Circulating the air cools the hot charge and, at the same time, preheats the cold charge before it is put into the furnace. Consequently, the furnace heating does not have to provide the thermal energy and through-put capacitiy of the furnace is increased of the same time.

The above systems for enhancing energy efficiency are only a few examples of technical alternatives. We would be happy to advise you on whether an additional heat recovery module would also be a sensible add-on to your furnace or system.

Heat transfer between a hot and a cold charge

Production system, consisting of four chamber dryers for moving the load during heat treatment along with a three-stage heat exchanger to optimize energy efficiency

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