

# Foundry



**Melting**  
**Holding**  
**Transporting**  
**Core Drying**  
**Thermal Decoring**  
**Dewaxing**  
**Heat Treatment**  
**Annealing**  
**Tempering**  
**Preheating**  
**Quenching**



### **Made in Germany**

Nabertherm with more than 350 employees worldwide have been developing and producing industrial furnaces for many different applications for over 60 years. 150,000 satisfied customers in 100 countries offer proof of our commitment to build quality equipment cost-effectively. Short delivery times are ensured due to our complete inhouse production and our wide variety of standard furnaces.

### **Setting Standards in Quality and Reliability**

Our products range from standard furnaces to flexible, state-of-the-art fully automatic systems and plants with material handling technology. Your complete heat treatment production process can be realized through our customized 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**

With our global sales network, we can offer on-site customer service wherever you choose to produce. Long term sales and distribution partners in all important world markets ensure individual on-site customer service and consultation. There are various reference customers in your neighborhood who have similar furnaces or systems.

### **Customer Service and Spare Parts**

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

### **More Than Heat – Experience in Many Fields of Thermal Processing**

In addition to furnaces for foundry, Nabertherm offers a wide range of standard furnaces and systems for many other thermal processing applications. The modular design of our products allows us to customize a solution to your individual needs without expensive modifications. Our professional R&D department will be pleased to test your product samples in order to specify the right heat treatment equipment for you.

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## Tilting Crucible Furnaces KB, Gas or Oil Fired, for Melting and Holding



Melting system with two furnaces KB 360/12 and work platform

The gas or oil fired tilting crucible furnaces of the KB series are characterized by their high melting performance. They are perfectly suited for the melting of aluminum and other nonferrous alloys. The use of high-quality insulation materials results in very low power requirements. The two-stage burner can be configured for either gas operation or oil operation.



Hydraulics assembly with nonflammable hydraulic fluid



Two-stage burner, fixed on furnace frame

- KB../12 with maximum furnace chamber temperature of 1200 °C for aluminum or zinc
- KB../14 with maximum furnace chamber temperature of 1400 °C suitable for bronze alloys or brass, with a maximum melt temperature of 1300 °C
- Fuel heating using gas or oil
- Two-stage power control: high load for melting operation, low load for holding mode, with automatic switching
- Positive pressure in the furnace chamber keeps air out for high-efficiency operation
- Gas system consisting of pressure regulator, gas filter, manometer, and solenoids
- Low NOx emissions
- Burner flame continuously monitored
- Burner technology with service-friendly construction, e.g. flame head easily removable when the burner is swung out
- Burner technology manufactured in compliance with EN/DIN 746 part 2
- High melting power due to powerful burner and high-quality insulation
- Insulation constructed in multiple layers with lightweight refractory bricks in the furnace chamber
- Crucible of clay-graphite up to KB 240, or isostatically pressed clay-graphite or SiC from KB 360 and up
- Electrohydraulic tilting system with nonflammable ultra-safe hydraulic fluid
- Safe, even, and precise pouring due to optimum pivot point in the furnace and manual throttling valve operation of the hydraulic system
- Emergency outlet for safe draining of the melt in case of crucible breakage
- Exhaust gas discharge over the crucible edge, resulting in about 20% higher melting performance than with side exhaust gas discharge. Swing lid as option
- 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 limit controller 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 pages 20/21



KB 400/12

### Additional Equipment

- Crucible of isostatically pressed clay-graphite or SiC with higher thermal conductivity up to KB 240
- Side exhaust gas discharge with swing lid, with the following features:
  - high melt quality due to lower burnoff
  - lower hydrogen absorption in the melt
  - reduction of power consumption due to swing lid in holding mode
  - operator exposed to less heat in the area above the crucible
  - about 20% lower melting performance compared with exhaust gas discharge over the crucible edge
- Insulated connection piece for side exhaust gas discharge to connect exhaust ductwork
- Exhaust gas collection hood for furnaces with exhaust gas discharge over the crucible edge
- Work platform
- Crucible breakage monitor with visual and audible signal (only for models KB ../12)
- Modulating burner with precise temperature control for optimum quality of the melt in holding mode
- 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
- For information on other accessories, see pages 18/19



KB 180/12 in production



Insulated connection piece for side exhaust gas discharge to connect exhaust ductwork

Model	Tmax °C	Crucible	Capacity		Melting performance <sup>3</sup>		Consumption holding lid closed KWh/h	Consumption Melting KWh/kg	Burner rating kW	Exterior dimensions in mm			Weight kg
			Kg Al	Kg Cu	Kg Al/hr	Kg Cu/hr				W	D	H	
KB 80/12	1200	TP 287	180	550	220 <sup>1</sup>	-	10	1,3 - 1,5	300	2030	1700	1510	1800
KB 150/12	1200	TP 412	330	970	240 <sup>1</sup>	-	11	1,3 - 1,5	300	2140	1900	1710	2200
KB 180/12	1200	TP 412 H	370	1200	260 <sup>1</sup>	-	13	1,3 - 1,5	300	2140	1900	1810	2400
KB 240/12	1200	TP 587	570	-	400 <sup>1</sup>	-	15	1,3 - 1,5	390	2650	2030	1810	2600
KB 360/12	1200	TBN 800	750	-	420 <sup>1</sup>	-	17	1,3 - 1,5	450	2650	2080	1910	2900
KB 400/12	1200	TBN 1100	1000	-	450 <sup>1</sup>	-	19	1,3 - 1,5	450	2650	2080	2080	3300
KB 40/14	1400	R 400/TP 982	120	400	-	330 <sup>2</sup>	22	1,0 - 1,3	400	2070	1700	1770	2300
KB 60/14	1400	R 500	150	500	-	360 <sup>2</sup>	25	1,0 - 1,3	400	2070	1900	1810	2500
KB 80/14	1400	R 600	180	600	-	380 <sup>2</sup>	25	1,0 - 1,3	400	2070	1900	1910	2650

<sup>1</sup>At 700 °C

<sup>2</sup>At 1000 °C

<sup>3</sup>The specified melting performances are maximum values. In practice, approx. 80 % are achieved.

## Tilting Crucible Furnaces K (Brick Insulation) and KF (Fiber Insulation), Electrically Heated, for Melting and Holding



K 150/12



KF 240/12

The electrically heated tilting crucible furnaces of the K and KF series are characterized by high melting performance with very uniform temperature distribution 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).



Side wall insulation with fiber materials in 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 uniform temperature distribution 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
- Electrohydraulic tilting system with nonflammable ultra-safe hydraulic fluid
- Safe, even, and precise pouring thanks to optimum pivot point in the furnace and manual throttling valve operation of the hydraulic system
- 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 limit controller 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 pages 20/21



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

### Additional Equipment

- Crucible of isostatically pressed clay-graphite or SiC with higher thermal conductivity up to K, KF 240
- Work platform
- Crucible breakage monitor with visual and audible signal (only for models K, KF ../12)
- 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 assures even power from heating elements
- Multi-step switching of the furnace heat (see page 21). 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 pages 18/19



Charging of transport ladle with K 360/12

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

<sup>1</sup>At 700 °C

<sup>2</sup>At 1000 °C

<sup>3</sup>The specified melting performances are maximum values. In practice, approx. 80 % are achieved.

## Tilting Crucible Furnace KC and Crucible Furnace TC, SiC-Rod-Heated, for Melting and Holding



KC 180/14



Heated on both sides by high performance SiC rods

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

- Maximum furnace chamber temperature of 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, uniform temperature distribution
- Simple exchange of individual heating elements
- Heat operation by thyristors 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 uniform temperature distribution
- Insulation constructed in multiple layers with lightweight refractory bricks on the hot face
- SiC-Crucible
- Electrohydraulic tilting system with nonflammable ultra-safe hydraulic fluid for KC models
- Safe, even, and precise pouring thanks to optimum pivot point in the furnace and manual throttling valve operation of the hydraulic system
- 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 limit controller 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 pages 20/21



Wiring of the heating elements in sections above each other



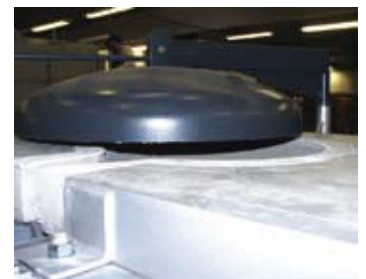
TC 80/14



KC 150/14

### Additional Equipment

- Work platform for simplified loading
- For information on other accessories, see pages 18/19



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

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

<sup>1</sup>At 700 °C

<sup>2</sup>At 1000 °C

<sup>3</sup>The specified melting performances are maximum values. In practice, approx. 80 % are achieved.



Switchgear with thyristors in phase angle operation for economic power consumption

## Crucible Furnaces TB, Gas or Oil Fired, for Melting and Holding



TB 20/14



TB 240/12



Two-step gas burner for low-load and high-load mode

The gas or oil fired crucible furnaces of the TB series are characterized by their high melting performance. They are the work horse for melting operation but also for holding of aluminum and zinc. The use of high-quality insulation materials results in very low power consumption. The two-step burner can laid-out for either gas operation or oil operation.

- TB../12 with maximum furnace chamber temperature of 1200 °C for aluminum or zinc
- TB../14 with maximum furnace chamber temperature of 1400 °C suitable for bronze alloys or brass, with a maximum melt temperature of 1300 °C
- Fuel heating using gas or oil
- Two-step power regulation: high load for melting operation, low load for holding mode, with automatic switching
- Positive pressure in the furnace chamber keeps air out for high-efficiency operation
- Gas system consisting of pressure regulator, gas filter, manometer, and solenoids
- Burner flame continuously monitored
- Burner technology with service-friendly construction, e.g. flame head easily removable when the burner is swung out
- Burner technology manufactured in compliance with EN/DIN 746 part 2
- High melting power due to powerful burner and high-quality insulation
- Multi-layer insulation with lightweight refractory bricks on the hot face, 1400 °C models with additional wear and tear layer consisting of copper-resistant high-performance concrete
- Emergency outlet for safe draining of the melt in case of crucible breakage



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

- Exhaust gas discharge over the crucible edge, resulting in about 20% higher melting performance than with side exhaust gas discharge, swing lid as option
- Side exhaust gas discharge for TB ../12 models, see Additional Equipment below for features
- 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 limit controller 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 pages 20/21

### Additional Equipment

- Crucible of clay-graphite or SiC with high thermal conductivity
- Side exhaust gas discharge with swing or flap lid, with the following features:
  - high melt quality due to lower burnoff
  - lower hydrogen absorption in the melt
  - reduction of power consumption due to swing lid in holding mode
  - operator exposed to less heat in the area above the crucible
  - about 20% lower melting performance compared with exhaust gas discharge over the crucible edge
- Insulated connection piece for side exhaust gas discharge to connect exhaust ductwork
- Exhaust gas collection hood for furnaces with exhaust gas discharge over the crucible edge
- Work platform
- Crucible breakage monitor with visual and audible signal (only for models TB ../12)
- Modulating burner with precise temperature control for optimum quality of the melt in holding mode
- 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
- Crucible pulling feature for models up to TB 40/14 with special swinging collar plate
- For information on other accessories, see pages 18/19



TB 80/12 with side exhaust gas discharge



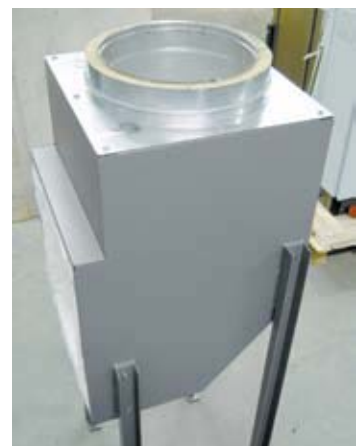
TB 40/14 with crucible pulling feature

Model	Tmax °C	Crucible	Capacity		Melting performance <sup>3</sup>		Consumption holding lid closed KWh/h	Use Melting KWh/kg	Burner rating kW	Exterior dimensions in mm			Weight kg
			Kg Al	Kg Cu	kg/hr Al	kg/h Cu				W	D	H	
TB 80/12	1200	BU 200	200	650	140 <sup>1</sup>	-	10	1,3 - 1,5	180	1200	1870	1240	900
TB 100/12	1200	BU 250	250	830	140 <sup>1</sup>	-	11	1,3 - 1,5	180	1310	1980	1380	1000
TB 110/12	1200	BU 300	300	1000	150 <sup>1</sup>	-	13	1,3 - 1,5	210	1310	1980	1510	1200
TB 150/12	1200	BU 350	350	1150	220 <sup>1</sup>	-	15	1,3 - 1,5	300	1310	1980	1550	1400
TB 180/12	1200	BU 500	500	1650	270 <sup>1</sup>	-	17	1,3 - 1,5	300	1450	2140	1560	1700
TB 240/12	1200	BU 600	600	2000	330 <sup>1</sup>	-	19	1,3 - 1,5	390	1490	2180	1700	1900
TB 360/12	1200	BN 800	800	-	350 <sup>1</sup>	-	20	1,3 - 1,5	400	1590	2280	1800	2000
TB 400/12	1200	BN 900	900	-	350 <sup>1</sup>	-	22	1,3 - 1,5	400	1590	2280	1900	2100
TB 500/12	1200	BU 1210	1200	-	350 <sup>1</sup>	-	23	1,3 - 1,5	400	1690	2380	1850	2300
TB 600/12	1200	BU 1310	1300	-	420 <sup>1</sup>	-	25	1,3 - 1,5	500	1690	2380	2000	2400
TB 650/12	1200	BU 1810	1400	-	420 <sup>1</sup>	-	26	1,3 - 1,5	500	1760	2450	1630	2300
TB 700/12	1200	BU 1510	1500	-	420 <sup>1</sup>	-	28	1,3 - 1,5	500	1690	2380	2120	2600
TB 800/12	1200	BU 1810	1800	-	440 <sup>1</sup>	-	30	1,3 - 1,5	500	1760	2450	2100	2800
								Al					
TB 10/14	1400	A 100	30	100	-	90 <sup>2</sup>	22	1,0 - 1,3	210	980	1590	1190	1000
TB 20/14	1400	A 150	45	150	-	100 <sup>2</sup>	22	1,0 - 1,3	210	1080	1870	1310	1250
TB 40/14	1400	A 400	120	400	-	300 <sup>2</sup>	25	1,0 - 1,3	300	1210	2000	1460	1500
TB 60/14	1400	A 500	150	500	-	320 <sup>2</sup>	25	1,0 - 1,3	320	1210	2000	1510	1600
TB 80/14	1400	A 600	180	600	-	320 <sup>2</sup>	25	1,0 - 1,3	320	1260	2050	1540	1750
								Cu					

<sup>1</sup>At 700 °C

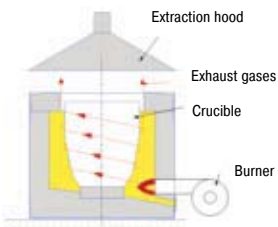
<sup>2</sup>At 1000 °C

<sup>3</sup>The specified melting performances are maximum values. In practice, approx. 80 % are achieved.



Insulated connection piece for side exhaust gas discharge to connect exhaust ductwork

## Exhaust Gas Discharge for Gas or Oil Fired Crucible Furnaces

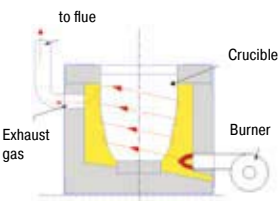


Exhaust gas discharge over the crucible edge

### Exhaust Gas Discharge over the Crucible Edge

Exhaust gas discharge over the crucible edge is a standard feature of our gas or oil fired crucible furnaces, with the exception of the TB models for 1200 °C furnace chamber temperature, because these furnaces are often also used for holding. Exhaust gas discharge over the crucible edge offers the following advantages:

- Very high melting performance
- Low power consumption, since the crucible is not only heated from outside, but also additionally from the top.



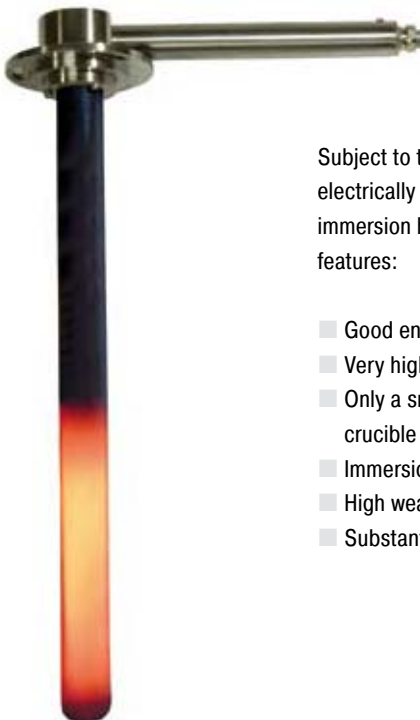
Side exhaust gas discharge

### Side Exhaust Gas Discharge

Side exhaust gas discharge is available for all gas and oil fired crucible furnaces as optional equipment. Although the melting performance is not as high as for exhaust gas discharge over the crucible edge, this alternative offers the following advantages:

- High melt quality due to lower burnoff
- Lower hydrogen absorption in the melt
- Reduction of power consumption due to swing lid in holding mode
- Operator exposed to less heat in the area above the crucible

## Alternative Heating Concepts Holding Furnaces with Immersion Heaters



Immersion heating element for direct bath heating

Subject to the specific application, direct heating with immersion heaters can be a practical alternative to an electrically heated holding furnace with indirect heating outside the crucible. Heating takes place through a powerful immersion heater which is introduced from above directly into the open crucible. This system has the following features:

- Good energy utilization due to direct heating
- Very high melt quality due to precise temperature control
- Only a small gap is needed between the crucible and the furnace wall, thus the furnace can be smaller or crucible might be larger with same outer furnace dimensions
- Immersion heating element might turn-out as obstacle during bale-out
- High wear & tear of heating elements
- Substantial heat loss due to operation without lid

**Crucible Furnaces TBR,  
 Gas Fired with Recuperator Burner,  
 for Energy-Saving Melting and Holding**



TBR 110/12

The gas or oil fired crucible furnaces of the TBR series are characterized by a high melting performance with the best possible energy utilization. They are perfectly suited for the melting of aluminum. Due to the use of a high-performance fan burner, which is feed with preheated air from a recuperator in the exhaust channel, energy consumption up to 25 % lower than conventional heating systems can be achieved.

- TBR../11 with maximum furnace chamber temperature of 1100 °C for aluminum or zinc
- Fuel-fired with gas
- Modulating burner control for optimum quality of the melt
- Positive pressure in the furnace chamber keeps air out for high-efficiency operation
- Low energy consumption due to use of air preheated up to 250 °C by a recuperator in the exhaust channel
- Gas system consisting of pressure regulator, gas filter, manometer, and solenoids
- Low NOx emissions
- Burner flame continuously monitored
- Burner technology with service-friendly construction, e.g. flame head easily removable when the burner is swung out
- Burner technology manufactured in compliance with EN/DIN 746 part 2
- High melting power due to powerful burner and high-quality insulation
- Side exhaust gas discharge with swing or flap lid, with the following features:
  - high melt quality due to lower burnoff
  - lower hydrogen absorption in the melt
  - reduction of power consumption due to swing lid in holding mode
  - Operator exposed to less heat in the area above the crucible
- General design like the TB models; see pages 10/11



Heat exchanger at gas outlet



Production with 16 x TBR 110/12 and 2 x TBR 180/12

## Crucible Furnaces T (Brick Insulation) and TF (Fiber Insulation), Electrically Heated, for Melting and Holding



TF 150/12



T 240/12 with pneumatic lid opening

The electrically heated crucible furnaces of the T and TF series are characterized by a good melting performance with excellent temperature uniformity in the melt. In the 1100 °C version, aluminum can be melted, and in the 1200 °C version, brass can be melted. The 1300 °C version is designed for melting bronze alloys. For faster heat-up times in batch operation, furnaces can alternatively be fiber insulated with low heat storage (TF models).

- 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 24 kW power rating controlled using long-lasting, noiseless solid-state-relays
- Heating of furnaces beyond 24 kW with contactors
- High melting performance with uniform temperature distribution 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 limit controller 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 20/21



Four side heating for excellent temperature uniformity



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



**Additional Equipment**

- Crucible of clay-graphite or SiC with high thermal conductivity
- Work platform
- Crucible breakage monitor with visual and audible signal (only for models T, TF ../12)
- 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 assures an even charging of heating elements
- Multi-step switching of the furnace heat (see page 21). In holding mode, a switch or the controller is used to turn off one heating section in order to reduce the electrical rating
- Transport function: Electrical plug connection on furnace and shock absorbers under the furnace for transport to pouring location (see page 22)
- Higher electrical ratings to increase melting performance
- For information on other accessories, see pages 18/19

2 x T 360/11 with melt bath regulation

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

<sup>1</sup>At 700 °C

<sup>2</sup>At 1000 °C

<sup>3</sup>The specified melting performances are maximum values. In practice, approx. 80 % are achieved.

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



T 150/10



Bale-out of T 650/10 with robot

Due to the particularly good insulation and reduced electrical rating, the furnaces of the T../10 series are perfectly suited for holding operation due to their great energy efficiency. Due to the reduced power rating only limited melting operation is possible.

- Maximum furnace chamber temperature of 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 24 kW power rating controlled using long-lasting, noiseless solid-state-relays
- Heating of furnaces beyond 24 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 limit controller 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 pages 20/21
- For additional equipment, see T(F) furnaces, page 15



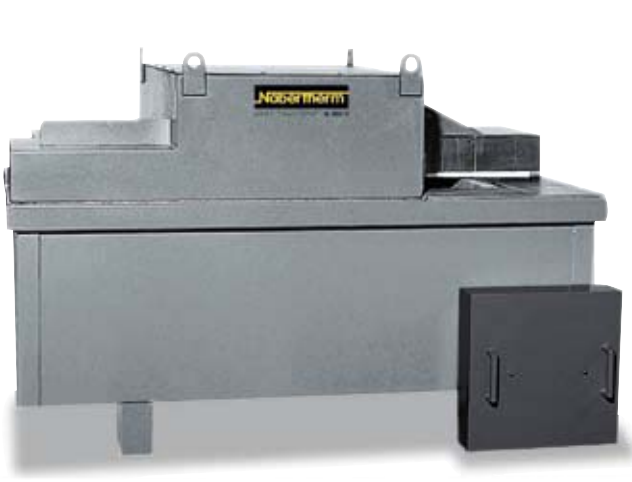
Manual ladling from a T 80/10

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

<sup>1</sup>At 700 °C

<sup>2</sup>The specified melting performances are maximum values. In practice, approx. 80 % are achieved.

## Bath Furnaces B, Electrically Heated, for Holding



B 250



B 500

The bath furnaces B 120 - B 500 have been especially designed for stationary holding in die-casting, with bale-out by robot. The bath chamber of the furnace is lined with long-lasting special bricks. The multi-layered back-up insulation allows very low electrical rating to keep the melt warm. The furnace chamber is divided into three interconnected sections. The center section is heated with elements mounted in the lid. The ladle openings are dimensioned for optimum access by robot for bale-out. Properly used in holding mode, it can provide for a higher energy efficiency than bale-out furnaces.

- Maximum furnace chamber temperature of 1000 °C, perfectly suited for holding of aluminum at about 720 °C
- Heating mounted in the lid, freely radiating from carrier tubes
- Particularly low energy consumption due to generously dimensioned, multi-layer insulation
- High melt quality due to very low corundum formation on the surface
- Heating switched by solid-state-relays
- No exhaust gas discharge needed
- Temperature control with measurement in the melt and in the furnace chamber
- Plug for connection with separate switchgear cabinet
- For information on temperature control, see pages 20/21

### Additional Equipment

- Customized furnace sizes
- Adaptation to dosing pump
- Automated lid opening for ladling operation
- Ladle opening adapted to size of ladle
- Alternative heating using immersion heaters for optimum melt quality (see page 12)



Walled basin of a B 250



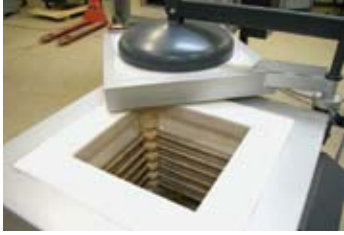
Special bricks in furnace chamber, multi-layered back-up insulation



Heating mounted in the lid, simple replacement of the heating elements

Model	Tmax °C	Capacity Kg Al	Outer dimensions in mm			Weight kg	Ladle opening mm	Power kW	Holding kW
			W	D	H				
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

## Accessories for Bale-Out and Tilting Crucible 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 T.. models 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

The Crucible furnaces of the T.. Series 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).



Charging funnel for ingots

### Charging Funnel for Ingots

Especially for melting of ingots, the charging funnel, made of 1.4301 (304) stainless steel, is a handy tool for charging the furnace. Long ingots can also be loaded above the rim of the crucible taking a guided slide while sinking into the crucible. The charging funnel is suitable for all melting furnaces, whether electrically heated or gas-fired with a side exhaust gas discharge.



Work platform for K 240/12

### Work Platform for Loading for Bale-Out and Tilting Crucible Furnaces

For crucible and tilting crucible 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.

**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. series 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 type of control is not as precise as with measurement in the melt. However, the thermocouple is positioned in a protected location. Information about temperature controllers, see pages 20/21.



Work platform of K 360/12



Bath control with thermocouple in the melt.

**Crucible Breakage Alarm Device**

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.



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.



Measurement probe for fill level measurement

**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 should 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.



Separate bath temperature measurement device

## Control and Documentation Alternatives for Melting Furnaces

### Furnace Control with the Eurotherm 2208e

In the basic model, Nabertherm melting furnaces are equipped with furnace chamber control using the Eurotherm 2208 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.



Eurotherm 2208e controller

### Bath Control with H 100 Compact Controller

Alternatively, all melting furnaces can be equipped with bath control. Instead of using only a thermocouple behind the crucible, the temperature is also measured in the melt or in the crucible pocket (see also the description on page 19). The H 100 controller has a graphical display and is easy to operate with its intuitive menu. Existing furnaces can be upgraded with this controller. 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.

- Furnace chamber control or alternatively bath control via cascade applicable
- Colored graphic display
- Entry of data using function keys
- Programming of furnace operation with two set values (working temperature and holding temperature resp. night temperature)
- Real time clock to switch between both set values
- A separate, user-entered furnace preparation program, freely settable e.g. to dry the crucible
- Available in different languages



H 100 compact controller

### PLC Bath Controls with H 700 Cascade control system

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.

- Furnace chamber control or alternatively bath control via cascade applicable
- Colored graphic display
- 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



Seven day to switch between melting temperature and night temperature

**H 700 additional features**

■ **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.

■ **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 H700 resumes its normal control mode.

■ **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.



H 700



Control Center NCC user interface displayed on a PC

**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.



Multi-Step Switch

**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.

## Tilting Crucible Furnaces with Electrohydraulic Lifting Platforms



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

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 crucible 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 automatically operated.

## Combi Transport Ladle for Melting, Holding, and Transporting



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

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.

- Furnace chamber temperature 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			Power kW
				W	D	H	
TRP 240/S	900	TP 587/TP 587 SF	200	2230	1430	1210	69

## Transportable Crucible Furnaces T and TF



Transportable crucible furnace T 150/11

The melting furnaces of the T and TF series can be equipped with a device for transport with a forklift. For this application, the furnaces are equipped with a pluggable connection and shock absorbers under the furnace. By using several switchgears, the same furnace can be transported to and used at different pouring locations.

## 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

## Melting Furnaces for Heavy Metals

Our melting furnaces in the K, KF, T, and TF series 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.



K 240/11 for melting of lead

## Magnesium Melting Furnaces

In a variety of projects, Nabertherm has supplied melting furnaces 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

## Dewaxing Furnaces, Electrically Heated (N/WAX) or Gas-Fired (NB/WAX)



N 150/WAX



N 660/WAX

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.

### 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 flap)
- Air inlet openings for reliable air exchange
- Double-walled furnace housing for low exterior temperatures
- Removable base included in delivery (fixed base for models N 440 and larger)
- Over-temperature limit controller which must be set below the ignition point of the wax and prevents the wax from igniting during heating
- C 290 controller with up to 40 segments and extra functions to deactivate the over-temperature limit controller for sintering



NB 660/WAX

### Standard NB..WAX, Directly Gas-Fired

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

### Additional Equipment for N and NB

- Catalytic or thermal afterburning systems



Grid bottom



Drain pan in floor

Model	Tmax °C	Interior dimensions in mm			Volume in l	Outer dimensions in mm			Power kW	Electrical connection	Weight in kg
		w	d	h		W	D	H			
NB 660/WAX	850	550	700	780	300	860	1340	1750	36,0	-	430
NB 1000/WAX	850	600	1100	1000	650	1000	1820	1820	105,0	3-phase	850
N 100/WAX	850	400	530	460	100	660	1045	1430	7,5	3-phase	340
N 150/WAX	850	450	530	590	150	710	1045	1560	9,5	3-phase	360
N 200/WAX	850	500	530	720	200	760	1045	1690	11,5	3-phase	440
N 300/WAX	850	550	700	780	300	810	1215	1750	15,5	3-phase	480
N 440/WAX	850	600	750	1000	450	1010	1440	1815	20,5	3-phase	885
N 660/WAX	850	700	850	1100	650	1120	1540	1925	26,5	3-phase	1000
N 1000/WAX	850	800	1000	1250	1000	1290	1730	1830	40,5	3-phase	1870
N 1500/WAX	850	900	1200	1400	1500	1390	1930	1990	57,5	3-phase	2570
N 2200/WAX	850	1000	1400	1600	2200	1490	2130	2190	75,5	3-phase	3170



Drawer for collection of liquid wax

## Chamber Furnaces, Electrical (N) or Gas-Fired (NB) for Core Drying, Thermal Decoring, and Preheating of Forms



N 4000/26HA with lift-door



N 3920/26HAS



Enclosed heater coils on electrically heated models



Gas burner firing into a radiant tube

These low-temperature chamber furnaces are available for maximum working temperatures of 260 °C or 450 °C. They can be used for various processes such as preheating, drying, curing, artificial ageing, soft annealing, and tempering. These furnaces are suited for use with baskets, pallets as well as mobile furnace racks. The charging can be carried out with fork lift, pallet truck or charging trolley. All furnaces are available with electric or gas heating.

- Maximum Temperatures up to 260 °C or 450 °C
- Heated electrically or with gas
- Electrical 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
- Available with horizontal (type/HA) or vertical air circulation (type/A) for optimal uniformity in your charge
- Ground level charging without floor insulation for 260 °C models
- Optimum temperature uniformity (according to DIN 17052-1) up to  $\Delta T$  10 K
- Optimal air circulation for your charge by means of adjustable air outlets
- Furnace chamber lined with alloy 314 (AISI)/(DIN material no. 1.4841) for 450 °C models
- Low shell temperature by means of high quality mineral wool insulation
- Manually adjustable air inlet and exhaust air vent
- High air exchange for fast drying processes
- Furnace sizes suitable for common charging systems, such as pallets, baskets, etc.
- Double-wing door for furnaces N 1500/.. and larger
- Over-temperature limit controller with adjustable cutout temperature for thermal protection class in accordance with EN 60519-2 as temperature limiter controller to protect the oven and load
- For control system see page 38

### Additional Equipment

- Optional floor insulation for improved temperature uniformity on 260 °C models
- Entry ramp or track cutouts for floor-level charging of models with insulated bottom
- Electro-hydraulic lift-door
- Fan system for faster cooling with manual or automatic control
- Automatic control of exhaust air vents for better ventilation of the furnace chamber
- Window and furnace chamber illumination



2 x N 12000/26S with charge racks for preheating of molds

- Safety technology according to EN 1539 for charges containing solvents
- Catalytic or thermal exhaust gas cleaning systems
- Custom sizes up to 30,000 liters and charge weights up to 30 tons

Model	Tmax °C	Inner dimensions in mm			Volume in l	Exterior dimensions in mm			Circulation rate m³/h	Supply power/kW	Electrical connections
		w	d	h		W	D	H			
N 560/26..	260	750	1000	750	560	1450	1865	2220	900	13,0	3-phase
N 1000/26..	260	1000	1000	1000	1000	1930	1900	1600	3600	18,0	3-phase
N 1500/26..	260	1500	1000	1000	1500	2380	1900	1600	3600	22,0	3-phase
N 1500/26..1	260	1000	1500	1000	1500	1880	2400	1600	3600	22,0	3-phase
N 2000/26..	260	1500	1100	1200	2000	2380	2000	1800	6400	22,0	3-phase
N 2000/26..1	260	1100	1500	1200	2000	1980	2400	1800	6400	22,0	3-phase
N 2010/26..	260	1000	1000	2000	2000	1880	1900	2720	7200	30,0	3-phase
N 2880/26..	260	1200	1200	2000	2880	2080	2100	2720	9000	54,0	3-phase
N 4000/26..	260	1500	2200	1200	4000	2380	3110	1800	9000	47,0	3-phase
N 4000/26..1	260	2200	1500	1200	4000	3080	2410	1800	9000	47,0	3-phase
N 4010/26..	260	1000	2000	2000	4000	1880	2900	2720	9000	54,0	3-phase
N 4500/26..	260	1500	1500	2000	4500	2380	2400	2720	12800	54,0	3-phase
N 5600/26..	260	1500	2500	1500	5600	2110	3180	2340	9000	69,0	3-phase
N 6750/26..	260	1500	3000	1500	6750	2110	3680	2340	19200	98,0	3-phase
N 7200/26..	260	2000	1500	2400	7200	2610	2410	3000	18000	93,0	3-phase
N 10000/26..	260	2000	2500	2000	10000	2610	3180	2840	25600	106,0	3-phase
N 560/45..E	450	750	1000	750	560	1450	1865	2220	900	13,0 <sup>1</sup> / 19,0	3-phase
N 1000/45..E	450	1000	1000	1000	1000	1930	1900	1600	3600	18,0 <sup>1</sup> / 40,0	3-phase
N 1500/45..E	450	1500	1000	1000	2380	1900	1600	1320	3600	22,0 <sup>1</sup> / 40,0	3-phase
N 1500/45..1E	450	1000	1500	1000	1500	1880	2400	1600	3600	22,0 <sup>1</sup> / 40,0	3-phase
N 2000/45..E	450	1500	1100	1200	2000	2380	2000	1800	6400	22,0 <sup>1</sup> / 46,0	3-phase
N 2000/45..1E	450	1100	1500	1200	2000	1980	2400	1800	6400	22,0 <sup>1</sup> / 46,0	3-phase
N 2010/45..E	450	1000	1000	2000	2000	1880	1900	2720	7200	30,0 <sup>1</sup> / 54,0	3-phase
N 2880/45..E	450	1200	1200	2000	2880	2080	2100	2720	9000	54,0 <sup>1</sup> / 66,0	3-phase
N 4000/45..E	450	1500	2200	1200	4000	2380	3110	1800	9000	47,0 <sup>1</sup> / 65,0	3-phase
N 4000/45..1E	450	2200	1500	1200	4000	3080	2410	1800	9000	47,0 <sup>1</sup> / 65,0	3-phase
N 4010/45..E	450	1000	2000	2000	4000	1880	2900	2720	9000	54,0 <sup>1</sup> / 66,0	3-phase
N 4500/45..E	450	1500	1500	2000	4500	2380	2400	2720	12800	54,0 <sup>1</sup> / 66,0	3-phase
N 5600/45..E	450	1500	2500	1500	5600	2110	3180	2340	9000	69,0 <sup>1</sup> / 93,0	3-phase
N 6750/45..E	450	1500	3000	1500	6750	2110	3680	2340	19200	98,0 <sup>1</sup> /116,0	3-phase
N 7200/45..E	450	2000	1500	2400	7200	2610	2410	3000	18000	93,0 <sup>1</sup> /117,0	3-phase
N 10000/45..E	450	2000	2500	2000	10000	2610	3180	2840	25600	106,0 <sup>1</sup> /130,0	3-phase

<sup>1</sup>Reduced connected power for plastics applications



Charging on different levels



Drive-in tracks for pallet truck or charging trolley

## Bogie Hearth Furnaces, Electric (W) or Gas-Fired (WB) for Core Drying, Thermal Decoring, and Preheating of Forms



Indirectly gas-heated bogie hearth furnace, with electrical bogie drive, vertical air circulation used for artificial ageing of aluminum pistons with charge weights of approx. 2 tons

For processes such as normalizing, ageing, curing, or preheating that include a heat treatment of heavy charges, we recommend our low-temperature bogie hearth furnaces. These furnaces are available for maximum working temperatures of 260 °C or 450 °C. They can be heated either electrically or with gas.

- Maximum temperatures of 260°C or 450 °C
- Bogie on rails for weights up to 50 tons
- Swing door hinged on the right
- Heated electrically or with gas
- Electrical heating of the furnace 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
- Optimum temperature uniformity (according to DIN 17052-1) up to  $\Delta T$  6 K
- Powerful fan with vertical air circulation
- Optimal air circulation with help of adjustable air outlets tailored to charge requirement
- Air inlet and exhaust air vent, manually adjustable
- High circulation rate for fast and steady heat transfer
- Furnace chamber lined with alloy 314 (AISI)/(DIN material no. 1.4841) for 450 °C models
- Over-temperature limit controller with adjustable cutout temperature for thermal protection class in accordance with EN 60518-2 as temperature limiter controller to protect the oven and load
- See page 38 for control systems



Enclosed heating coils for models with electric heating



Gas burner firing into a radiant tube for models with gas heating

Model	Tmax °C	Inner dimensions in mm			Volume in l	Exterior dimensions in mm			Circulation rate m³/h	Heating power/kW	Electrical connections
		w	d	h		W	D	H			
W(B) 5800/26AS	260	1100	2400	2200	5800	1980	3500	3400	12600	180	3-phase
W(B) 17280/26AS	260	2400	4000	1800	17280	3900	4400	3000	36000	240	3-phase
W(B) 21875/26AS	260	2500	3500	2500	21875	3400	4300	3400	36000	266	3-phase
W(B) 28800/26AS	260	2400	8000	1500	28800	3600	8400	2700	48000	360	3-phase
W(B) 2380/45AS	450	1100	1600	1350	2380	1600	2650	1850	6400	70	3-phase
W(B) 18790/45AS	450	1790	6000	1750	18790	3300	7200	2950	36000	300	3-phase



W 21875/26AS bogie hearth furnace for coil preheating, available for charge weights up to 50 tons

### Additional Equipment

- Electro-hydraulic vertical lift-door
- Horizontal air circulation for optimal temperature control throughout the useful height
- Electrical bogie drive
- Second door in combination with second bogie for optimal charging and faster process turnaround
- Automatic bogie movement systems
- Cooling fan for shorter process times
- Automatic control of exhaust air vents for optimal cooling of the furnace chamber
- Recuperator systems for exhaust heat recovery available on gas-heated models
- Optimum temperature uniformity (according to DIN 17052-1) up to  $\Delta T$  6 K on models with multiple zones of control
- Support structure made from heat-resisting cast alloy steel for high charge weights (see also page 19)
- Heat resistant boxes for protective gas or carburizing processes
- Process and charge documentation via Controltherm software or PLC-based control system
- Custom dimensions up to 30,000 liters
- Fixed furnace hearth and movable furnace (envelope concept) for precise loading of heavy charges up to 100 tons



Motor-driven valve actuators



Cooling fan for shorter process times



Bogie hearth furnace system with cross-transfer car for automatic bogie exchange

## Bogie Hearth Furnaces, Electrically Heated (W) or Gas-Fired (WB) for Annealing



W 1500/H



W 4700/S with lift-door



High-quality fibre insulation with corner bricks for shorter heating and cooling times



Cooling fan for shorter process cycles



Bogie with chain drive

For annealing and hardening of large parts, like heavy cast parts or tool steel dies to temperatures between 800 °C and 1200 °C, we recommend our bogie hearth furnaces with radiation heating. The bogie can be conveniently loaded outside the furnace. With a second door or bogie-transfer system, one bogie can be charged outside the furnace while the other bogie is in the furnace. This way, turnaround time between process cycles will be reduced substantially.

- Maximum temperatures of 900 °C or 1280 °C
- Double-walled housing with rear ventilation, provides low shell temperatures
- Swing door hinged on the right side
- Heating from five sides (four sides and bogie) provides for a uniform temperature distribution
- Automatic power connection to the bogie when moved into the furnace
- Heating elements mounted on support tubes provide for free radiation and long service life
- Floor 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 roof arch
- Bogie on rails incl. rails in front of the furnace for charging
- Adjustable air inlet damper
- Manual vapor vent on the furnace roof
- For control system see page 38

Model	Tmax °C	Inner dimensions in mm			Volume in l	Exterior dimensions in mm			Supply power/kW	Electrical connections	Weight in kg
		w	d	h		W	D	H			
W 1000/G	900	800	1600	800	1000	1400	2350	1880	57	3-phase	3000
W 1500/G	900	900	1900	900	1500	1500	2650	2010	75	3-phase	3500
W 2200/G	900	1000	2200	1000	2200	1600	2950	2120	110	3-phase	4000
W 3300/G	900	1000	2800	1200	3300	1600	3550	2320	140	3-phase	5300
W 4100/G	900	1200	2800	1200	4040	1800	3550	2350	140	3-phase	5400
W 5000/G	900	1000	3600	1400	5000	1600	4350	2520	185	3-phase	7500
W 7100/G	900	1400	3600	1400	7060	2000	4350	2570	185	3-phase	8500
W 7500/G	900	1000	5400	1400	7500	1600	6150	2520	235	3-phase	9100
W 8100/G	900	1600	3600	1400	8070	2200	4350	2590	275	3-phase	10400
W 10000/G	900	1000	7100	1400	10000	1600	7850	2520	300	3-phase	11000
W 1000	1280	800	1600	800	1000	1470	2400	1820	75	3-phase	3000
W 1500	1280	900	1900	900	1500	1570	2700	2010	110	3-phase	3500
W 2200	1280	1000	2200	1000	2200	1670	3000	2120	140	3-phase	4000
W 3300	1280	1000	2800	1200	3300	1670	3600	2320	185	3-phase	5300
W 4100	1280	1200	2800	1200	4040	1870	3600	2350	185	3-phase	5600
W 5000	1280	1000	3600	1400	5000	1670	4400	2520	235	3-phase	7500
W 7100	1280	1400	3600	1400	7060	2070	4400	2570	235	3-phase	8800
W 7500	1280	1000	5400	1400	7500	1670	6200	2520	300	3-phase	9100
W 8100	1280	1600	3600	1400	8070	2270	4400	2590	370	3-phase	10800
W 10000	1280	1000	7100	1400	10000	1670	7900	2520	390	3-phase	11000



Gas heated bogie hearth furnace WB 14880 S for annealing of large steel parts

#### Additional Equipment

- Powerful direct gas heating
- Support grid made of heat-resistant cast steel for optimum weight distribution on the bogie for use up to 1100 °C
- Second door in rear wall for use of second bogie
- Lift-door instead of swing door including heat shield for opening while hot
- Heat shield „filler bogie“ to prevent heat loss when the bogie is removed at high temperatures
- High-quality fibre insulation with corner bricks for shorter heating and cooling times
- Second bogie
- Electrical bogie drive
- Freely maneuverable bogie on Pevolon casters when using light charge weights
- Cooling fan for shorter process times
- Automatic control of exhaust air dampers
- Multiple zone control for optimum temperature uniformity according to DIN 17052-1 up to  $\Delta T$  10 K
- Alternative connected power
- Special sizes up to 20,000 liters
- Fixed hearth and movable furnace (envelope concept) for heavy charges up to 100 tons



W 6430/S1 with chain driven bogie



W 10800/HS1 with divided bogie for easier movement of heavy loads



Steel grid on bogie for charging heavy loads

## Rotary Hearth Furnaces for Preheating and Sintering of Molds



Rotary Hearth Furnace DH 630/S



Gear rim drive under the furnace



Exhaust air hood above charging opening

Rotary hearth furnaces are used in the area of precision casting. They are used to preheat and sinter molds which have already been dewaxed in autoclaves. This type of furnace is always recommended when the working temperature is maintained continuously and the molds have to be discharged for pouring. A servo motor is installed under the furnace which moves the furnace table at defined time intervals. The movement takes place in predetermined segments which can be specified for each application.

- Tmax up to 1000 °C
- Designed for continuous operation at one temperature
- Diameter up to 3000 mm
- Servo motor under the furnace for movement in defined segments
- Smooth table movement
- Parallel swinging door for charging/discharging
- Table movement triggered by a foot pedal, timer or input from another system
- Very compact design in comparison with other continuous furnaces
- Electric heating using wire heating elements mounted in the furnace ceiling

### Additional Equipment

- Multizone control for adjustable charge temperature profiles during passage
- Heating with powerful SiC heating rods for Tmax up to 1300 °C
- Fuel heating instead of electric heating
- Injection of protective gas for particular applications, such as the heat treatment of stainless steels

## Salt-Bath Furnaces, electrically (TS) or gas heated (TSB) for Heat Treatment of Steel or Light Metals

Salt-bath furnaces offer remarkably high temperature uniformity and excellent heat transfer to the work piece. Our salt-bath furnaces TS 20/15 - TS or TSB 70/90 are especially useful for heat-treating of metals in neutral or active salt baths. Processes such as carbonitriding (e.g. Tenifer) up to 600 °C, carburizing up to 950 °C, or bright annealing up to 1000 °C can be realized. In their standard version these furnaces are equipped with safety technology for heat treatment of steel. As additional feature they can be equipped with extended safety technology for heat treatment of light metals.

### Standard Model

- Maximum temperatures of 750 °C or 1000 °C in the salt bath
- Safety technology according to EN 60519-2
- Useful for heat treatment of steel
- Bath temperature control
- Electric (TS) all-round heating or gas heating (TSB)
- Removable collar plate made of solid steel
- Insulated swing-a-way lid
- Optimum temperature uniformity according to DIN 17052-1 up to  $\Delta T$  4 K in the bath
- Over-temperature limit controller in the furnace chamber to prevent dangerous conditions for the furnace or personnel
- Bath control of salt bath and furnace chamber

### Crucibles

- Type P: low carbon steel, CrNi plated and corundum coated for carburizing baths up to 950 °C, neutral salt and annealing baths up to 850 °C
- Type C: high alloy CrNi steel for neutral salt and annealing baths up to 1000 °C

### Additional Equipment

- Exhaust gas collection at rim for connection to an exhaust system
- Custom dimensions
- Enhanced safety systems for heat treatment of aluminium and magnesium in the salt bath with second over-temperature limit controller and PLC-bath control with thermocouples in the salt bath and in the furnace chamber



TS 40/30  
with exhaust gas collection at crucible rim



TSB 30/30  
with exhaust gas collection at crucible rim

Model	Tmax °C <sup>2</sup>	Inner dimensions crucible		Volume in l	Exterior dimensions in mm			Supply power/kW <sup>1</sup>	Electrical connections	Weight in kg <sup>1</sup>
		Ø in mm	h in mm		W	D	H			
TS 20/15	750	230	500	20	850	970	800	16	3-phase	650
TS 30/18	750	300	500	30	950	1070	800	20	3-phase	700
TS 40/30	750	400	500	60	1050	1170	800	33	3-phase	750
TS 50/48	750	500	600	110	1150	1270	970	58	3-phase	1000
TS 60/63	750	610	800	220	1250	1370	1170	70	3-phase	1200
TS 70/72	750	700	1000	370	1350	1470	1370	80	3-phase	1500
TS, TSB 20/20	1000	230	500	20	850	970	800	21	3-phase	650
TS, TSB 30/30	1000	300	500	30	950	1070	800	33	3-phase	700
TS, TSB 40/40	1000	400	500	60	1050	1170	800	44	3-phase	750
TS, TSB 50/60	1000	500	600	110	1150	1270	970	66	3-phase	1000
TS, TSB 60/72	1000	610	800	220	1250	1370	1170	80	3-phase	1200
TS, TSB 70/90	1000	700	1000	370	1350	1470	1370	100	3-phase	1500

<sup>1</sup>Only for electric version

<sup>2</sup>Salt bath temperature



Salt bath plant for annealing of aluminum components in the aircraft industry

## Tempering Plants for Steel and Aluminum



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

### Fully Automatic Tempering System with Air-Circulating 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.



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

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.

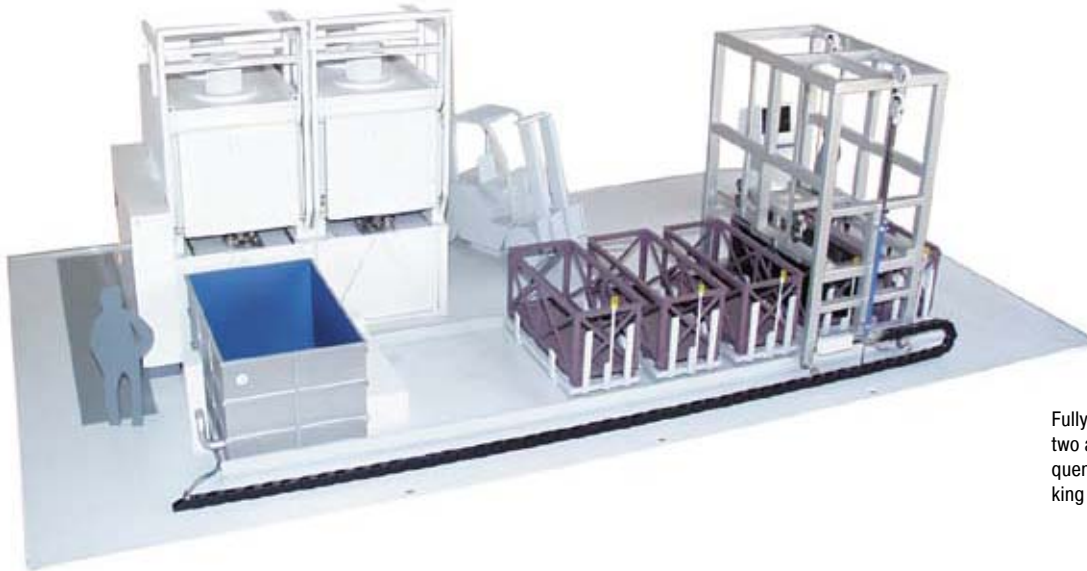
The entire heat treatment, including all movements, is fully automated. The PLC controls handle all movement and locking processes. The system automatically detects occupied parking spaces and furnaces and starts the programmed processes according to priority. Charge documentation takes place on an ongoing 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.



PC interface for central operation

### 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 air-circulating bogie hearth furnaces, quench bath, conveyor system, and parking spots for five charge baskets

## Fully Automated Tempering System with Air-Circulating 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 is, the loaded basket is documented from its process start in the parking space until removal after the end of the process.

### Implementation of the System

- 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



## Tempering Systems for Steel and Aluminum



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 Tempering System with Two Air-Circulating 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 automotive 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.

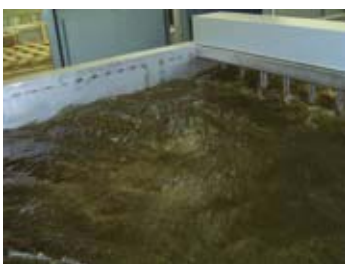
Solution annealing of the components takes place in two pit furnaces with 3570 liter furnace chambers. After the solution annealing process is concluded, the lid of the furnace is opened pneumatically, the basket is removed using the crane, and it is placed into the water bath. For better quench results,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

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.

#### Design of the System

- 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



Water bath with powerful circulation pump



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

### Manual Tempering System for Steel with Top-Hat Furnace H 4263/12S and Water Bath

This tempering system is available for the tempering of 8 meter steel profiles with a quenching time of 30 seconds. The furnace is a top-hat furnace which is loaded with a crane. After heat treatment, the operator positions the crane with attached C-hook in front of the furnace. The furnace is electrohydraulically opened by the operator at 1150 °C and the bogie is moved out of the furnace.

The charge holder on the bogie and the C-hook are designed in such a way that the charge is positioned into the C-hook directly when the bogie drives out. The crane only needs to lift it up. The operator then moves the material over the water bath and lowers it for quenching. After the quenching process, the basket is lifted back out of the water bath, drips dry, and is manually placed onto a free parking spot with the crane.

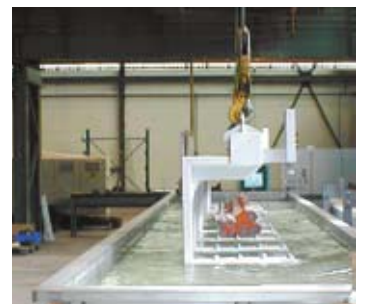
The system has PLC controls for temperature measurement and charge documentation. Every load can be assigned a name or a charge number, which is then stored along with the date.

#### Systems Design

- Top-hat furnace H 4263/12S, Tmax. 1200 °C, volume 4260 liters, electrohydraulic hood drive, chain drive for bogie
- Water bath with powerful circulation
- PLC controls with Nabertherm Control Center (NCC) for temperature regulation and charge documentation
- Safety fence around the entire system



Moving furnace table and material under the C hook of the crane



Quenching of steel bars in water

## Professional Control and Documentation Alternatives



H 1700 with colored, tabular depiction of the data



H 3700 with colored graphic presentation of data



Control Center NCC user interface displayed on a PC



Graphic printer

### HiProSystems Control and Documentation

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

#### Alternative User Interfaces

##### Touch panel H 700

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

##### Touch panel H 1700

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

##### Touch panel H 3700

All functions and process data are stored and displayed in easy to read charts. The data can be exported through various interfaces (RS 232, RS 422 /485, USB, Ethernet TCI/IP, MPI, Profibus) to a local PC or your company network for further processing. A CF card also gives the opportunity for data storage and transfer to a PC with a card reader.

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

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

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

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

Documentation and reproducibility gain increased attention with steadily rising quality standards.

The powerful Nabertherm software Controltherm MV provides for an optimum solution for the control and documentation of one or more furnaces (furnace data only).

#### Features

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

\*not possible in combination with temperature transducer

### Temperature Recorder

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

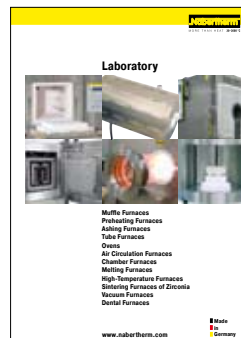
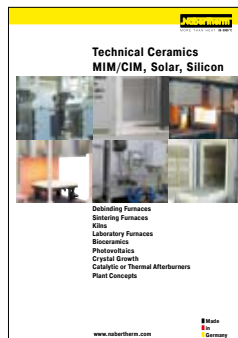
## The Nabertherm Product Range – [www.nabertherm.com](http://www.nabertherm.com)

### Heat Treatment of Metals, Plastics and Surface Finishing

With the furnaces shown in this catalog, Nabertherm offers a wide variety of furnaces and accessories. Please also ask for our catalogs Heat Treatment I + II, which provide more detail.



Continuous furnace D 650/S



### Arts & Crafts

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

### Glass

Different furnace concepts for annealing, bending slumping, decorating and tempering make Nabertherm your strong partner for the heat treatment of glass and quartz.

### Technical Ceramics MIM/CIM, Solar, Silicon/BioCeramics

Wire-heated kilns for use up to 1400 °C and MoSi<sub>2</sub> kilns for use up to 1800 C offer the best value and quality for sintering Technical Ceramics. All are available in sizes from bench-top to walk-in. To remove binders, we offer solutions from our Combi-Furnaces that debind and sinter in the same furnace to specialized systems for binder removal in a specialized atmosphere (e.g. BASF Catamold).

### Laboratory/Dental

Laboratory furnaces are available for a variety of applications ranging between 30 - 3000 °C. Our standard product range includes muffle, tube, convection, melting, assay, and high temperature furnaces.

## The whole World of Nabertherm: [www.nabertherm.com](http://www.nabertherm.com)

Please visit our website  
[www.nabertherm.com](http://www.nabertherm.com) and find out all you  
want to know about us and our products.

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

### Professional Solutions for:

- Arts & Crafts
- Glass
- Ceramics
- Laboratory/Dental
- Heat Treatment of Metals, Plastics & Surface Finishing
- Foundry



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Her finner du også informasjon om våre kurs.