Nabertherm
MORE THAN HEAT 30-3000 °C

Operating Instructions

Electrically Heated Chamber Furnaces

N 40 E - N 500 E
N 100 - N 2200/H
NW 150 - NW 1000/H

-> 01.2015

Original instructions

Made in Germany

www.nabertherm.com

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1 Introduction

Dear Customer,

Thank you for choosing a quality product from Nabertherm GmbH.

You can be proud that you have chosen a furnace which has been especially tailored to suit your manufacturing and production conditions.

This product is characterized by

- professional workmanship
- high performance due to its high efficiency
- high-quality insulation
- low power consumption
- low noise level
- simple installation
- easy to maintain
- high availability of spare parts

Your Nabertherm Team

Note

These documents are intended only for buyers of our products and may not be copied or disclosed to third parties without our written consent. (Law governing copyright and associated protective rights, German Copyright Law from Sept. 9, 1965)

Protective Rights

Nabertherm GmbH owns all rights to drawings, other documents and authorizations, also in case of applications for protective rights.

Note

All the figures in the instructions have a descriptive character; in other words, they do not represent the exact details of the furnace.

Note

The pictures contained in the instruction manual may contain inaccuracies in terms of the function, design and furnace model.

1.1 Product Description

These electrically heated furnaces are a high-quality product which will give you many years of reliable service if they are properly cared for and maintained. One basic prerequisite is that the furnace is used the way it was designed to be used.

During development and production a high priority was placed on safety, functionality and economy.

Furnaces in this model series are electrically heated firing furnaces for ceramic, glass or porcelain paintings, but can also be used for simply fusing jobs. This furnace model features an attractive design, highest quality and an excellent temperature uniformity. Ceramic furnaces are, depending on the furnace model, heated from both sides, three sides or five sides. The right furnaces fo hobby, schools, nursery schools, studios as well as small workshops.

Description of the Furnace

Basic Construction:

- Professional design
- Rugged housing design
- Environment-friendly, long-life powder-coating of housing
- Dual shell door with low outside temperatures
- Multi-layered lining with light weight insulation bricks and microporous insulation for a cooler shell and low power consumption
- Air outlet in the ceiling
- Thermocouple Type S
- High quality heating wire with optimal thickness and length results in long life time
- Special arrangement of the heating elements for optimal temperature uniformity
- Solid state relays provide for low-noise operation
- Fast power switching for precise temperature uniformity
- Door safety switch shuts down power to the elements when the door is opened

Other Characteristics of this Product are:

N 40 E(R) - N 100 E

- Tabletop mounting
- Heating from both sides with high-quality heating elements, protected in grooves
- Infinitely adjustable, manual air inlet opening

Accessories

- Base: comfortable charging height of 770 mm
- Door can be secured with padlock.

N 140 E(LE) - N 500 E

- Heated from two walls and the foor
- Heating elements embedded in grooves for protection (N 140 E(LE) – N 280 E(LE))
- Freely radiating heating elements placed on supporting tubes (N 500 E)

- Rugged, self-supporting, vaulted arch construction
- Solid, dual shell door with long-life sealing
- Semi-automatic, electromagnetic controlled air inlet flap (models N 140 E(LE) – N 280 E(LE))
- Infinitely adjustable, manual air inlet opening (N 500 E)
- Delivery incl. 3 ceramic supports and lower shelve for safe stacking of the kiln furniture (models N 140 E- N 280 E)
- Delivery incl. SiC-bottom plate for even stacking of the kiln furniture (N 500 E)
- Delivery includes pipe connection for connecting an air outlet with 80 mm diameter for N 140 E(LE) – N 280 E(LE)
- Base
- Comfortable charging height with base of 800 mm (N 500 E = 500 mm)
- Dual shell housing for low outside temperatures.

Accessories

- Door can be secured with padlock.

Additional Equipment

- Fully automatic, electromagnetically controlled air inlet flap (Model N 140 E(LE) – N 280 E(LE))

N 100(H) - N 2200(H)

- Heating on five sides
- Heating elements on support tubes ensure uninterrupted heat radiation
- Bottom heating is protected with SIC tiles with an even stacking base
- Heating operates quietly with semi-conductor relay (N 100(H) – N 300(H))
- Self-supporting and resilient roof design, built as a brick arch
- Low outer temperatures due to double-walled housing
- Semi-automatic, electromagnetic controlled air inlet flap (models N 100(H) – N 300(H))
- Infinitely adjustable, manual air inlet opening from Model N 440(H)
- Exhaust air opening in the roof, automatic exhaust air flap from Model N 440(H)
- Delivery includes a connector to connect an exhaust air pipe (80 mm diameter) (N 100(H) – N 300(H)), automatic exhaust air flap from Model N 440(H)
- Base (N 100(H) – N 300(H))
- Convenient charging height with 800 mm base (N 440(H) / N 660(H) = 500 mm)
- Manual zone control is available for challenging firings
- Other sizes and special designs on request

Additional Equipment

- Fully automatic, electromagnetically controlled air inlet flap (Model N 100(H) – N 300(H))
- Motor-driven exhaust air flap/s

NW 150(H) - NW 1000(H)

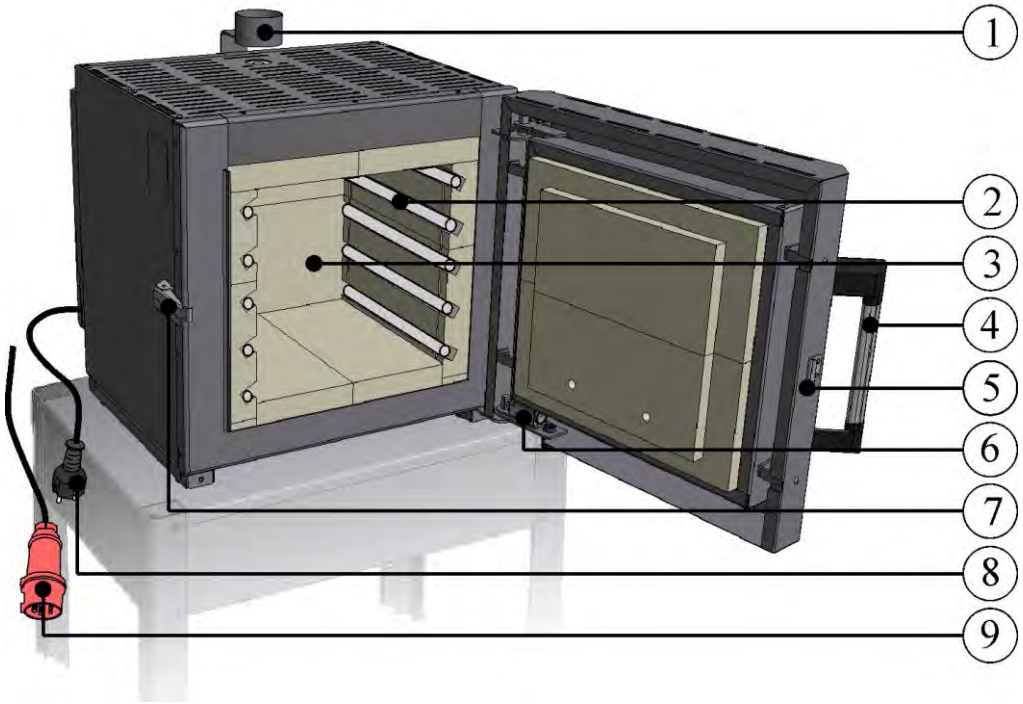
- The furnace floor can be pulled out of the furnace conveniently via a drawer mechanism (NW 150(H) – NW 300(H)) or a bogie system (N 440 ff.). Free access in front of the furnace enables easy charging. Ergonomic aspects are important as regards the charging height. The improved overview during charging also allows the furnace to be packed more densely.
- Energy-saving insulation
- Heating on five sides
- Intuitively operated controller for space-saving installation
- Bottom heating protected by SIC tiles with an even stacking base
- Self-supporting and resilient roof design, built as a brick arch
- Low outer temperatures due to double-walled housing
- Sturdy, double-walled door
- Fully automatic, electromagnetically controlled air inlet flap (Model NW 150(H) – NW 300(H))
- Infinitely adjustable, manual air inlet opening from Model NW 440(H) ff.
- Exhaust air opening in the roof
- Delivery includes a connector to connect an exhaust air pipe (80 mm diameter) (NW 150(H) – NW 300(H)), automatic exhaust air flap from Model N 440(H)
- Convenient charging height with 800 mm base (NW 440(H) / NW 1000(H) = 500 mm)

Additional Equipment

- Fully automatic, electromagnetically controlled air inlet flap (Model NW 150(H) – NW 300(H))
- Motor-driven exhaust air flap/s

1.2 Overview of the Complete Furnace

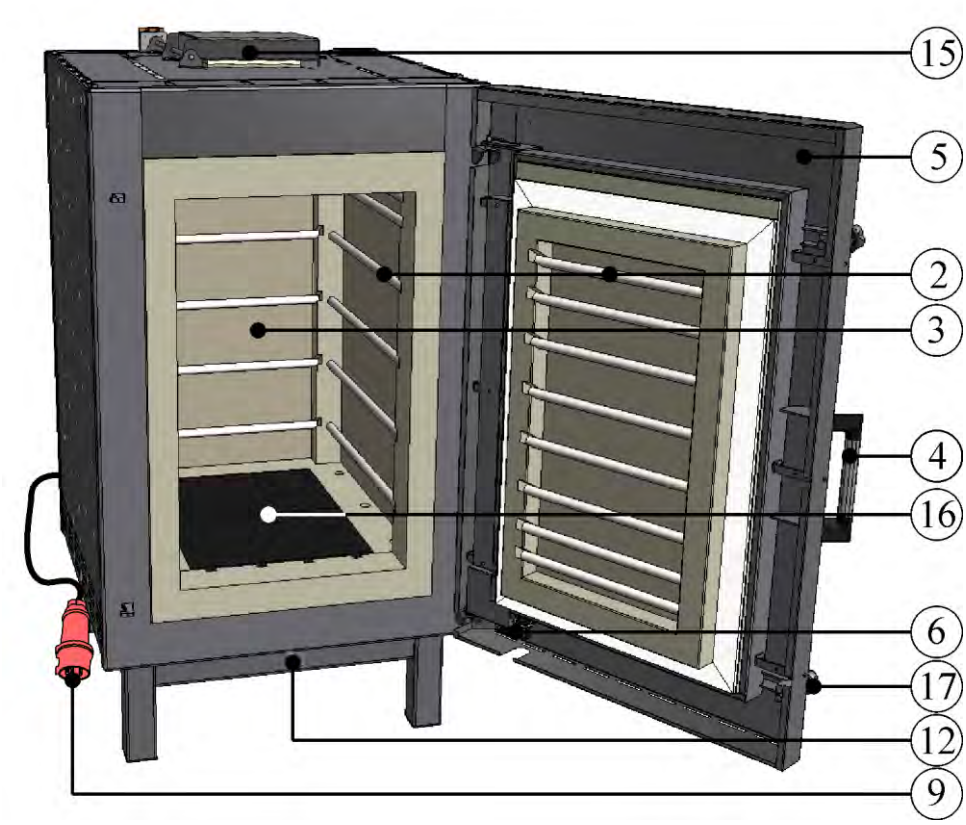
Furnace model N 40 E - N 500 E (similar to picture)



Chamber furnace as tabletop model (table not included with delivery)

Fig. 1: Example: Chamber furnace N 40 E (tabletop model) with base and transport casters as accessories

Furnace model N 100(H) - N 2200(H) (similar to picture)



Example N 440/H

Example 150/H

Fig. 2: Example: Chamber furnace N 440/H and N 150/H

Furnace model NW 150(H) – NW 300(H) (similar to picture)

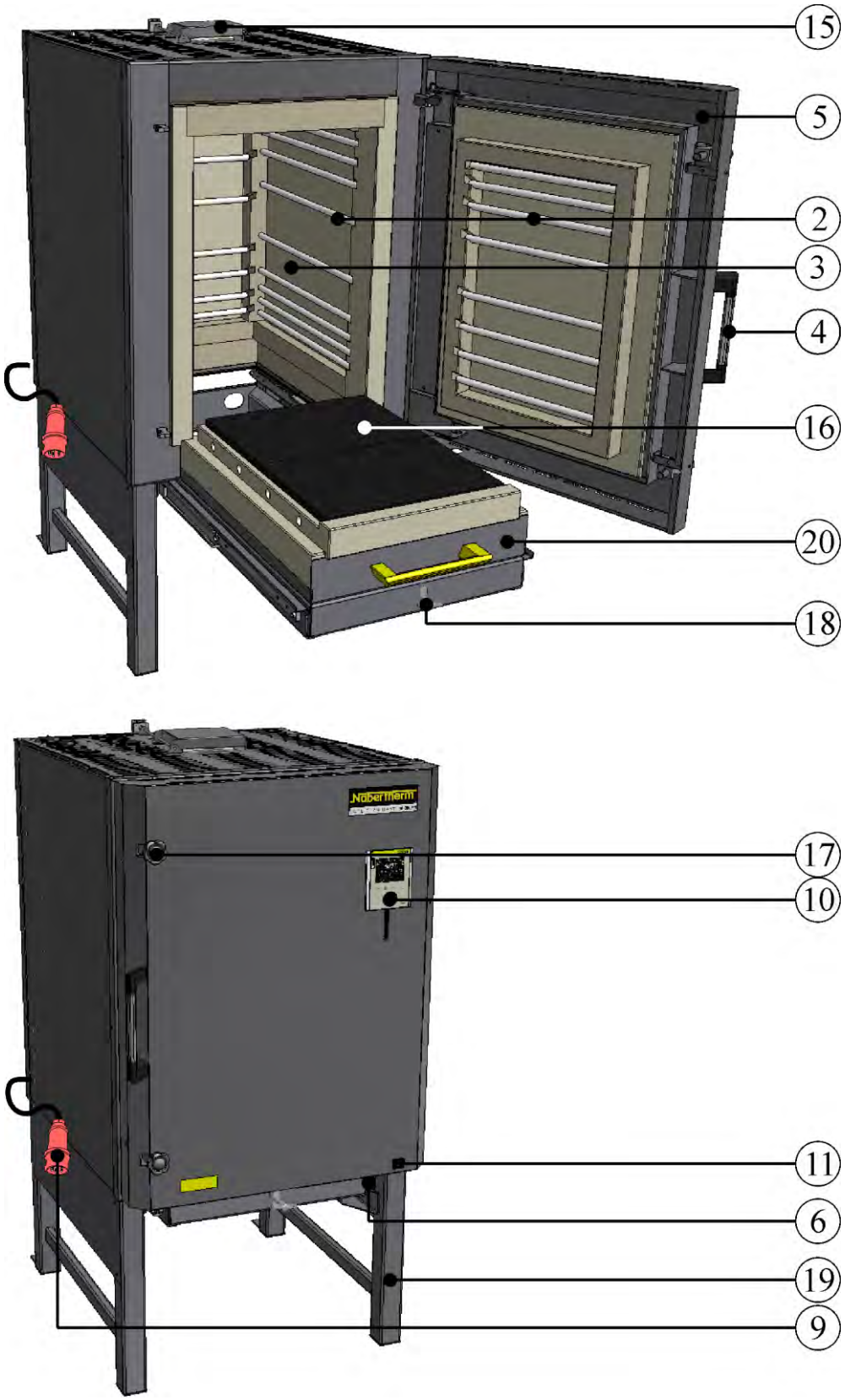
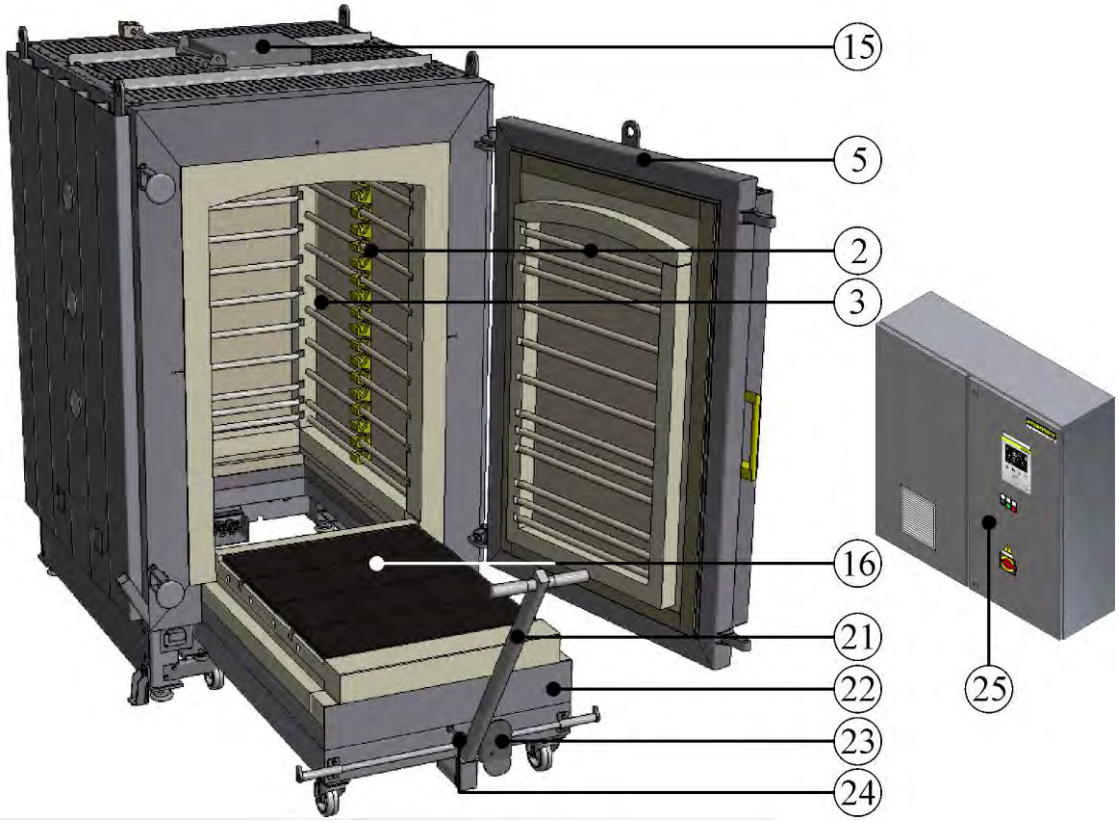


Fig. 3: Example: Chamber furnace NW 300 with slide-in drawer

Furnace model NW 440(H) - NW 1000(H) (similar to picture)



NW 1000 with external switchgear(controller and switching elements depending on design)

NW 660

Fig. 4: Example: Chamber furnace with pull-out bogie

No.	Name
1	Bypass connection
2	Heating elements on carrier tubes
3	Furnace chamber
4	Handle
5	Swing door
6	Door contact switch
7	Adjustable door lock
8	Power plug (up to 3600 watts)
9	Power plug (from 5500 watts)
10	Controller (depending on model)
11	Power switch with integrated fuse (switching furnace on/off)
12	Air inlet (infinitely adjustable)
13	Base (accessory): Convenient filling height of 770 mm (without transport casters)
14	Transport casters as accessories (front casters with locking brake)
15	Automatic exhaust air flap (N100-N300/H as an accessory; standard from N440)
16	SiC floor tile to protect the bottom heating
17	Lock
18	Semi-automatic, electromagnetically controlled air inlet flap (fully automatic as an additional feature)
19	Base
20	Pull-out drawer (to pull out the furnace floor for easy charging. NW 150 – NW 300/H; from NW 440, the furnace floor is designed as a bogie)
21	Drawbar
22	Bogie can be moved freely, with internal heating elements
23	Foot pedal (for easy locking of the bogie and furnace housing)
24	Infinitely adjustable, manual fresh air opening
25	Switchgear (controller and switching elements depending on model)

1.3 Safeguarding against Dangers Posed by Over-Temperature

Over-temperature limiters with manual reset/with automatic reset to protect against over-temperature in the furnace chamber are available for Nabertherm GmbH furnaces either as a standard feature (depending on the model series) or as additional equipment (customized design).

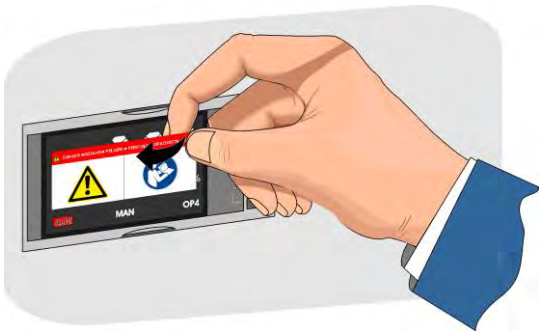
The over-temperature limiter with manual reset/with automatic reset monitors the furnace chamber temperature. The display shows the most recently set cut-off temperature. If the furnace chamber temperature rises about the pre-set cut-off temperature the heating is shut

down to protect the furnace, the charge and/or the operating equipment.

	**⚠ DANGER** • **Danger caused by incorrectly entered cut-off temperature at the over-temperature limiter with manual reset/over-temperature limiter with automatic reset.** • **Mortal danger** • If, as a result of over-temperature from the charge and/or the operating equipment, a charge is likely to be damaged at this pre-set cut-off temperature of the over-temperature limiter with manual reset/over-temperature limiter with automatic reset, or if the charge itself becomes a source of danger for the furnace or its surroundings, the cut-off temperature must be reduced at the over-temperature limiter with manual reset/automatic reset to the maximum permissible value.

Read the operating instructions of the over-temperature limiter with manual reset/with automatic reset before starting the furnace. The safety sticker must be removed from the over-temperature limiter with manual reset/with automatic reset. Any time a change is made in the heat treatment program, the maximum permissible cut-off temperature (alarm trigger temperature) at the over-temperature limiter with manual reset/with automatic reset must be checked or re-entered.

We recommend setting the maximum setpoint temperature of the heating program in the limiter between 5 °C and 30 °C, depending on the physical characteristics of the furnace, below the trigger temperature of the over-temperature limiter with manual reset/with automatic reset. This prevents an unwanted triggering of the over-temperature limiter with manual reset/with automatic reset.



Description and function, see the Operating Instructions of the over-temperature limit controller/guard

Fig. 5: Removing the sticker (similar to picture)

1.3.1 Key to the Model Names

Example	Explanation
N 100 E	**N** = Chamber kiln (chamber furnace) **NW** = Chamber kiln with drawer bottom or as a bogie
N **100** E	**40** = 40 liter furnace chamber (volume in L) **70** = 70 liter furnace chamber (volume in L) **100** = 100 liter furnace chamber (volume in L) **140** = 140 liter furnace chamber (volume in L) **1000** = 1000 liter furnace chamber (volume in L) **1500** = 1500 liter furnace chamber (volume in L) **2200** = 2200 liter furnace chamber (volume in L)
N 100 **E**	**E** = entry (entry-level model) **H** = high temperature **LE** = low energy **R** = rapid **S** = custom designs

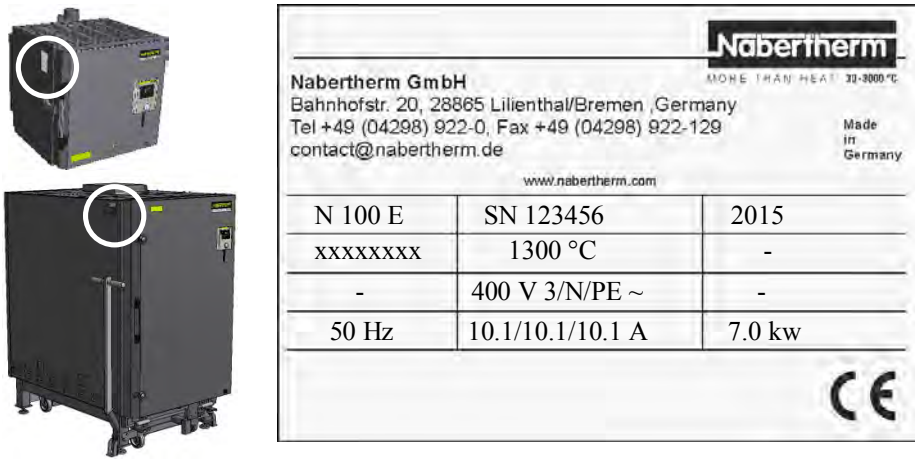


Fig. 6: Example: Model name (type plate)

1.4 Scope of Delivery

The scope of delivery includes:

	Furnace components	Quantity	Comment
	Chamber furnace N ...	1 x	Nabertherm GmbH
	Power cable[1]	1 x	Nabertherm GmbH
	Bypass connecting piece[1]	1 x	Nabertherm GmbH
	Fresh-air flap[1]	1 x	Nabertherm GmbH
	SiC floor board[1] (Furnace model N 100 – NW 1000/H)	[3]	Nabertherm GmbH
	Allen key	1 x	Nabertherm GmbH
	Ceramic underlayers[1] 691600956 (Furnace model N 40 E – N 280 E)	3 x	Nabertherm GmbH
	Installation connecting piece[1] 691600185 (Furnace model N 140 LE – N 280 E)	3 x	Nabertherm GmbH
	Accessories:		
	Base[2]	1 x	Nabertherm GmbH
	Transport castors[2]	4 x	
	Installation board/s[2] Installation connecting piece[2]	[4]	Nabertherm GmbH
	Charging frame[2]	1x[2]	
	Forklift truck[2]	1x[2]	Nabertherm GmbH
	Other components, variable depending on the particular furnace	- - -	Consult the shipping papers
	**Document type**	**Quantity**	**Comment**
	Furnace Operating Instructions	1 x	Nabertherm GmbH
	Controller Operating Instructions	1 x	Nabertherm GmbH
	Other documents, variable dependent on the particular furnace	- - -	

[1] in scope of delivery depends on design/furnace model
[2] in scope of delivery depend on need, see shipping papers
[3] quantity depends on furnace model
[4] quantity depends on on need, see shipping papers

Note

Make sure that all documents are carefully stored. All the functions of this furnace were tested during manufacturing and prior to shipping.

Note

The documents included do not always contain the electrical schematics and pneumatic schematics.

If you need the respective schematics they can be ordered from Nabertherm Service.

2 Specifications

Electrical specifications are on the type plate located on the side of the furnace.

Model	Tmax	Inner dimensions in mm			Volume	Outer dimensions in mm			Connected load	Electrical connection	Weight
	°C	w	d	h	in L	W	D	H	kW		in kg
N 40 E	1300	350	330	350	40	640	800	600[2]	2.9	1-phase	90
N 40 E/R	1300	350	330	350	40	640	800	600[2]	5.5	3-phase[1]	90
N 70 LE	1200	400	380	450	70	690	850	700[2]	2.9	1-phase	120
N 70 E	1300	400	380	450	70	690	850	700[2]	3.6	1-phase	120
N 70 E/R	1300	400	380	450	70	690	850	700[2]	5.5	3-phase[1]	120
N 100 E	1300	460	440	500	100	750	910	750[2]	7.0	3-phase	150

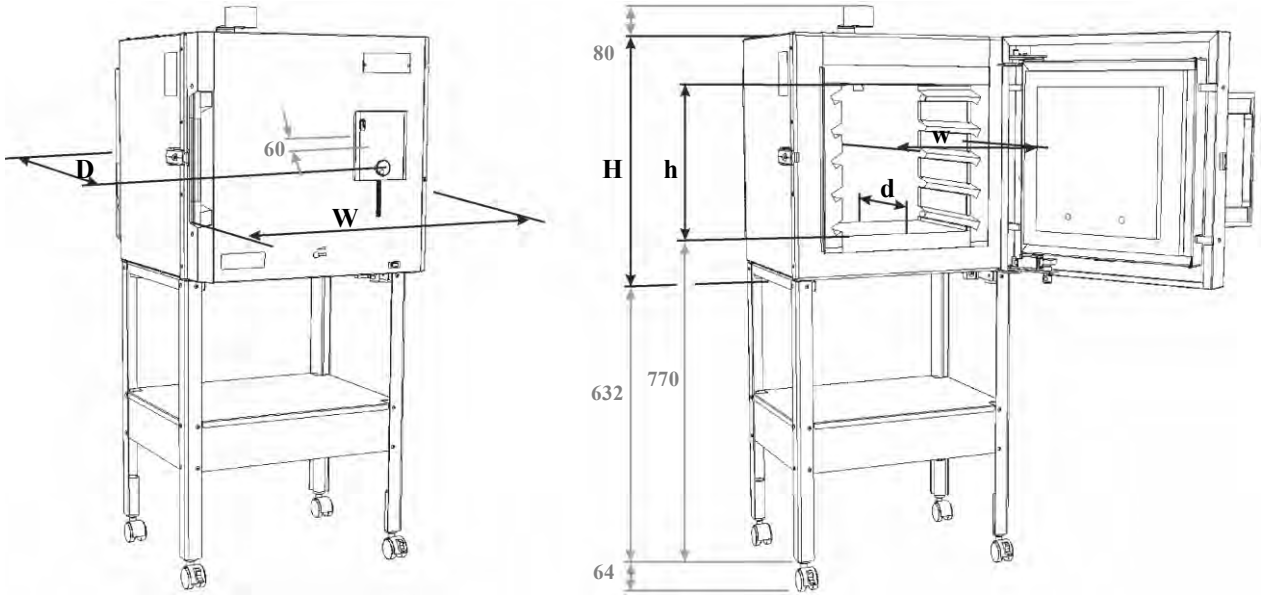


Fig. 7: Dimensions (N 40 E – N 100 E)

Model	Tmax	Inner dimensions in mm			Volume	Outer dimensions in mm			Connected load	Electrical connection	Weight
	°C	w	d	h	in L	W	D	H	kW		in kg
N 140 LE	1100	450	580	570	140	720	1030	1440[3]	6.0	1-phase[4]	220
N 210 LE	1100	500	580	700	210	770	1030	1570[3]	9.0	3-phase	270
N 280 LE	1100	550	580	830	280	820	1030	1700[3]	9.0	3-phase	300
N 140 E	1300	450	580	570	140	720	1030	1440[3]	9.0	3-phase	220
N 210 E	1300	500	580	700	210	770	1030	1570[3]	11.0	3-phase	270
N 280 E	1300	520	580	890	280	820	1030	1700[3]	15.0	3-phase	300
N 500 E	1300	600	820	1000	500	1000	1470	1820[3]	30.0	3-phase	700
N 100	1300	400	530	460	100	720	1130	1440[3]	9.0	3-phase	275
N 150	1300	450	530	590	150	770	1130	1570[3]	11.0	3-phase	320
N 200	1300	470	530	780	200	790	1130	1760[3]	15.0	3-phase	375
N 300	1300	550	700	780	300	870	1300	1760[3]	20.0	3-phase	450
N 440	1300	600	750	1000	440	1000	1400	1830[3]	30.0	3-phase	780
N 660	1300	600	1100	1000	660	1000	1750	1830[3]	40.0	3-phase	950
N 1000	1300	800	1000	1250	1000	1470	1850	2000[3]	57.0	3-phase	1800
N 1500	1300	900	1200	1400	1500	1570	2050	2160[3]	75.0	3-phase	2500
N 2200	1300	1000	1400	1600	2200	1670	2250	2360[3]	110.0	3-phase	3100
N 100/H	1340	400	530	460	100	760	1150	1440[3]	11.0	3-phase	310
N 150/H	1340	430	530	620	150	790	1150	1600[3]	15.0	3-phase	380
N 200/H	1340	500	530	720	200	860	1150	1700[3]	20.0	3-phase	420
N 300/H	1340	550	700	780	300	910	1320	1760[3]	27.0	3-phase	550
N 440/H	1340	600	750	1000	440	1000	1400	1830[3]	40.0	3-phase	880
N 660/H	1340	600	1100	1000	660	1000	1750	1830[3]	52.0	3-phase	1080
N 1000/H	1340	800	1000	1250	1000	1470	1850	2000[3]	75.0	3-phase	2320
N 1500/H	1340	900	1200	1400	1500	1570	2050	2160[3]	110.0	3-phase	2700
N 2200/H	1340	1000	1400	1600	2200	1670	2250	2360[3]	140.0	3-phase	3600

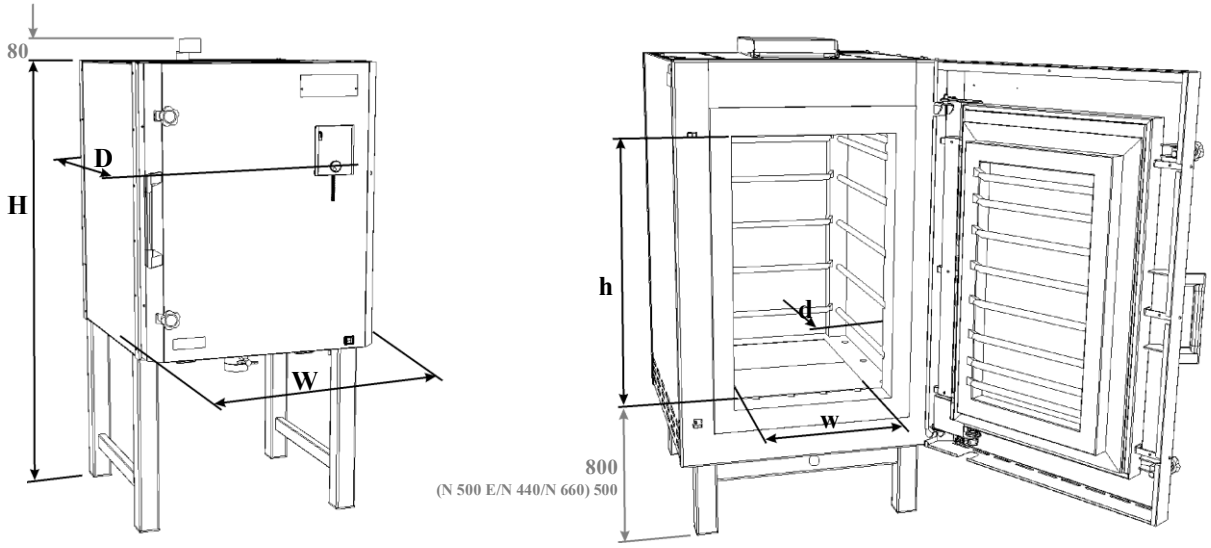


Fig. 8: Dimensions (N 140 LE – N 2200/H)

Model	Tmax	Inner dimensions in mm			Volume	Outer dimensions in mm			Connected load	Electrical connection	Weight
	°C	w	d	h	in L	W	D	H	kW		in kg
NW 150	1300	430	530	620	150	790	1150	1600	11.0	3-phase	400
NW 200	1300	500	530	720	200	860	1150	1700	15.0	3-phase	460
NW 300	1300	550	700	780	300	910	1320	1840	20.0	3-phase	560
NW 440	1300	600	750	1000	450	1000	1400	1830	30.0	3-phase	970
NW 660	1300	600	1100	1000	660	1000	1750	1830	40.0	3-phase	1180
NW 1000	1300	800	1000	1250	1000	1470	1750	2220	57.0	3-phase	1800
NW…150/H	1340	430	530	620	150	790	1150	1600	15.0	3-phase	520
NW…200/H	1340	500	530	720	200	860	1150	1700	20.0	3-phase	600
NW 300/H	1340	550	700	780	300	910	1320	1840	27.0	3-phase	730
NW 440/H	1340	600	750	1000	450	1000	1400	1830	40.0	3-phase	1260
NW 660/H	1340	600	1100	1000	660	1000	1750	1830	57.0	3-phase	1530
NW 1000/H	1340	800	1000	1250	1000	1470	1750	2220	75.0	3-phase	2320

Note	
	Model **NW 150** with pull-out drawer – maximum charge weight **75 kg** Model **NW 200** with pull-out drawer – maximum charge weight**100 kg** Model **NW 300** with pull-out drawer – maximum charge weight **150 kg**

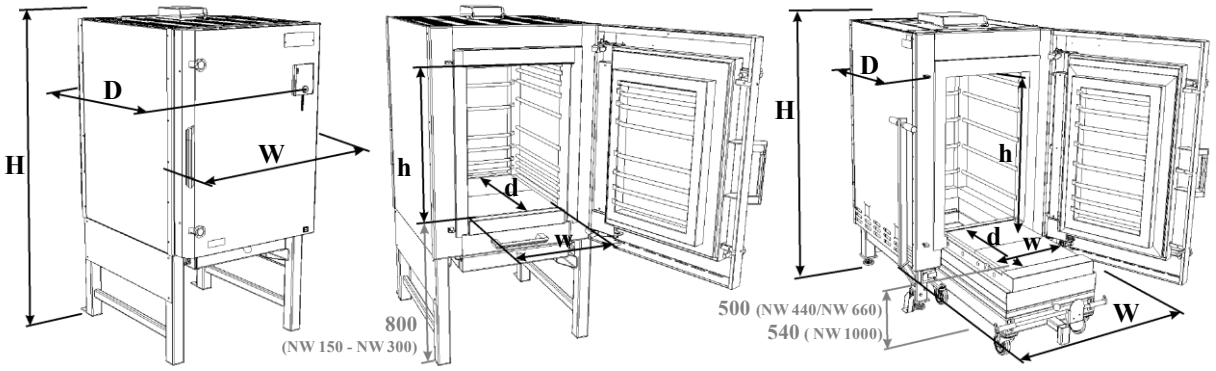


Fig. 9: Dimensions (NW 150 – NW 1000/H)

[1] Heating only beetween two phases
[2] Height, including base, **+ 632 mm**
[3] Base included
[4] Fusing of 32 A if connected to 230 V

Electrical Connection	Voltage (V):	Consult type plate
	Frequency (Hz):	Consult type plate
	Electric current (A)	Consult type plate
Thermal Protection Class	Furnaces:	**as specified in DIN EN 60519-2** without safety controller: Class 0 with safety controller: Class 2
Protective Type	Furnaces:	IP20
	Switch cabinet	IP40

Ambient Conditions for Electrical Equipment	Temperature: Humidity:	+5 °C to + 40 °C max. 80 % not condensing
Weights	Furnace with accessories	Varies (consult the shipping papers)
Emissions	Continuous sound pressure level:	< 80 dB(A)

2.1 Warranty and Liability

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As regards warranty and liability, the normal Nabertherm warranty terms apply, unless individual terms and conditions have been agreed. However, the following conditions also apply:

Warranty and liability claims for personal injury or damage to property shall be excluded if they are attributable to one or more of the following causes:

- Everyone involved in operation, installation, maintenance, or repair of the furnace must have read and understood the operating instructions. No liability will be accepted for damage or disruptions to operation resulting from non-compliance with the operating instructions.
- Not using the furnace as intended,
- Improper installation, start-up, operation, or maintenance of the furnace,
- Operation of the furnace with defective safety equipment or improperly installed or non-functioning safety and protective equipment,
- Not observing the references in the operating instructions to transportation, storage, installation, start-up, operation, maintenance, or equipping the furnace,
- Making unauthorized changes to the furnace,
- Making unauthorized changes to the operating parameters,
- Making unauthorized changes to the parameterization, the settings, or the program,
- Original parts and accessories are designed especially for Nabertherm furnaces. Replace parts only with original Nabertherm parts. Otherwise the warranty will be void. Nabertherm accepts absolutely no liability for damage caused by using parts that are not original Nabertherm parts.
- Catastrophes due to third-party causes and force majeure.

3 Safety

3.1 Intended Use

The Nabertherm furnace was designed and built in conformance with a careful selection of the applicable harmonized standards and other technical specifications. Hence, it corresponds to the state of the art and assures the greatest degree of safety.

Furnaces in this model series are electrically heated firing furnaces for ceramic, glass or porcelain paintings, but can also be used for simply fusing jobs.

- Any other use, such as processing of products other than those for which the furnace was intended as well as handling hazardous materials or materials dangerous to health is deemed IMPROPER and such uses must be approved in writing by Nabertherm.
- Under certain circumstances gases or materials may be released from the materials in the furnaces that settle on the insulation or the heating elements and destroy them. **If**

applicable, read the labels and instructions on the packaging of materials that you use.

- Furnaces with over-temperature limit controllers must have their shut-down temperatures set to prevent any overheating of the material.
- The set-up instructions and safety regulations must be followed, otherwise the furnace will be considered improperly used, effectively cancelling any claims against Nabertherm GmbH. The EC Declaration of Conformity will cease to be valid if any modifications are made to the machine without our approval.
- The set-up instructions and safety regulations must be followed, otherwise the furnace will be considered improperly used, effectively cancelling any claims against Nabertherm GmbH.
- Opening the furnace while it is still hot, over 200 °C (392 °F), can lead to increased wear of the following components: insulation, door seal, heating elements and furnace housing. No liability shall be accepted for any damage to the goods or the furnace resulting from non-compliance with this warning.

Operation with power sources, products, operating equipment, auxiliary materials, etc., which are listed as hazardous or which may in any way harm the health of the operator is prohibited.

The furnace must not be filled with materials or substances that release explosive gases or vapors. Only materials and substances whose properties are known may be used.

This furnace was designed for **private and commercial** use. The furnace is **NOT** to be used for heating food, animals, wood, grains, etc.

The furnace must NOT be used to heat the workplace.

Do NOT use the furnace to melt ice or for similar purposes.

Do NOT use the furnace as a clothes dryer.

▶ **Note**

See safety instructions in the individual sections.

The operator is liable for any resulting damages.

Caution

Operating the furnace with explosive gases or mixtures, including explosive gases or mixtures created as a result of heating/drying, is prohibited.

This furnace features **no** safety technology for processes which produce combustible mixtures, for example debinding.

If the furnace is still used for such processes despite this fact, the concentration of organic gas mixtures in the furnace must never exceed 3% of the lower explosion limit (LEL). This pre-requisite applies not only to normal operation but, in particular, to exceptional situations such as process disruptions (caused, for example, by the failure of a power unit). You must ensure that the furnace is adequately ventilated and vented.

Nabertherm offers a broad range of furnaces which were especially developed for processes involving the use of combustible gas mixtures.

Note

This product does **not** comply with the ATEX Directive and may **not** be used in ignitable atmospheres. It must not be operated with explosive gases or mixtures or during processes where explosive gases or mixtures are produced.

3.2 Requirements for the Furnace Operator

The set-up instructions and safety regulations must be followed, otherwise the furnace will be deemed to have been used improperly, effectively cancelling any claims against Nabertherm GmbH.

This level of safety can be achieved only if all the necessary measures have been taken. It depends on the furnace operator's diligence in planning these measures and controlling how they are carried out.

The operator must ensure that

- **This furnace is NOT used by certain persons (including children) with restricted physical, sensorial or mental capabilities or who have insufficient experience and/or insufficient knowledge, unless they are supervised by a person who is responsible for their safety or are instructed in how to use the furnace. Children should be supervised to make sure that they do not play with the furnace.**
- When ceramics, clay, or glaze are fired, they can emit gases and vapors that are harmful to your health. It is therefore necessary to make sure that the "exhaust gases" emitted from the exhaust air opening are directed outdoors in a suitable manner (ventilate the working area). If adequate ventilation cannot be ensured at the working area, the "exhaust gases" must be removed via a pipe (see "Exhaust Gas System").
- Before placing materials in the furnace, check whether they could harm or destroy the insulation or the heating elements. Materials that could damage the insulation include: alkalis, alkaline earths, metal vapors, metal oxides, chlorine compounds, phosphorous compounds, and halogens. **If applicable, read the labels and instructions on the packaging of materials that you use.**
- The furnace is operated only in a perfect operating condition and, in particular, that the functions of the safety components are checked regularly.
- Necessary personal protective equipment is available. Example: protective gloves, suitable apron, etc.
- This instruction manual is to be kept beside the furnace. These instructions must be available at all times for anyone working with or on the furnace;
- All the safety and operating instruction signs on the furnace can be read properly. Damaged or unreadable signs must be replaced immediately,
- Personnel are informed regularly about all issues involving occupational safety and environmental protection and are familiar with all the operating instructions, especially those involving safety,
- If the furnace is used commercially:
  Observe the safety regulations applicable in your country. In Germany, the furnace must be checked by a qualified electrician at defined intervals in accordance with a regulation issued by the employers' accident insurance fund.

Note

In Germany, the general accident protection guidelines must be observed. The national accident prevention regulations of the country of operation apply.

3.3 Protective Clothing

Wear heat-resistant gloves to protect your hands.

Wear safety boots to protect your feet.

3.4 Basic Measures During Normal Operation

Risks during normal operation

Before switching the furnace on, check and ensure that only authorized persons are in the working area of the furnace and that no one can be injured as a result of operating the furnace.

Each time, before starting production check and ensure that all the safety equipment functions as intended (for example, that the contact safety switch switches the heating off when the lid is opened).

Before starting production each time, check the furnace for obvious damage and ensure that it is operated only in a perfect condition. Report any defects to Nabertherm Service immediately.

Before starting production each time, remove all materials and objects that are not needed for production from the working area.

At least once every day (see also Servicing and Maintenance) check the following:

- Check the furnace for obvious external damage (visual check), for example insulation, heating elements, power cable, exhaust gas system, if applicable.
- Check that all safety equipment is functioning (for example, that the contact safety switch switches the heating off when the door is opened).

3.5 Basic Measures in Case of Emergency

3.5.1 What to do in an Emergency

Note

The power plug is to be pulled out to stop the furnace in case of an emergency. Therefore, the power plug must be accessible at all times when the furnace is operating so that it can be pulled out quickly in case of an emergency.

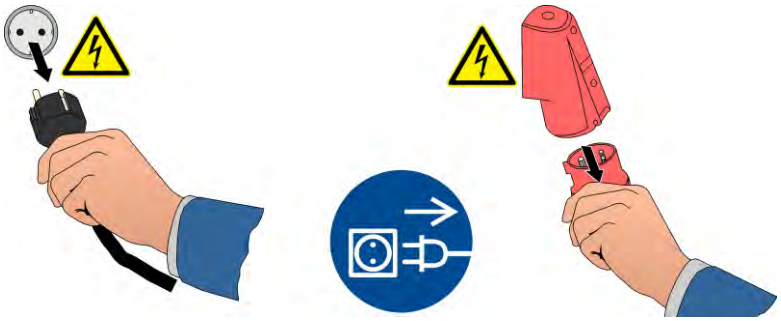
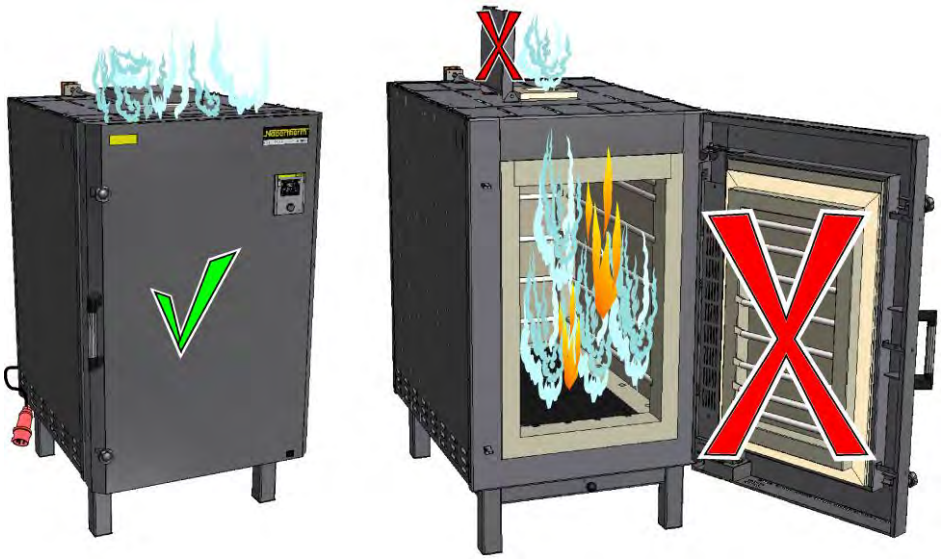


Fig. 10: Pull the power plug (similar to picture)

Risks during Normal Operation!

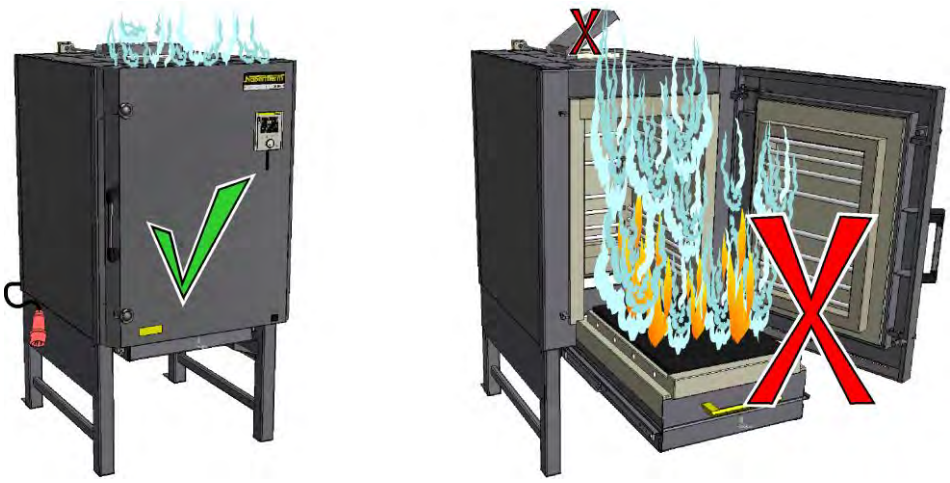
Switch the furnace off immediately in case of unexpected occurrences in the furnace (e.g. a lot of smoke or unusual smells). Wait until the furnace has cooled naturally to room temperature.

In case of fire, keep the door and exhaust-air flap (in included) **closed. This will allow you to prevent the spread of smoke and keep out a supply of oxygen. Pull the power plug immediately.**
Keep doors and windows closed! This prevents the spread of smoke.
No matter how serious the fire is, contact the fire department without delay. When you call, speak calmly and clearly.

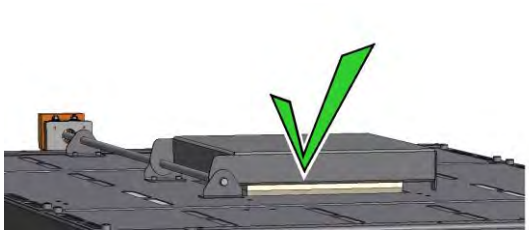


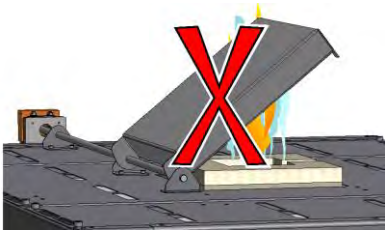
Similar to picture

Similar to picture



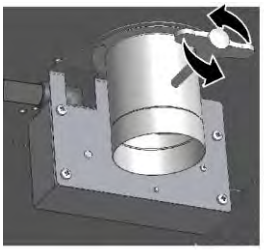
The exhaust-air flaps must remain closed.

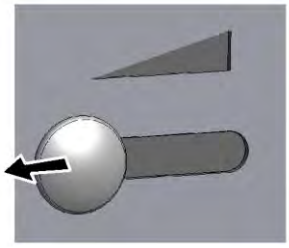


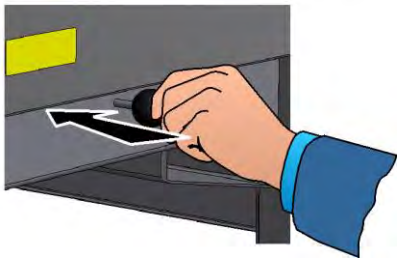


Close the fresh-air flap or adjustable fresh-air inlet

Similar to picture







Fresh-air flap

Adjustable fresh air inlet

	**⚠ DANGER** • **Danger of electric shock.** • **Risk of fatal injury.** • Work on electrical equipment may be carried out only by qualified electricians or by trained personnel authorized by Nabertherm. • Before starting work, pull out the power plug	

3.6 Basic Measures for Servicing and Maintenance

Maintenance work must be performed by authorized persons, following the maintenance instructions and the accident prevention regulations. We recommend that the maintenance and repair work be carried out by the service team of Nabertherm GmbH. Non-compliance may cause injuries, death, or considerable damage to property.

Switch the furnace off at the power supply **and pull out the plug**.

The furnace must be completely empty.

When cleaning furnaces, control cabinets, or electrical equipment housings, never spray them with water.

When maintenance or repair work has been completed, before recommencing production ensure the following:

- Check that loosened screw connections/tensioning straps have been re-tightened,
- Reinstall protective equipment, screens, and filters If applicable),
- Remove all material, tools, and other equipment used for the maintenance or repair work from the working area of the furnace,
- Power cables may be replaced only with similar, approved cables.

3.7 Explanation of the Symbols and Warnings

Note

In the following operating instructions, specific warnings are given to draw attention to residual risks that cannot be avoided when the furnace is operating. These residual risks include dangers for humans/products/ the furnace, and the environment.

The symbols used in the operating instructions are especially intended to draw attention to safety information.

The symbols used cannot replace the text of the safety information. Therefore, always read the entire text.

Graphic symbols correspond to **ISO 3864**. In accordance with the **A**merican **N**ational **S**tandard **I**nstitute (ANSI) **Z535.6** the following warning information and words are used in this document:

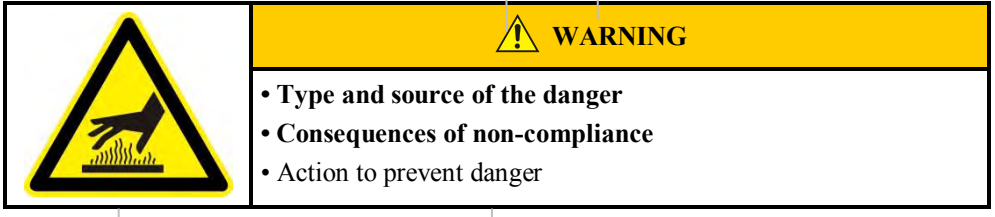
The general hazard symbol, in combination with the words **CAUTION**, **WARNING** and **DANGER** warns about the risk of serious injury. Observe the following information to prevent injury or death.

NOTICE	Refers to a hazard that could damage or destroy the equipment.
CAUTION	Refers to a hazard with a minor or medium risk of injury.
WARNING	Refers to a hazard that could cause death, serious or irreversible injury.
DANGER	Refers to a hazard that could directly cause death, serious or irreversible injury.

Structure of the Warning: All Warnings are Structured as Follows

Hazard symbol
Indicates the risk of injury

Signal word
Classifies the danger



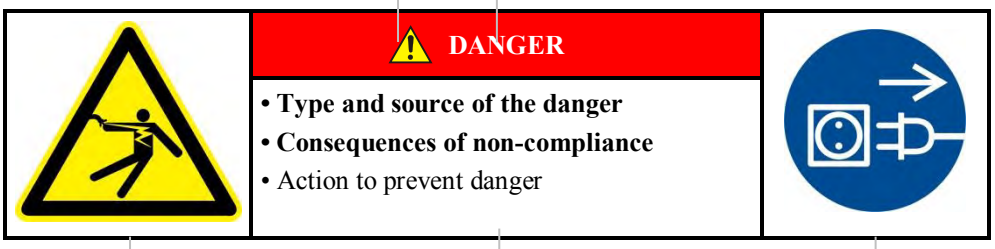
Graphical symbols (optional) according to ISO 3864:
Consequences, measures, and prohibitions

Reference texts:
• Type and source of the danger
• Possible consequences of non-compliance
• Measures/Prohibitions

or

Hazard symbol
Indicates the risk of injury

Signal word
Classifies the danger



Graphical symbols (optional) according to ISO 3864:
Consequences, measures, and prohibitions

Graphical symbols (optional) according to ISO 3864:
Instructions or prohibitions

Reference texts:
• Type and source of the danger
• Possible consequences of non-compliance
• Measures/prohibitions

Information Symbols in the Instructions:

Note
Below this symbol you will find instructions and particularly useful information.

Rule - Rule Sign
This symbol draws attention to important rules that must be followed. Rule signs protect people against injury and show what is to be done in certain situations.

Rule - Important Information for Operators
This symbol draws the operator's attention to important information and operating instructions that must be followed.

Rule - Important Information for Maintenance Personnel
This symbol draws the maintenance personnel's attention to important operating and maintenance instructions (service) that must be followed.

Rule - Pull Out the Power Plug
This symbol tells the operator to pull out the power plug.

Rule - Lift only with Several People

This symbol draws the personnel's attention to the fact that this device may only be lifted and moved to its final destination by several people.

Warning - Hot Surface, Do Not Touch

This symbol warns the operator that the surface is hot and should not be touched.

Warning - Danger of Electric Shock

This symbol warns the operator that there is a risk of an electric shock if the following warnings are not heeded.

Warning – Danger if Heavy Loads Are Lifted

This symbol warns the operator of the potential dangers of lifting heavy loads. Ignoring this can lead to injury.

Caution – Danger of Falling

Ignoring this can lead to death Danger of falling exists at a height less than 1.00 m above the ground or another sufficiently broad bearing surface (for example, on elevated operating positions and workplaces, working platforms, galleries, landing platforms, footbridges, flying bridges, ramps and stairways). Openings and recesses through which people can fall (for example in floors, platforms, installation openings, hatchways and pits, non-bearing roofs).

Warning - Fire Danger

This symbol warns operators of the danger of fire if the following information is not followed.

Prohibited - Important Information for Operators

This symbol warns the operator that water or cleaning products must NOT be poured over the objects. A high-pressure cleaning device must also not be used.

Warning Signs on the Furnace:

Warning - Hot Surface, Danger of Burning – Do Not Touch

You may not always realize that surfaces, such as furnace components, furnace walls, doors and materials, and even liquids are hot. Do not touch the surface.

Warning - Danger of Electric Shock!

Warning, dangerous electric voltage

3.8 General Risks with the Furnace

Warning! General Hazards!

Risk of burning on the furnace housing

The door handle/grip can become very hot during operation; wear gloves.

Risk of crushing on moving parts (door hinge)

The switchgear cabinet (if present) and the terminal boxes on the system contain dangerous electrical voltages.

Do not insert any objects into the openings on the furnace housing, exhaust air holes, or cooling slots on the switchgear or furnace (if present). This poses a risk of electric shock.

Fire hazard if an extension cable is used:

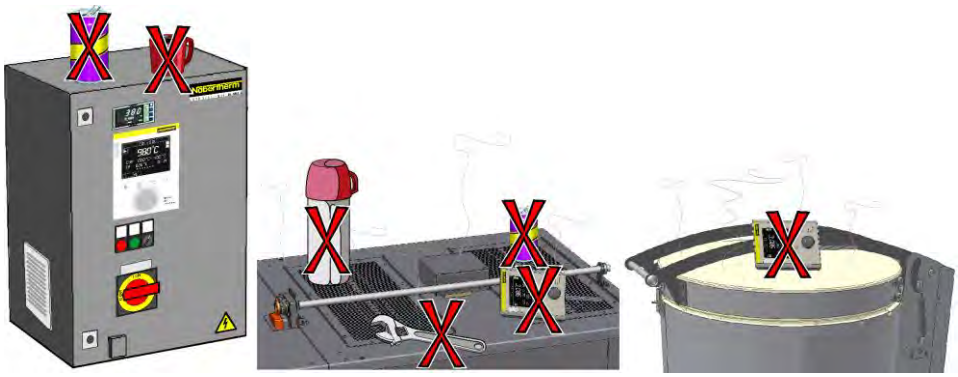
With **230 V** furnace models make sure that:

The distance between the circuit breaker and the power socket that the furnace is connected to is as short as possible.

NO power board or extension cable is used between the power socket and the furnace.

Warning! General Hazards!

No objects may be placed or set down on the furnace or switchgear. Doing so creates a fire or explosion hazard.



⚠ DANGER

- **Danger caused by incorrectly entered cut-off temperature at the over-temperature limiter with manual reset/over-temperature limiter with automatic reset.**
- **Mortal danger**
- If, as a result of over-temperature from the charge and/or the operating equipment, a charge is likely to be damaged at this pre-set cut-off temperature of the over-temperature limiter with manual reset/over-temperature limiter with automatic reset, or if the charge itself becomes a source of danger for the furnace or its surroundings, the cut-off temperature must be reduced at the over-temperature limiter with manual reset/automatic reset to the maximum permissible value.

DANGER

- **Danger from electrocution**
- **If there is no earth connection, or the earth connection is poorly connected, the result may be a deadly electrical shock.**
- Do not insert any metallic objects such as thermocouples, sensors or tools into the furnace chamber without having previously ensured that the plant has been correctly earthed. Entrust the job of making a earth connection between the object and the furnace housing to a qualified electrical technician. Any objects inserted into the furnace must be inserted only through those openings intended for this purpose.

4 Transportation, Installation, and Commissioning

4.1 Delivery

Check that everything is complete

Compare the delivered items with the delivery note and the purchase order documents. **Immediately** notify the carrier and Nabertherm GmbH of any missing or damaged parts, as complaints at a later date cannot be acknowledged.

Danger of injury

When the furnace is being lifted, parts of the furnace or the furnace itself could topple over, slip, or fall. Before the furnace is lifted, make sure no one is in the working area. Appropriate protective gloves must be worn.

Safety Instructions

- Industrial trucks (e.g.: crane/pallet truck) must be operated only by authorized personnel. The operator bears sole responsibility for safe operation and the load.
- Use only lifting equipment with sufficient load-bearing capacity.
- When the furnace is being lifted, make sure that the ends of the forks or the load do not catch on neighboring goods. Use a crane to move tall parts, such as control cabinets.
- Lifting gear must be attached only to positions that have been designated for this purpose.
- Attachments, piping, or cable conduits must never be used to affix lifting gear.
- Attach transportation equipment only to positions intended for this purpose.

Note

Wear protective gloves when installing the furnace.

Risks during normal operation

Suspended loads are dangerous. Working beneath a suspended load is prohibited. There is a risk of fatal injury.

Note
Safety and accident prevention guidelines applicable for forklift trucks must be followed.

Transportation with a Pallet Truck

Observe the maximum permitted capacity of the pallet truck.

1. Our furnaces are delivered ex works on wooden frames to facilitate unloading. Transport the furnace in its original packaging and with suitable equipment to prevent any damage. Remove the packaging only when the furnace is in its final location. When transporting the furnace, make sure it is secured against sliding, toppling over, and damage. The furnace should be transported and installed by at least two persons. **Do not store the furnace in damp rooms or outdoors.**
2. Push the pallet truck underneath the transportation frame. Make sure that the pallet truck is **completely** beneath the frame. Pay attention to neighboring goods.

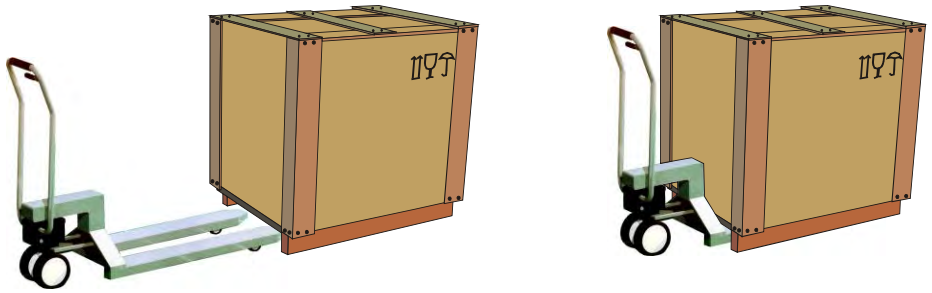
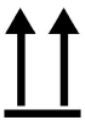


Fig. 11: Pallet truck is pushed **completely** beneath the transportation frame

3. Lift the furnace carefully and pay attention to its center of gravity. When the furnace is being lifted, make sure that the ends of the forks or the load do not catch on neighboring goods.
4. Make sure that the furnace is balanced safely; if not, attach securing equipment. Push the furnace carefully, slowly and with the pallet truck at its lowest position. Do not transport the furnace on inclines.
5. Carefully lower the furnace at its final position. Pay attention to neighboring goods. Try not to set it down too abruptly.

Symbols:

The international standard symbols for handling packaging are defined in ISO R/780 (International Organization for Standardization) and in DIN 55 402 (German Institute for Standardization).

Description	Symbol	Explanation
Fragile		This symbol is to be attached to fragile goods. Goods marked like this are to be handled carefully and must not be thrown or tied up.
This side up		The freight must be transported, transshipped, and stored in such a way that the arrows point upward. The freight must not be rolled, folded, or stored on edge. However, the package does not have to be packed on top of other freight.

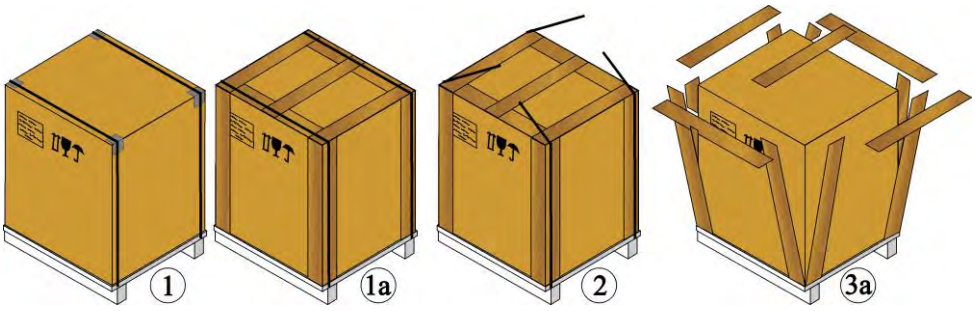
Description	Symbol	Explanation
Keep dry		Products with this symbol must be protected against high air moisture, hence, they must be stored under cover. If particularly heavy or bulky packages cannot be stored in halls or sheds, they must be covered carefully with a tarpaulin or similar.
Sling here		The symbol shows only where the sling should be attached, not the method of slinging. If the symbols are at an equal distance from the middle or center of gravity of the package, the package hangs straight if the slings are the same length. If this is not the case, the sling on one side has to be shortened.

⚠ CAUTION

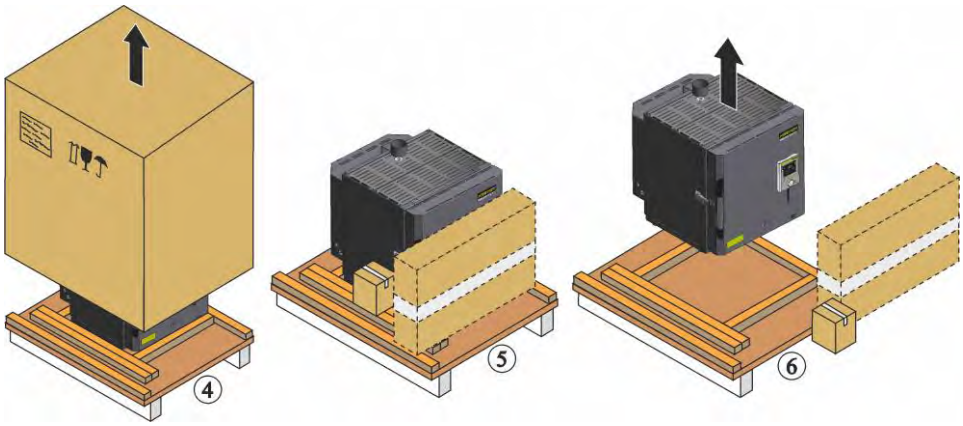
- **Device may slip or topple over.**
- **Damage to the device.**
- Risk of injury from lifting heavy loads.
- Transport device only in original packaging.
- Several people must carry the device.

4.2 Unpacking (N 40 E - N 100 E)

Wear protective gloves



1. Check the transportation packaging for possible damage.
2. Remove tensioning straps from the transportation packaging.
3. Slacken screws and remove wooden casing from the covering box (if available 3a).

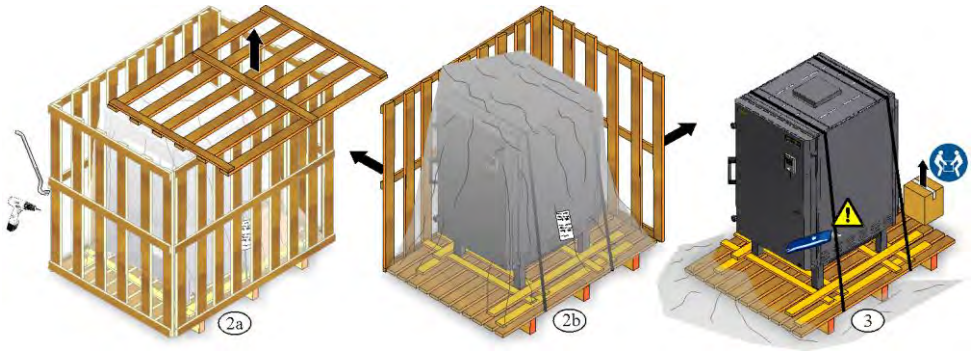


4. Carefully raise the covering box and remove from the pallet.
5. A flat box containing the accessories for your furnace (ceramic insert plate or optionally a cable) is located on the rear wall of the furnace. Compare the scope of delivery with the delivery note and the order documents, see chapter "Delivery". Loosen screws or nails from the retaining strips and remove.
6. Remove retaining strips from the pallet.

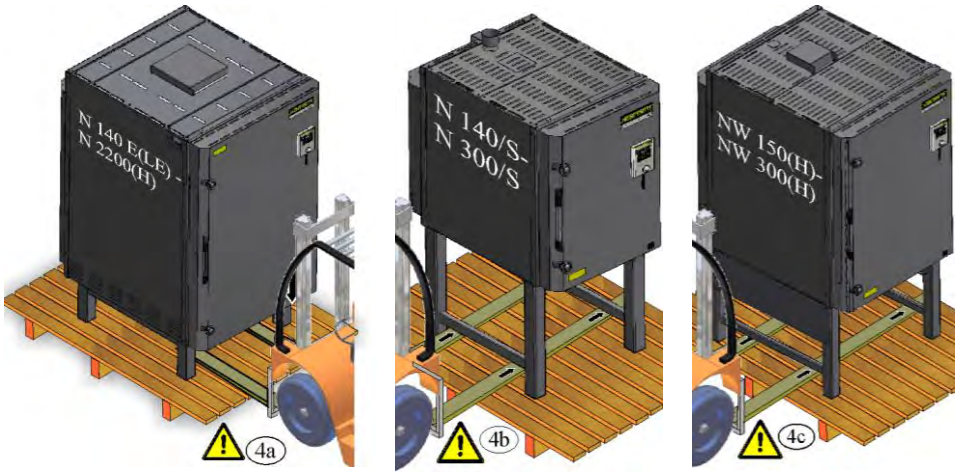
4.3 Unpacking (N 140 LE - N 2200/H - NW 300/H)

Wear protective gloves

1. Check the transport packaging for any signs of damage. The packaging differs depending on size, weight or installation site and, based on this, is provided in one of the following ways. On a pallet, in a wooden cage or in a wooden box (shown in figures 1a to 1c).



2. Remove screws/staples and then carefully remove the wooden siding from around the base. Remove any plastic transportation sheeting.
3. Remove any transportation sheets, straps and packaging materials.



4. The furnace frame is made of thick steel sections. Move the forklift forks into position under the furnace (4a) or, if the furnace has a base, under the base, as schown in the picture (4b-4c), carefully avoiding any attachments and lines, which, if necessary, should be removed first. Make sure that the forks of the forklift are **completely** under the frame. Mind the nearby transported goods.

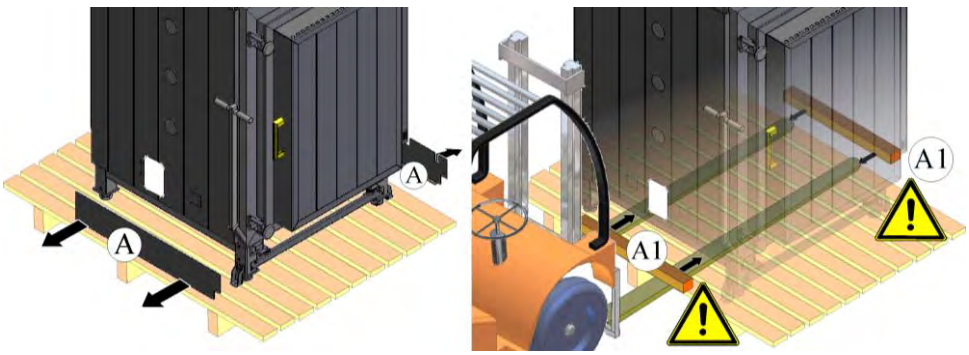
   Carefully lift the furnace from below minding the center of gravity. When lifting make sure that the fork tips or the load itself do not get caught on nearby stacked goods. Drive carefully, slowly and **in the lowest** position. Do not drive over any steep surfaces. Set the furnace carefully down at the installation site. Avoid any sudden drops.

Caution

We recommend that the system be moved to the installation site over longer distances or over bumpy surfaces using a forklift or a pallet lift.

4.4 Unpacking (NW 440 - NW 1000/H)

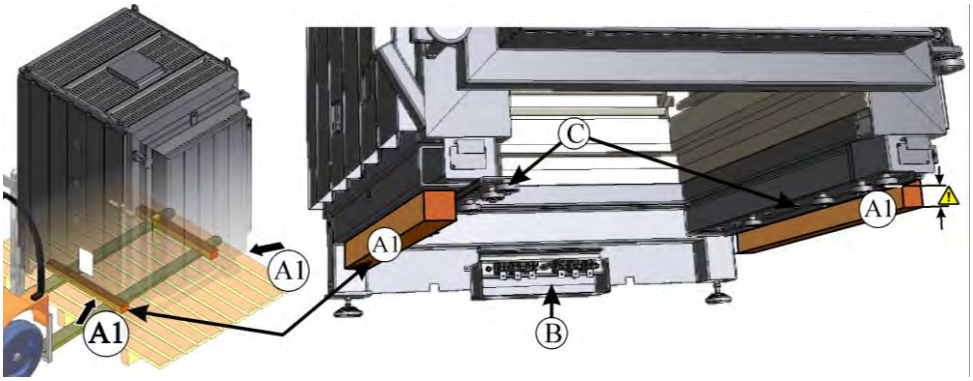
Transportation with suitable forklift truck



When moving the furnace with the help of appropriate forklifts remember:

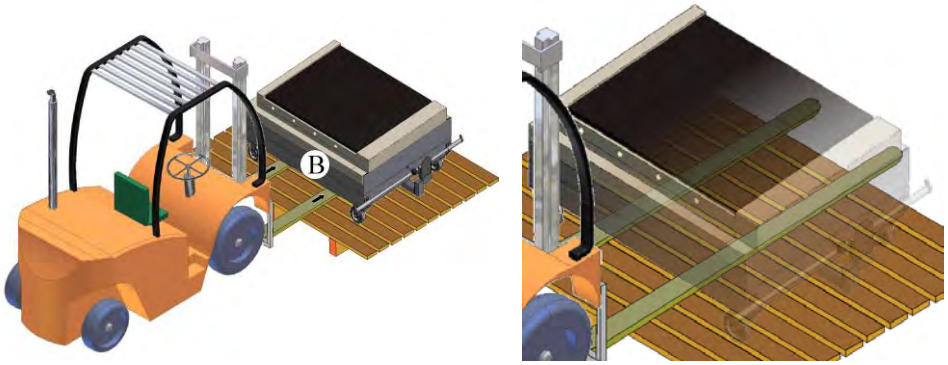
Some furnace models have side panels (A) that must be removed before removal from the frame of the furnace. Ignoring this results in damage to the side panels.

Move the forklift forks completely under the furnace frame and set it onto **wood platform**. Avoid damaging any attachments, pipes or cable raceways.



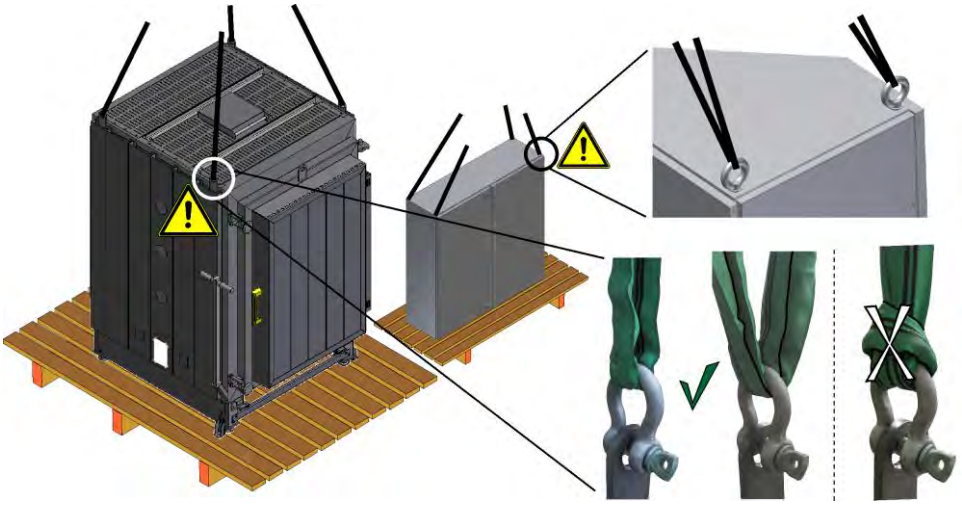
Place suitable squared timbers (A1) under the furnace frame. You must ensure that they are **not** positioned under the guide rails and rollers (C). Ignoring this results in damage to the guiderails and rollers.

Once the squared timbers have been positioned between the frame and the forklift forks, the furnace can be lifted carefully and slowly, paying close attention to the center of gravity. When lifting make sure that the fork tips or the load itself do not get caught on nearby stacked goods. Drive carefully, slowly and **in the lowest** position. Do not drive over any steep surfaces. Set the furnace carefully down at the installation site. Avoid any sudden drops.



The furnace frame is made of thick steel sections. Move the Forklift truck forks under the bogie. Avoid damaging any attachments, pipes or cable raceways. Make sure that the forks of the forklift are completely under the frame of the bogie. Mind the nearby transported goods. Drive carefully, slowly and in the lowest position. Do not drive over any steep surfaces. Set the bogie carefully down at the installation site. Avoid any sudden drops.

4.4.1 Furnace or Switchgear with Transportation Rings (if included)



The inner diameter of the lifting rings is roughly 35 mm. Attach an appropriate shackle to all the lifting rings.

Only use a suitable transportation strap on the shackle. The furnace/switchgear must not be lifted by its attachments, pipes or cable conduits. Lifting belts must not be tied together.

Avoid any sudden upward jerks. Working beneath a suspended load is prohibited. The risk of death is imminent. Lift and lower the furnace/switchgear carefully.

Note

In Germany, the general accident protection guidelines must be observed. The national accident prevention regulations of the country of operation apply.

4.5 Transportation Securing Equipment/Packaging

The furnace packaging prevents damage during transportation. Make sure that you remove all packaging material. All packaging material can be recycled. The packaging was designed so that no special description is necessary.

Note

Please keep the packaging for possible shipping or storing of the furnace.

Safety information

Do not allow children to play with packaging parts. They are at risk of suffocation from folding boxes and plastic film.

Note

No special transportation securing equipment is available for this furnace

During transportation, the furnace collar and door insulation are protected against mechanical effects all round with foil or cardboard strips (depending on the model). We recommend that you remove this protection only when the furnace is installed and set up.

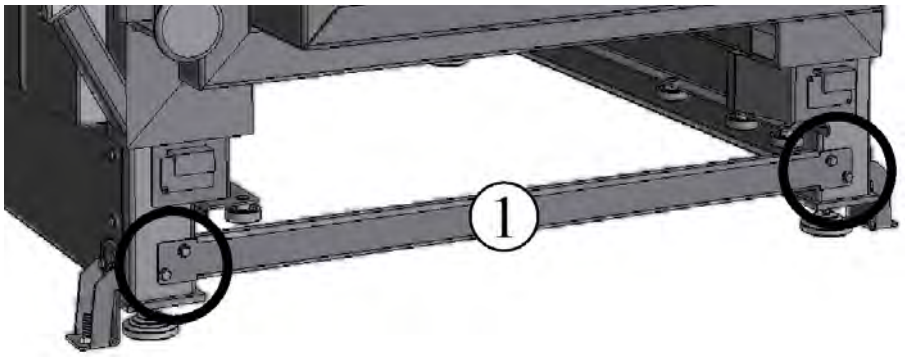
Fig. 12: Example: Removing the transportation protection (similar to picture)

NW 440 - NW 1000/H

Transportation fittings are for safe and secure transportation and to prevent damage to the furnace door and the furnace housing during installation.

Caution

The furnace must be securely anchored to the floor before the transportation fittings are removed, see the section "Installation (site of the furnace)".While the furnace is being anchored to the floor the door/lift door must remain locked. Any other sequence will result in damage.



1 = Transport rod (must remain in place until the furnace has been securely anchored to the floor)

Fig. 13: Transportation fitting (similar to picture)

4.6 Constructional and Connection Requirements

4.6.1 Installation (Furnace Location)

When setting up the furnace, these safety instructions must be followed:

Floor Characteristics

- The furnace must be positioned in a dry room as stated in the safety instructions.
- The floor must be level to permit the furnace to stand upright.
- The load-bearing capacity of the floor must be rated to take the weight of the furnace plus the operating personnel.
- Place the furnace on a **non flammable** surface (fire safety class A DIN 4102 – Example: concrete, tiles, glass, aluminum or steel) so that any hot material falling from the furnace cannot ignite the surface.

Installation Location

- The operator is responsible for adequate ventilation by installing the appropriate systems to supply fresh air and to vent exhaust air. If a batch emits gases or vapors, adequate ventilation of the installation site must be provided as well as a suitable exhaust air venting system. A suitable vent for combustion exhaust must be supplied by the customer
- Make sure that the heat radiated by the furnace is vented (consult a ventilation expert, if necessary)
- Although the furnace is well-insulated, the exterior surfaces of the furnace radiate heat. If necessary, this heat must be dissipated (**a ventilation technician may need to be consulted**). In addition, a minimum clearance (**S**) of 0.5 m on all sides and 1 m above the furnace must be maintained to flammable materials. In individual cases, more space must be chosen in order to match the local conditions. For **nonflammable materials**, the minimum **side** clearance can be reduced to 0.2 m.
- The furnace must be protected against weather and caustic atmospheres. Nabertherm accepts no liability or warranty claim for any corrosion damage as a result of installation in damp surroundings or for similar reasons.
- The furnace and switchgear are not designed to be operated outdoors.

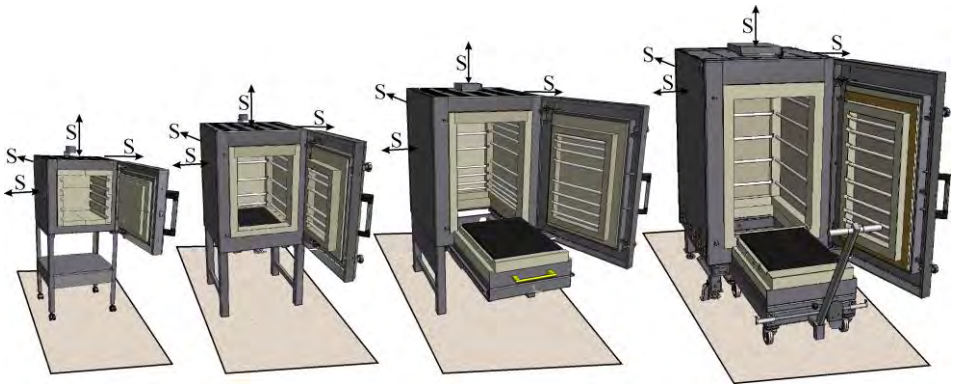


Fig. 14: Minimum safety distance to flammable materials

Requirements related to the ambient conditions of the switchgear

- The switchgear x must be readily accessible.
- The floor must be level to permit the switchgear to stand upright.
- The furnace's electrical equipment is designed to operate in temperatures from +5 °C to 40 °C (104 °F). At a temperature of 40 °C (104 °F) the humidity must not exceed 50%. At lower temperatures the humidity can be higher (max. 80%), but there must be no condensation.
- At higher temperatures the switch-cabinet coolers must be used. In case of higher humidity and very low temperatures, heaters must be used.
- The switchgear must be protected against heat, dust and moisture.
- The location must be sufficiently ventilated.

Connecting the switchgear

- When the switchgear is connected to the power source and, as necessary, to the furnace, a **clockwise rotating** field must be executed.
- Both connections must be made by specialized electricians. All applicable rules and legal regulations must be followed.
- Before connecting the furnace, the available supply voltage and frequency must be checked against the values stated on the type plate to ensure that they are identical.
- Check the protective conductor
- Select the cross sections of the feed line as specified in the schematic circuit.

	**⚠ DANGER** • **Fire- danger to health.** • **Risk of fatal injury.** • Adequate ventilation must be ensured at the installation location to conduct waste heat and any exhaust gases away.

⚠ DANGER

• Danger associated with the use of an atomatic extinguishing system

• Mortal danger posed by electrocution through wetness, suffocation caused by extinguishing gas, etc.

• If automatic extinguishing systems are in place to fight fires and protect the building, e.g. sprinkler systems, care must be taken during their planning and installation that no additional hazards are created, for example by extinguishing a pilot light, mixing hardening oil and extinguishing water, the disablement of electrical equipment, etc.

N 40 E(R) - N 100 E

When setting up the furnace, these safety instructions must be followed:

- The furnace must be installed in a dry room in accordance with the safety instructions.
- The table/supporting surface must be flat to enable the furnace to be installed straight. Place the furnace on a **non flammable** surface (fire safety class A DIN 4102 – Example: concrete, tiles, glass, aluminum or steel) so that any hot material falling from the furnace cannot ignite the surface.
- The carrying capacity of the table must be designed to bear the weight of the furnace incl. accessories.
- The floor covering must be made of nonflammable material so that hot material falling out of the furnace will not cause the floor covering to ignite.

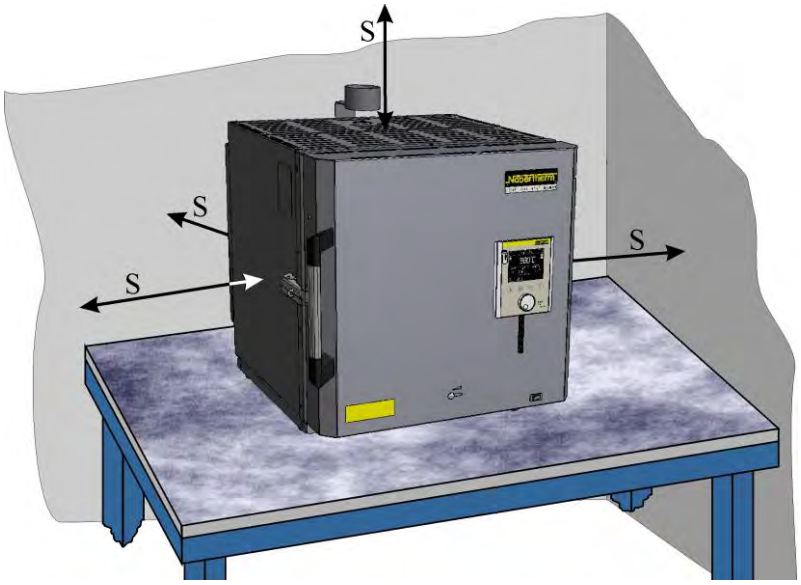
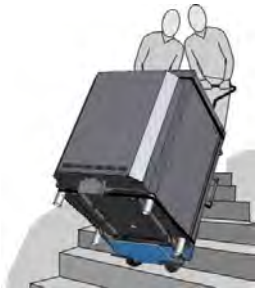


Fig. 15: Minimum safety distance to flammable materials (Table-top model) (similar to picture)

4.6.2 Stairclimber to Transport Chamber Furnaces N 100(H) – N 300(H) (Accessory)



To negotiate all types of stairs, we recommend the use of a **suitable stairclimber** and fastening strap to transport chamber furnaces up to a maximum of 450 kg (Models N 100 to N 300/H).

To prevent the furnaces being damaged, they must only be transported on their side using the transportation aid that is part of the delivery (accessories).

For technical data, operating components, operation and safety information, please refer to the operating instructions for the stairclimber included with the delivery (not included in the scope of delivery of the transportation aid).

Observe the safety information for the stairclimber.

Nabertherm accepts no liability if the stairclimber is not handled or operated properly.

To transport the furnaces safely with a stairclimber, some models have a transportation aid (accessories), which must be removed when the furnace has been installed. If not already installed on the furnace, the transportation aid must be installed correctly as shown in the figure below.

Dismantling the Collar Protection Strip

Before the transportation frame is installed on the furnace, the collar protection strip must be dismantled from the furnace collar (see figure below). Undo the screws on the collar protection strip and remove it upward (keep the collar protection strip and the screws to reuse them).

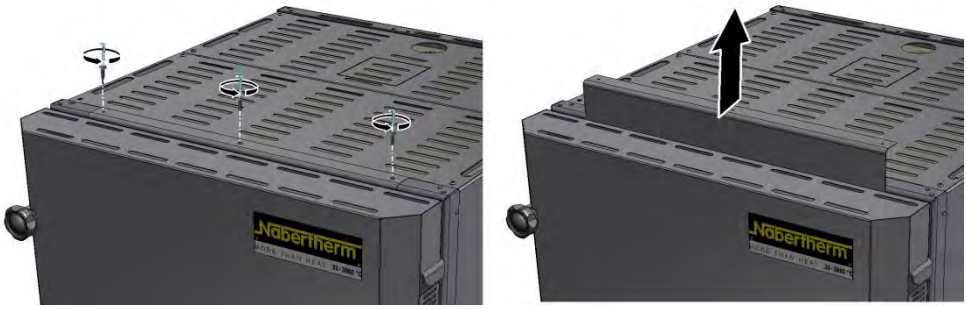


Fig. 16: Dismantling the collar protection strip (similar to picture)

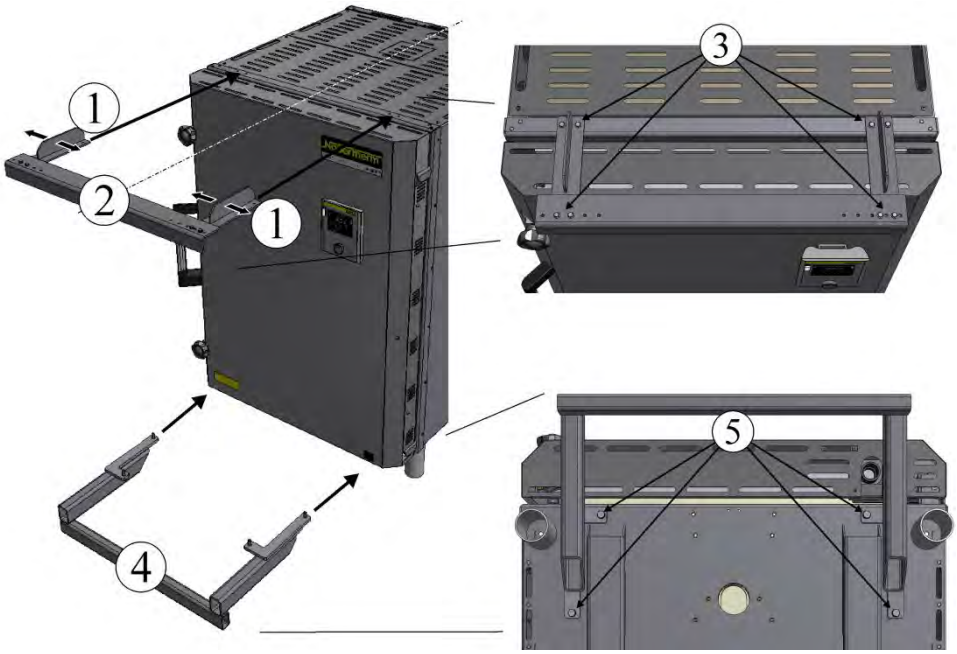
Installing the Transportation Aid

First, place the two brackets (1) at the position of the previously dismantled collar protection strip and connect them using the screws that were included in the delivery (3). The furnace collar has suitable threaded holes for the brackets. When the two brackets have been assembled, screw the support bracket (2) to them using the screws that were included in the delivery.

When the top transportation aid has been assembled, the bottom transportation aid (4) can be fixed to the base of the furnace using the screws that are part of the delivery (5). The bottom of the furnace has suitable threaded holes.

Check all screw connections on the transportation aid.

Transportation aid	Number of screws delivered	Screws
Top transportation aid (1, 2)	8	M5 x 20
Bottom transportation aid (4)	4	M8 x 30



3 = M5 x 20 / **5** = M8 x 30

Fig. 17: Assembling the transportation aid (similar to picture)

Using and Positioning the Transport Straps

The furnace must be secured with **suitable, adequately dimensioned fastening straps** (1a). When securing and transporting the furnace, make sure that **add-on parts, cable ducts, air inlet flap, and controller are not damaged**.

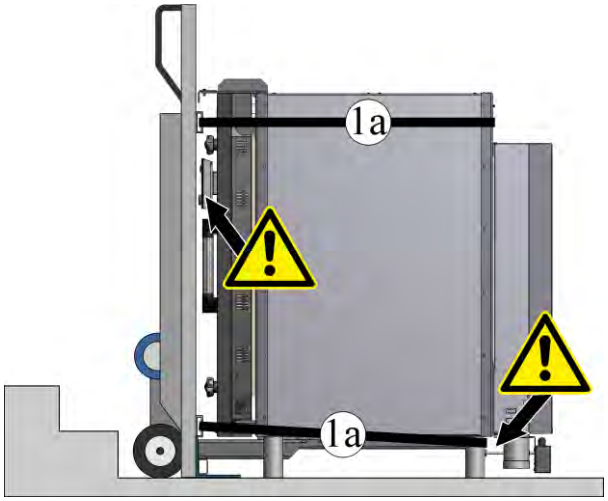
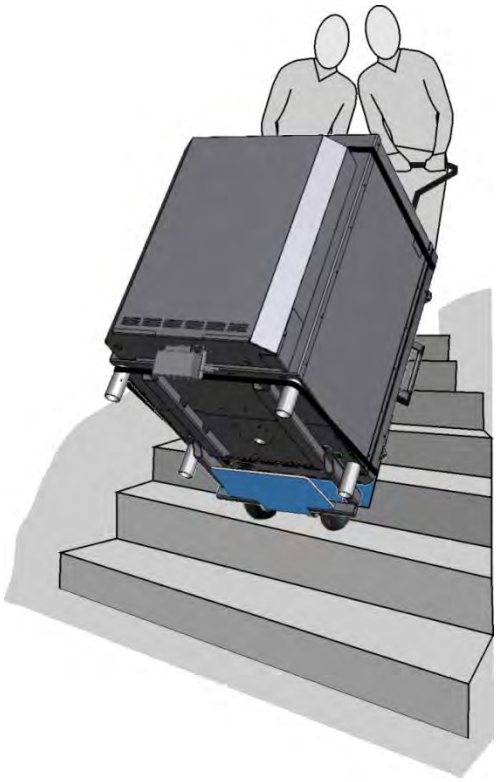


Fig. 18: Using the transport straps (recommendation) (similar to picture)

For technical data, operating components, operation and safety information, please refer to the operating instructions for the stairclimber that are included with the delivery.



Safety Instructions:

Wear suitable work clothing and slip-resistant footwear.

Stairclimbers may be used only by trained persons.

Get an idea of the exact stair situation before you start.

There must be no one in the danger area below the load.

Fig. 19: Safe transportation of a furnace with a stairclimber (similar to picture)

Assembling the Collar Protection Strip

When the furnace has been installed and the transportation aid removed, reinstall the collar protection strip that was previously removed using the appropriate screws.

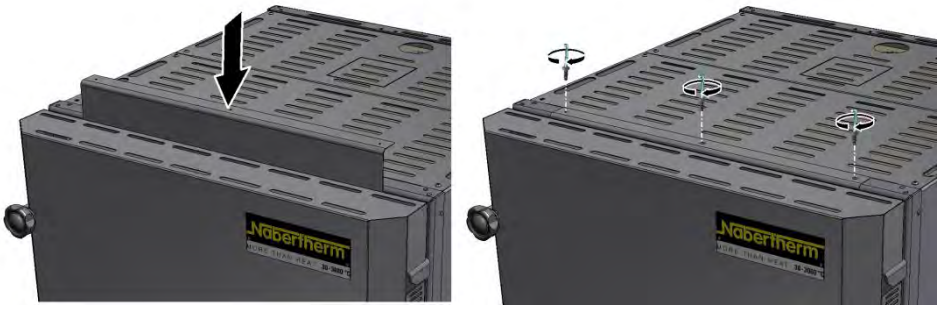
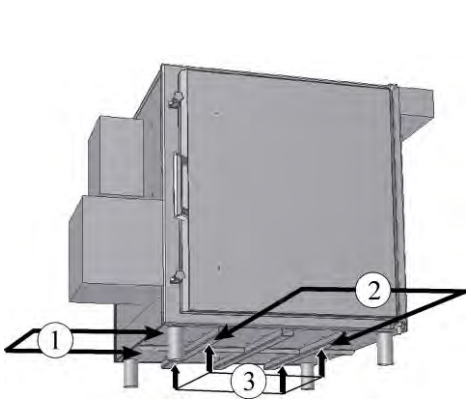


Fig. 20: Assembling the collar protection strip (similar to picture)

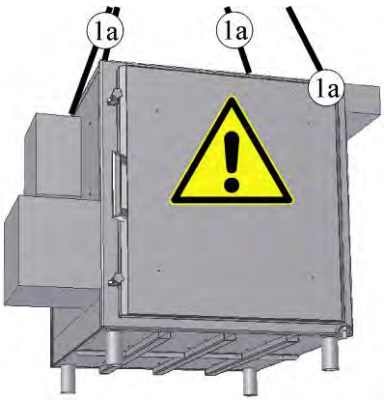
Notice

The customer keeps the transportation aid in case it is needed for future transportation/shipment

N100.. – N300.. Assembling the base if not assembled



Notice: Do not lift with a crane, this will damage the furnace. Use only suitable forklift trucks



Use a crane to lift the furnace only with models from 1000 liters. Only these furnace models are suitable for transporting with a crane

Fig. 21: Lifting the furnace with a forklift or a crane (models from 1000 liters) (similar to picture)

Lifting the Furnace with a Suitable Industrial Truck

The forks of the industrial truck should be completely inserted under the furnace floor either from the side (1) or from the front (2). Only the floor profiles (3) of the furnace floor may rest on the forks of the industrial truck. Make sure the forks are clear of attachments, pipework or cable conduits. Lift the furnace gently; avoid any sudden movements.

Lifting the furnace with a suitable crane (from 1000-liter model)

There are 4 lifting rings (1a) on the furnace for attaching shackles. The inner diameter of the lifting rings is roughly 35 mm. Attach an appropriate shackle to each of the 4 lifting rings. The lifting belts attached to the shackles must be adequate for the task (see the illustration "Lifting the furnace" in the section entitled "Unpacking"). The furnace must not be lifted by its attachments, pipes or cable conduits. Lifting belts must not be tied together. Lift the furnace gently; avoid any sudden movements.

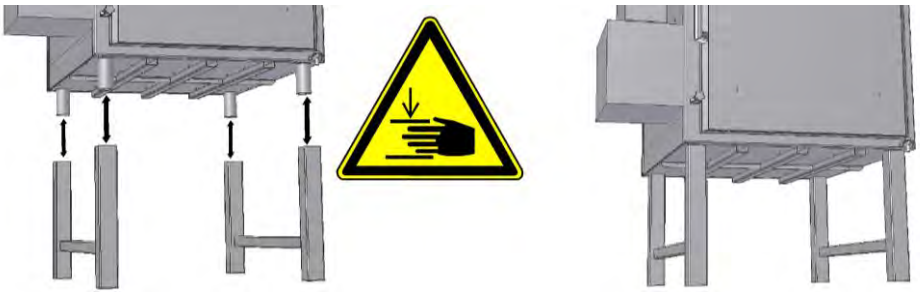
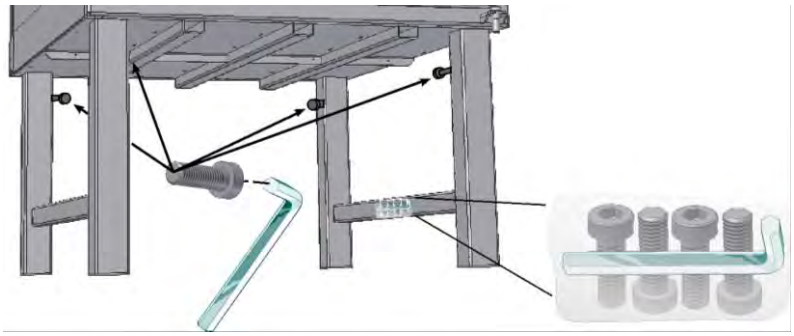


Fig. 22: Lowering onto the base frame (similar to picture)

Lower the furnace carefully onto the base frame and make sure that it rests securely in place.



Scope of delivery: 4x screws M10x30 mm / 1x Allen key 8 mm

Secure the base frame by attaching the screws included in the scope of delivery.

Fig. 23: Secure attachment of the base frame (similar to picture)

Caution

Nabertherm assumes no liability for damages caused by improper installation.

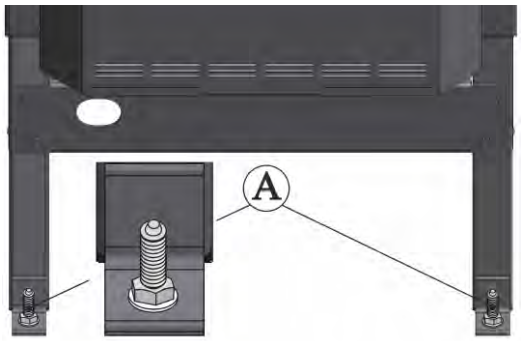
NW 150(H) - NW 300(H)

Secure the furnace with drawer to the floor to prevent it toppling over. We recommend that the furnace be installed and assembled by a qualified professional. To allow the heating elements to be replaced and for maintenance, we recommend that a gap of about 0.5 m be left between the back of the furnace and the wall

Note

Make sure you know where the power and water lines are located before you drill any holes. Nabertherm does not assume any liability for possible damage or injuries.

- Securely anchor the furnace to the floor using the brackets (A) (installation package included in delivery).
- To assemble the chemical anchor capsule and anchor rod, refer to "Chemical Anchor Capsule/Anchor Rod Installation Instructions"
- When charging the furnace with drawer (NW 150(H) – NW 300(H)) pay attention to the **maximum** charge weight. If this is ignored, Nabertherm accepts no liability for damage or injuries.



For the scope of delivery, refer to the installation package (the number of materials delivered may differ depending on the model):

-Chemical anchor capsule
-Anchor rod

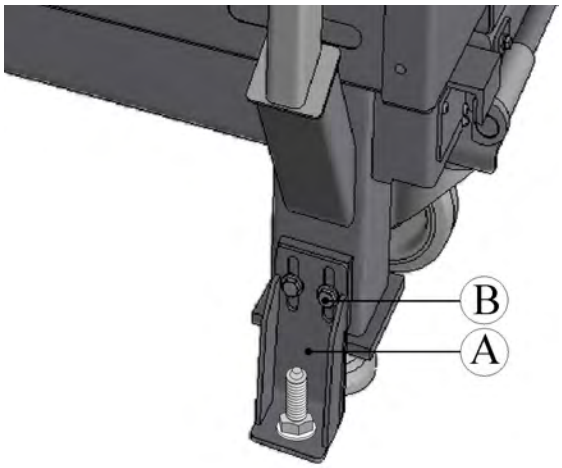
(the position of the bracket may differ depending on the model)

Fig. 24: Bolt the furnace to the base (similar to the figure)

NW 440 - NW 1000/H

When setting up the furnace, these safety instructions must be followed:

- Set the furnace down at the installation location and align accordingly.
- The floor must be level so that the furnace can stand upright. Align the furnace with a spirit level. The furnace can be leveled using the feet to balance out any unevenness (see "Aligning the Furnace").
- Securely anchor the furnace to the floor using the brackets (A) (installation package included in delivery). Make sure that the bolts (B) in the brackets (B) can be easily loosened so that the brackets can be moved vertically.
- To assemble the chemical anchor capsule and anchor rod, refer to "Chemical Anchor Capsule/Anchor Rod Installation Instructions"



For the scope of delivery, refer to the installation package (the number of materials delivered may differ depending on the model):

-Chemical anchor capsule
-Anchor rod

(the position of the bracket may differ depending on the model)

Fig. 25: Installing the furnace on the floor (similar to the figure)

Installation of a Wall Cabinet System (in scope of delivery depending on design/furnace model)

The wall must provide a safe and secure mounting surface. The top of the box should not be higher than 2.00 m so that all the operating elements are easy to reach. (Hardware for the attachment is not included in the scope of delivery).

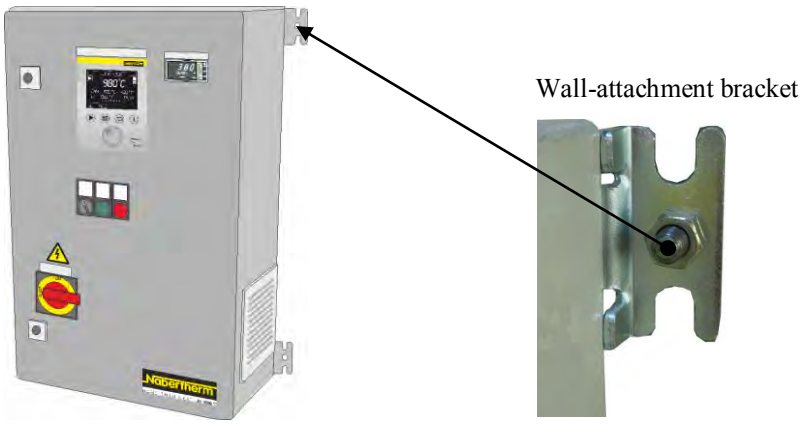


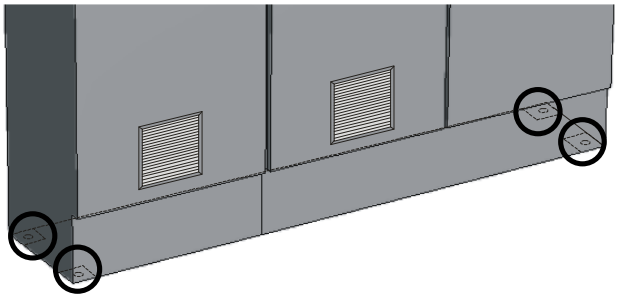
Fig. 26: Wall cabinet system (similar to picture)

Note

Make sure you know where the power and water lines are located before you drill any holes. Nabertherm does not assume any liability for possible damage or injuries.

Installation of a Free-Standing System (in scope of delivery depending on design/furnace model)

- Secure the switchgear using the screws included in the delivery (The quantity of materials included in the scope of delivery can vary from one model to another).
- The number and position of the screws may differ from one furnace model to the next.



Scope of delivery:

-Height adjustment disks
-Threaded anchors

Fig. 27: Installing the switchgear

Note

To ensure that the floor switchgear cabinets are safely and securely installed we recommend that they be bolted to the floor. The switchgear cabinets supplied by Nabertherm are provided with bores in the base for this purpose.

4.6.3 Installation Package for Installing the Furnace Framework

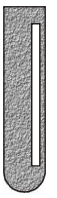
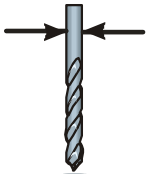
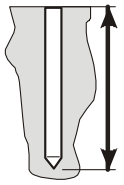
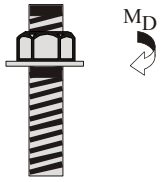
The safe and secure installation of the furnace requires that these safety instructions be followed:

- The floor must be level to permit the furnace to stand upright. Level the furnace with a water level. Use the height adjustment disks from the installation package to compensate for any unevenness in the floor.
- The bearing capacity of the floor must be dimensioned to hold the weight of the furnace and the operators.
- Installation of the compound anchor cartridges and anchor rod see "Installation Instructions Compound Anchor Cartridges/Anchor Rod".

4.6.4 Chemical Anchor Capsule/Anchor Rod Installation Instructions

The chemical anchor capsule contains a number of components (synthetic resin, quartz sand) and a special hardener encapsulated in a glass tube. When the anchor rod is vibrated into the cleaned drill hole using a hammer drill or impact drill, the glass is broken up by the chiseled end of the anchor rod and the hardener is mixed with the other components. A fast-setting synthetic resin mortar forms in a reaction, producing a stronger bond between the anchor rod and the drill hole than embedding in concrete would achieve. The absolutely

stress-free anchor makes this system far superior to expansion dowels and results in a high load capacity (up to 60 kN) even with small edge distances and axial spacings.

 Chemical Anchor Capsule	 Ø in mm	 mm	 Nm	 Anchor Rod
M10	12	90	20	M10
M12	14	110	40	M12
M14	16	120	50	M14
M16	18	125	60	M16
M20	25	170	150	M20

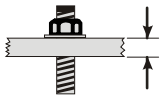
Suitable Building Materials:
Allowed for uncracked concrete grades B15 to B55. Also suitable for dense natural stone.

Allowable Loads:
Allowed for loads of 3 kN to 60 kN in the compression zone.

The anchor can be fully loaded after the specified cure time.

	
> 20°	10 min
10°–20°	20 min
0°–9°	45 min
-5°–-1°	4 h

Anchor Rod

 Anchor Rod	 mm	 mm
M10	20	130
M12	25	160
M14	38	170
M16	35	190
M20	70	260

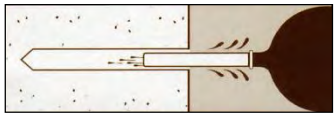
Installation Type:

- Threaded rod

Installation Instructions:

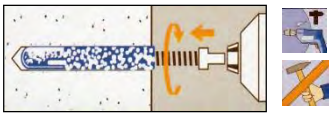
- Insert the anchor rod with a rotary-impact electric tool (impact drill, hammer drill).
- Can also be used in wet concrete and under water.

Drill hole with depth and diameter according to specifications given in the above table.

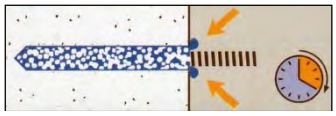


Thoroughly clean (blow out) drill hole.

Insert chemical anchor capsule completely into drill hole.



To facilitate installation, the anchor rod has a hexagonal head. Vibrate anchor rod down to embedment depth mark. Then immediately shut off drill and remove from anchor rod.



The synthetic resin bonds the entire inserted surface of the anchor rod to the wall of the drill hole and largely seals the hole. Do not remove excess resin.

The anchor can be fully loaded after the specified cure time (see above table).

Hazard Information:

 Xi – Irritant	R 43: May cause skin sensitization on contact. S36/37: Wear suitable gloves and protective clothing when working. S60: This product and its container must be disposed of as hazardous waste.
General Information	Change clothes if contaminated with product.
Following inhalation	Ensure adequate ventilation. Consult a doctor in case of symptoms.
Following contact with skin	In case of contact with skin, immediately wash off with plenty of soap and water. Consult a doctor if skin irritation persists.
Following contact with eyes	In case of contact with eyes, rinse thoroughly with plenty of water and consult a doctor.
Following ingestion	Not applicable
Instructions for physicians	Treat symptoms.
Safety data sheet	1907/2006/EC

4.6.5 Removing the Transportation Fittings

4.6.5.1 Removing the Wood Blocks (NW 440 – NW 1000/H)

Once the furnace has been successfully installed and secured to the floor, remove the transportation rod with a suitable tool.

Once the furnace has been successfully installed and secured to the floor, remove the transportation rod with a suitable tool.

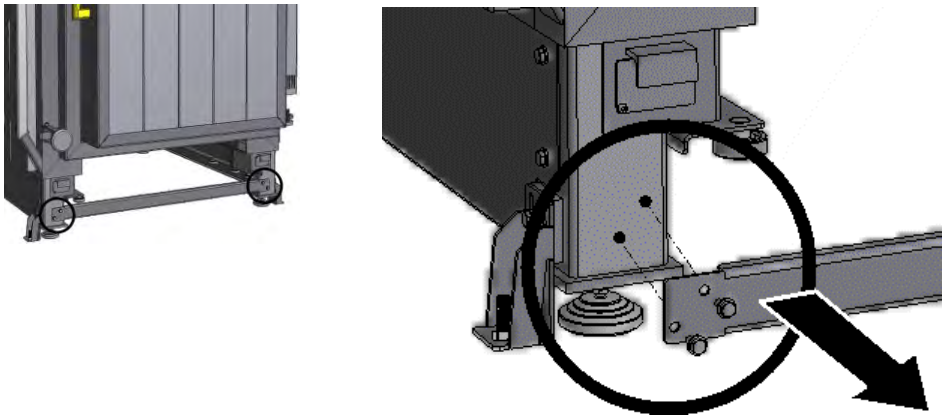


Fig. 28: Removing the transportation rod (similar to picture)

During transportation, the furnace collar and door insulation are protected against mechanical effects all round with foil or cardboard strips (depending on the model). We recommend that you remove this protection only when the furnace is installed and set up.

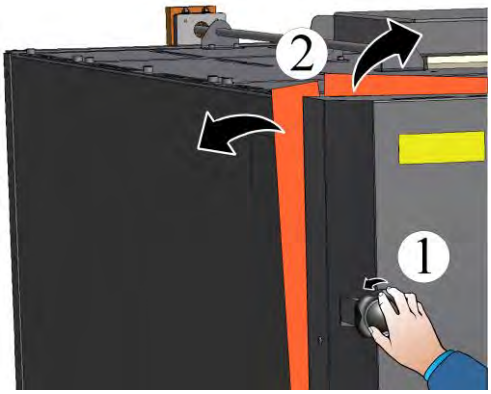


Fig. 29: Example: Removing the transportation protection (similar to picture)

4.6.5.2 Removing the Foam Mats (NW 440 – NW 1000/H)

Between the SIC tiles (1) and bogie to protect the insulation there are foam mats (2) which must be removed. You must ensure that, before using the furnace, all the foam mats under the SIC tiles have been removed.

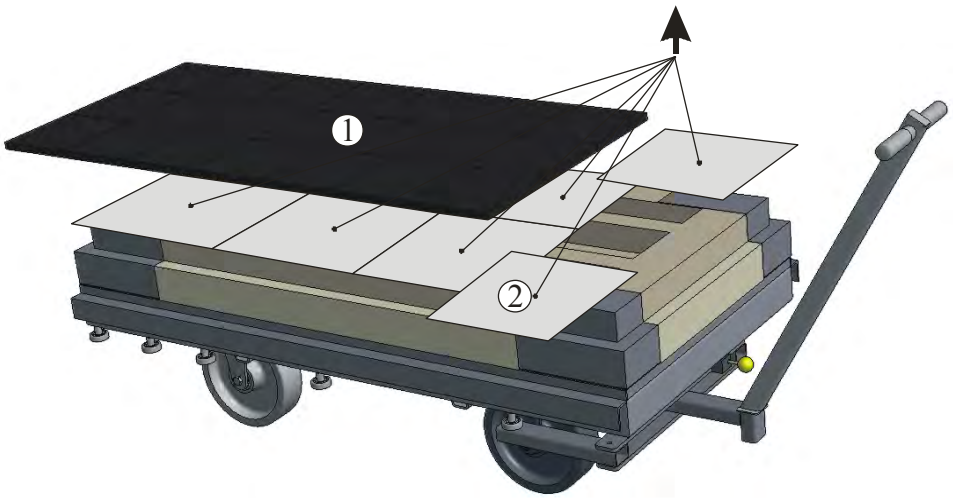


Fig. 30: Removing the foam mats (similar to picture)

Caution

Keep the transportation edging in case it is needed for future transportation or storage. Use the transportation block to prevent damage during transportation.

4.6.6 Aligning the Furnace (NW 440 – NW 1000/H) if Necessary

To align the furnace, open the door completely in order to push the bogie in front of the furnace carefully and slowly.

Pull out the draw bar (1) (on the side of the furnace housing) and insert it into the holder (2) of the bogie.

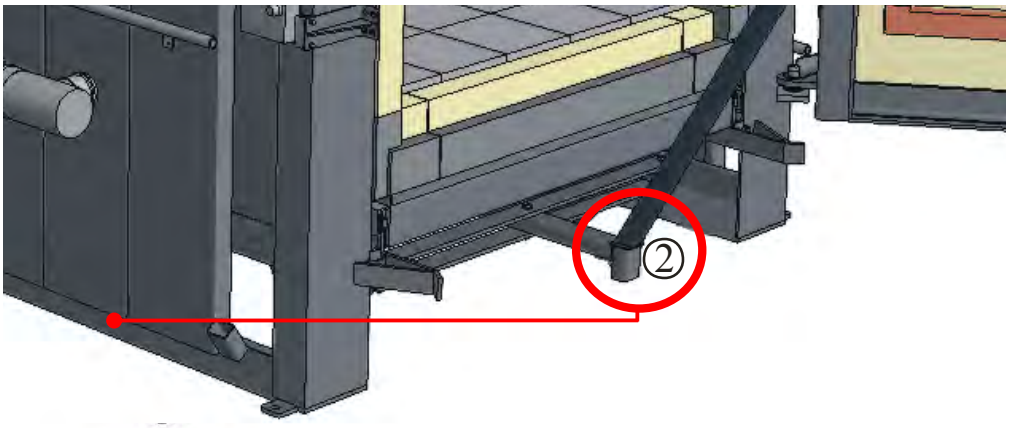


Fig. 31: Insert draw bar

If necessary, check whether the top of the bogie (X1) and the top of the furnace (X2) are at the same level (this applies to the complete length of the furnace/bogie). The height of the furnace can be adjusted at its feet.

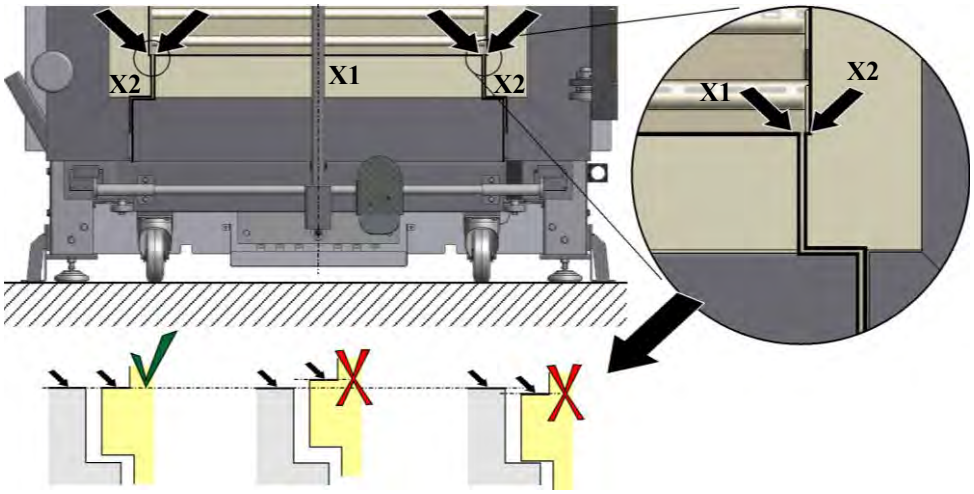
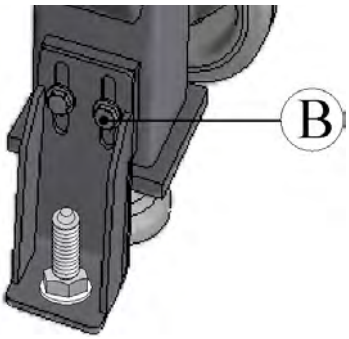


Fig. 32: Aligning the furnace (vertical alignment of the furnace)

Fig. 33: Check the height along the entire length (similar to the figure)



After checking and (if necessary) aligning the height of the furnace, tighten the bolts (B) on the bracket with a suitable tool.

Fig. 34: Tighten the bolts on the bracket (similar to the figure)

The bogie must be positioned in the middle of the furnace. An even gap must be maintained between the insulation of the bogie (Y1) and that of the furnace (Y2).

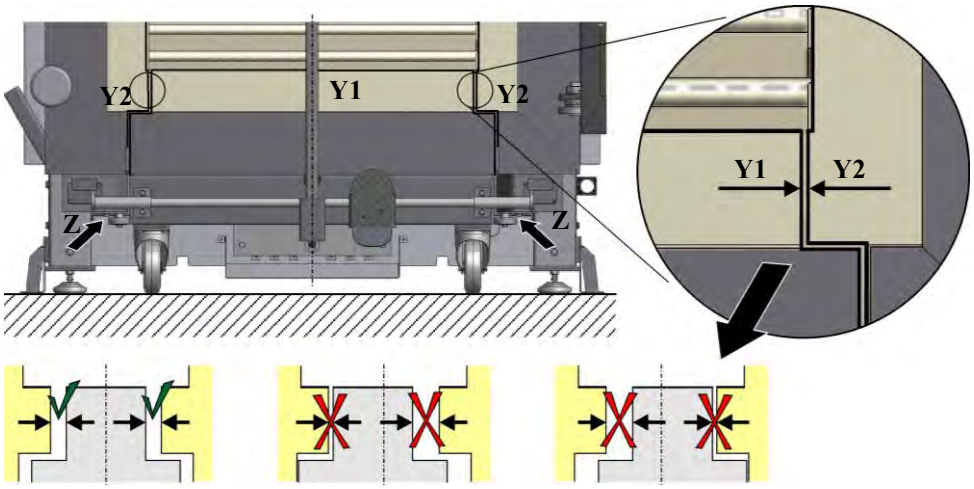
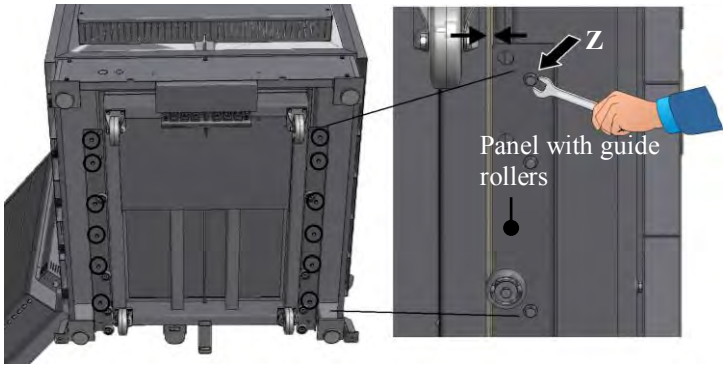


Fig. 35: Aligning the bogie (horizontal alignment of the bogie)

On the bottom of the bogie there are two panels with guide rollers held in place with bolts. Before centering the bogie (if necessary) slightly loosen the bolts (Z) on the panels with a suitable tool. Center the bogie along its entire length. The guide rollers on the panels must touch the bottom of the bogie. When the bogie has been aligned, replace all the bolts.



The number and position of the rollers and bolts may differ depending on the furnace model.

Fig. 36: Furnace with bogie seen from below (similar toi the figure)

Assembling the previously dismantled side panels (model-related)

To transport the furnace to its installation location, the side panels (A) are removed from the frame of the furnace and must be replaced when the furnace has been installed, assembled, and set up.

Fig. 37: Assembling the side panels (similar to figure)

4.7 Assembly, Installation, and Connection

4.7.1 Assembling the Bypass Connection (Depending on Model)

Mount the bypass connection (model-related) that is part of the delivery on the furnace.

- At the bypass connection position there are screws (1) to assemble the connection; these must be loosened beforehand.
- Place the bypass connection (2) with the screws loosened on to the correct position on the furnace and fasten it with suitable tools.

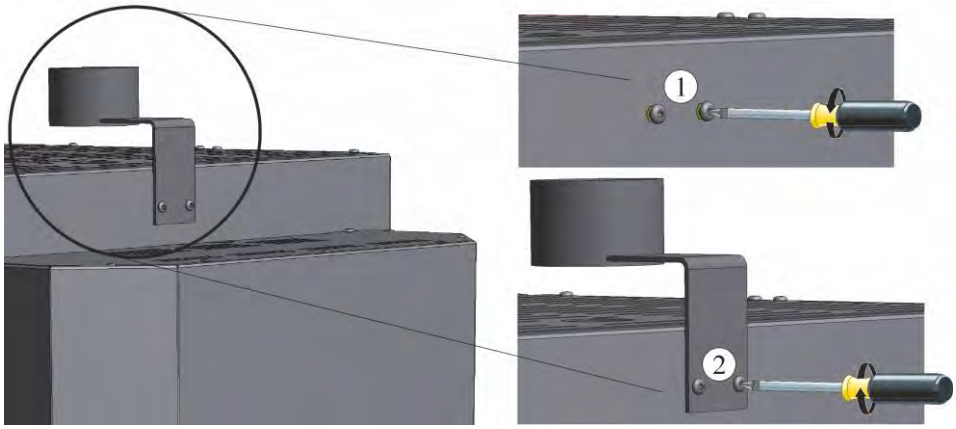


Fig. 38: Assembling the bypass connection (similar to picture)

4.7.2 Assembling the Air Inlet Flap After Assembling the Frame (N 100(H) – N 300(H))

When the furnace has been carefully placed on the frame (1) and has been secured in place with the screws, the air inlet flap can be installed under the floor of the furnace (see Installation (Furnace Location) – Installing the Frame if not Installed).

To protect the air inlet flap during transportation, it is inserted into a bracket on the rear wall.

Carefully remove the air inlet flap from the bracket on the rear wall (2).

Fig. 39: Remove the bracket from the air inlet flap (similar to picture)

Where the air inlet flap is to be installed, there are screws (3) to fasten the air inlet flap that first have to be undone (the quantity and position of the screws depend on the furnace model).

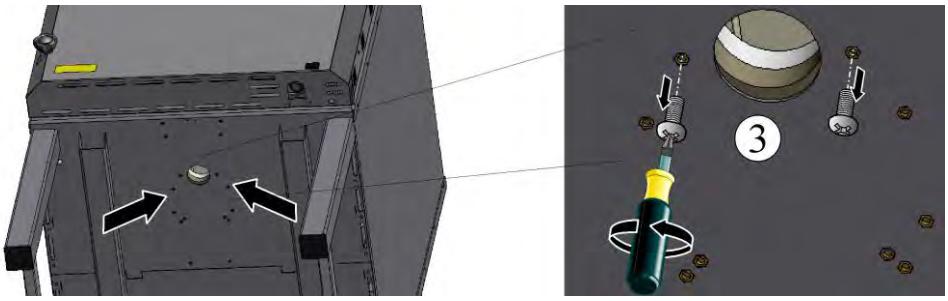


Fig. 40: Undo the screws of the air inlet flap (similar to picture)

Place the air inlet flap with the screws at the correct position on the furnace floor and fasten with a suitable tool (4). Check that the connection (screws) between the air inlet flap and the furnace floor is firm.

Then install the cable that runs between the air inlet flap and the rear wall in the pre-assembled cable supports (the number of cable supports depends on the furnace model).

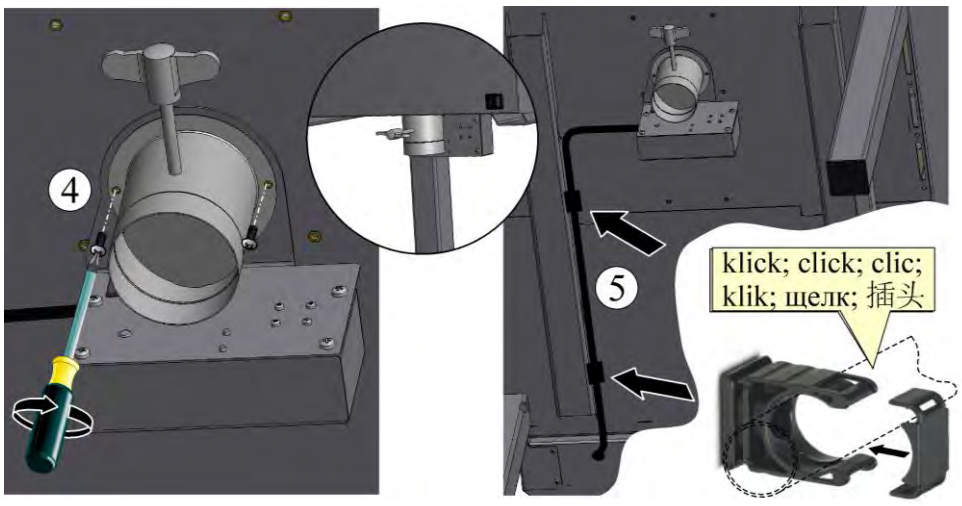


Fig. 41: Assembling the air inlet flap and installing the cable (similar to picture)

4.7.3 Place the Controller in the Holder on the Furnace (model-related)

Place the controller in the holder on the furnace.

Make sure that the controller is placed correctly in the holder. If this is ignored, the controller may be damaged or destroyed. Nabertherm accepts no liability if the controller is not handled properly.

Fig. 42: Place the controller in the holder on the furnace (similar to the picture)

The controller can simply be removed from the holder for especially ergonomic handling and more comfortable operation.

4.7.4 Venting Exhaust Fumes

Exhaust air control without piping/hood

If the process causes the release of hazardous vapors or gases, the operator must vent the exhaust gases **through the exhaust-air flaps to a suitable exhaust air purification system out of the building and supply sufficient fresh-air for the inlet flap.**

In this case the operation of the furnace is not permissible without a suitable exhaust air purification system and exhaust air pipework to carry the exhaust out of the building.

You must ensure that the hot air emitted by the furnace does not endanger people, property or the building.

When starting up, you must ensure that enough fresh air (room ventilation) comes into the room (for example: by opening windows).

If no exhaust top hat is included in the scope of delivery, an equivalent construction must be provided.

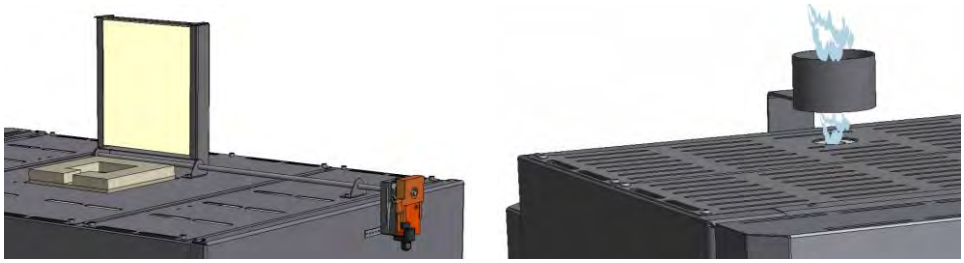
Large heat loads released into the working environment during cooling may have to be drawn off by a structure built for that purpose. This also applies if the room housing the furnace is small. Even when the exhaust-air flaps are closed enormous heat loads can be produced.

The exhaust can be removed passively by the natural draw of the extended piping or actively by a suction unit provided by the customer.

A passive or active suction system must be able to draw off the air flows and temperatures produced by the furnace. Any bottleneck or backing up in the direction of the furnace is not permissible.

Caution

The exhaust can only be vented if the workspace is ventilated with a corresponding fresh-air opening (for example: by opening windows).



Exhaust-air flap/s Bypass connection

Fig. 43: Exhaust air (depending on model - similar to picture)

Exhaust air control with piping

When ceramics are fired, depending on the quality of the clay and/or glaze, they can emit gases and vapors that are harmful to your health. It is therefore necessary to make sure that the "exhaust gases" emitted from the exhaust air opening are directed outdoors in a suitable manner (ventilate the working area). If adequate ventilation cannot be ensured at the working area, the "exhaust gases" must be removed via a pipe. We recommend that you connect a pipe to the furnace to remove the exhaust gases.
A suitable metal exhaust gas pipe with NW80 can be used to vent the gases. Use only metal pipes (example: stainless steel). The pipe must be attached facing upwards and be fixed to the wall or ceiling. Adequate room ventilation is needed to achieve the bypass effect. Vapors may not be extracted through a fan.
Assume a maximum exhaust gas temperature of approx. 200 °C (392 °F) for the piping system. There is a risk of burning at the bypass connection and the piping. Make sure that the wall duct is made from (A) heatproof material.

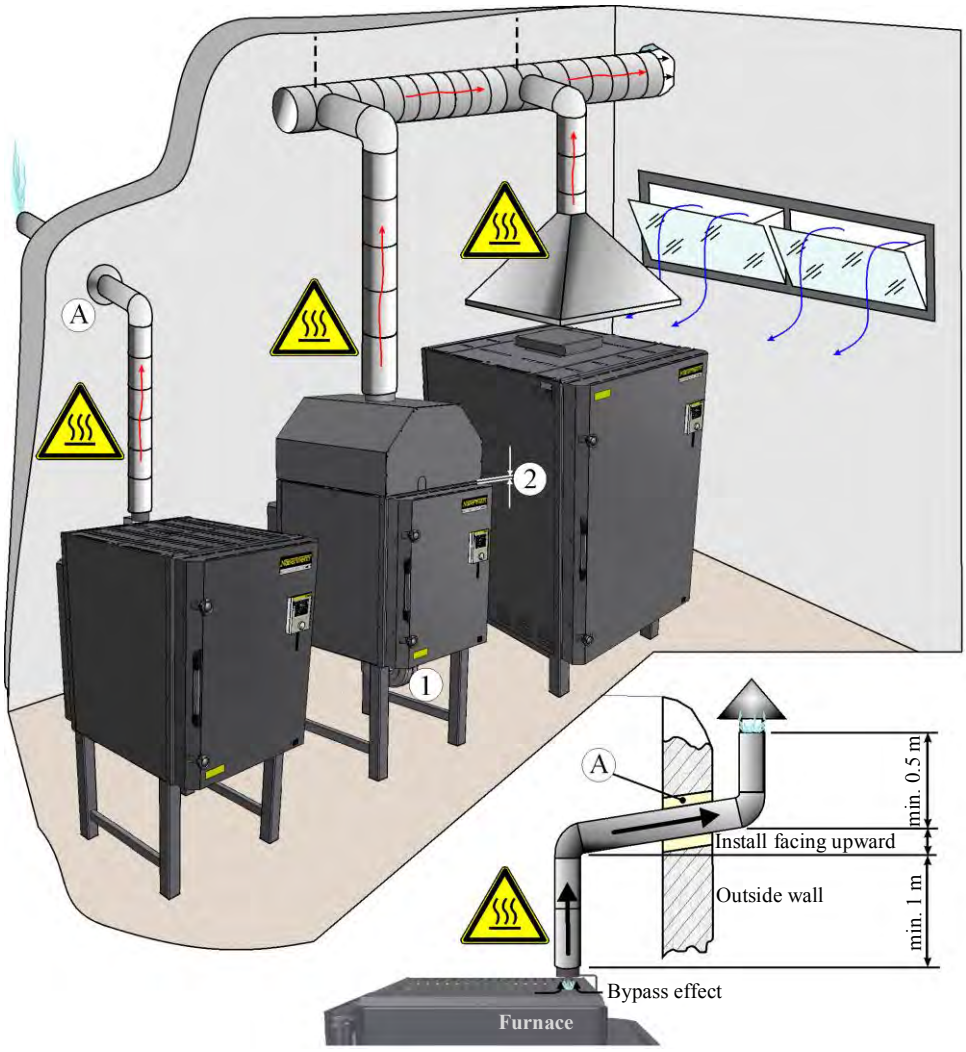


Fig. 44: Example: Assembling exhaust air piping (similar to picture)

Caution

Steps must be taken to ensure that the flow of hot air emitted from the furnace's exhaust outlet flap is not hazardous to people, property or the building.

If the furnace is installed in a "passive house" it must be ensured that the room has an adequate fresh air supply. Because of potential aggressive vapors, we do not recommend that it is connected to the house ventilation system. We recommend a separate furnace room that can be ventilated adequately.

Note

Roof work and/or masonry by the customer is required for the exhaust gas discharge. The size and design of the exhaust gas discharge must be determined by a ventilation technician. The national regulations of the local country apply.

Volumetric Flow Quantities and Temperature Behavior

Use the exhaust air volumetric flow rates in the table below to calculate the exhaust air piping via the bypass connector. If the exhaust air piping is designed continuously rising with DN 80 according to our recommendations, it can be assumed that this value will be achieved if this volume of air can also be fed to the room from outdoors (ventilation opening with a minimum cross section of 50 cm²).

In the case of furnaces with an exhaust air flap and also the fresh air fan option the volumetric flow rate is much higher and can be extracted from the room only in combination with an exhaust air hood (flue).

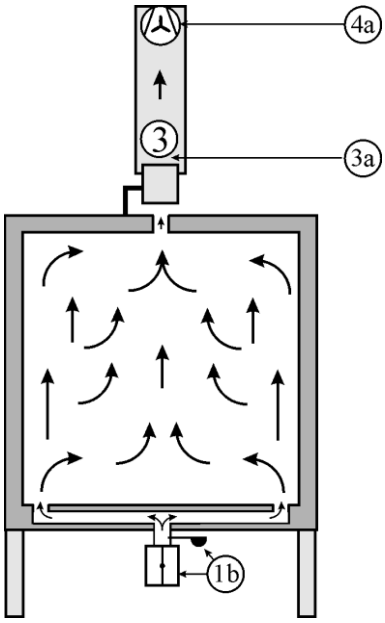
Furnace model	Maximum temperature inside the furnace in °C	① Flow rate of cooling fan[1] m^3/h	② Flow rate of exhaust air flap[1] m^3/h	③ Flow rate of bypass connector[1] m^3/h	④ Flow rate of exhaust air hood[1] m^3/h
N 40 E(LE) – N 300(H)	1300	-	-	approx. 25	-
N 300(H)	1300	max. 600	approx. 40	-	approx. 260
N 440(H)	1300	max. 600	approx. 40	-	approx. 260
N 660(H) – N 1000(H)	1300	max. 600	approx. 40	-	approx. 400
Top 16 – Top 220	1300	-	-	approx. 25	-
①a	1x cooling fan D05 ambient air (~ 25 °C)				
②a	Additional air drawn from the environment (mixing air flow) (~ 35 °C)				
③a	The exhaust air must be dissipated and the maximum temperature defined by the customer. It must be ensured that the flow of hot air emitted from the furnace is not hazardous to people, property or the building.				
④a	Recommended exhaust air fan (not part of the delivery/must be provided by customer)				
[1]if present (model-related)					

Fig. 45: Flow rates and temperature patterns

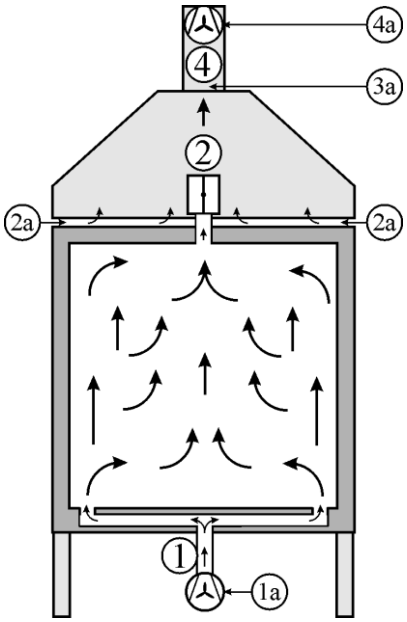
The information described above and in the table relates exclusively to extraction of the gases from the furnace. The heat occurring in case of fire may make additional room ventilation necessary, depending on the size of the room. As the heat depends to a great extent on the firing program, it is not possible to provide precise data. 1/3 of the heat output of the respective furnace can be used as a guide for dimensioning room ventilation.

Warning:

Active ventilation of the installation room must not cause underpressure in the room, as otherwise extraction of the exhaust air from the furnace via the bypass connector will be affected.



Example: Furnace with air inlet valve/flap (1b) and bypass connection



Example: Furnace with cooling fan, exhaust air flap, and exhaust air hood (flue)

4.7.4.1 Installing the Exhaust Hood(s)(design and number depending on furnace model) (Accessories)

When the furnace is delivered, remove the packaging materials. The exhaust hood/s must be visually checked for damage. We recommend that at least two or more persons perform the work of transporting and installing.

Protective gloves must be worn when installing the exhaust hood/s.

The danger of falling is still present (from the roof of the furnace, from the ladder or from the scaffolding). Observe the occupational safety regulations of the respective country of installation.

When positioning the exhaust hood make sure the orientation is correct. Position the cut-out of the exhaust hood on the side of the shaft (1) of the exhaust-air flaps (if included).

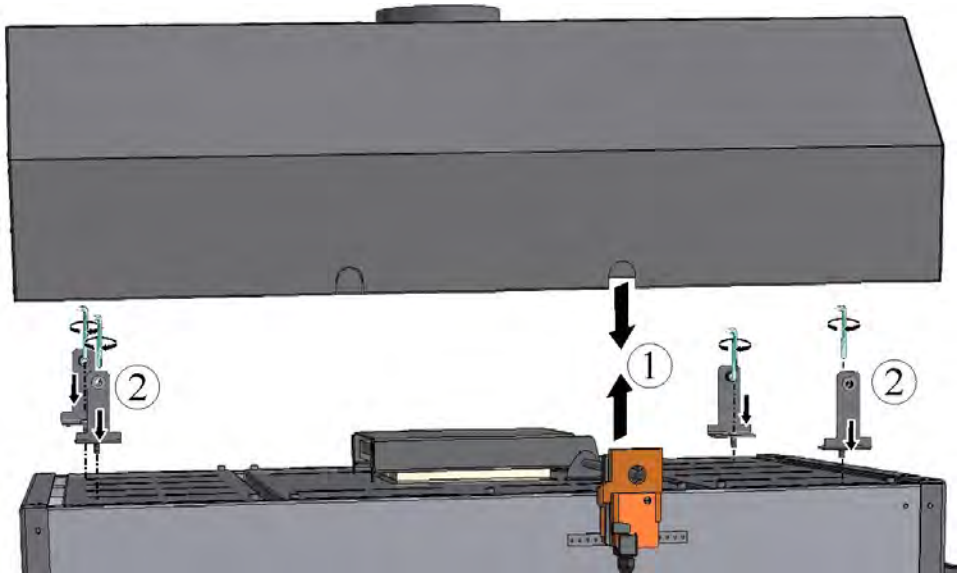


Fig. 46: Example: Positioning the exhaust hood/s (similar to picture)

The screws (2) for fastening the exhaust top hat are on the roof of the furnace. Position the exhaust top hat/s where the screws have been screwed in at the factory. The quantity and positions of the screws may vary from one model to the next. Tighten the screw materials to the furnace turning clockwise and make sure they are firmly in place. The exhaust-air flap/s under the exhaust top hat/s must be able to move freely.

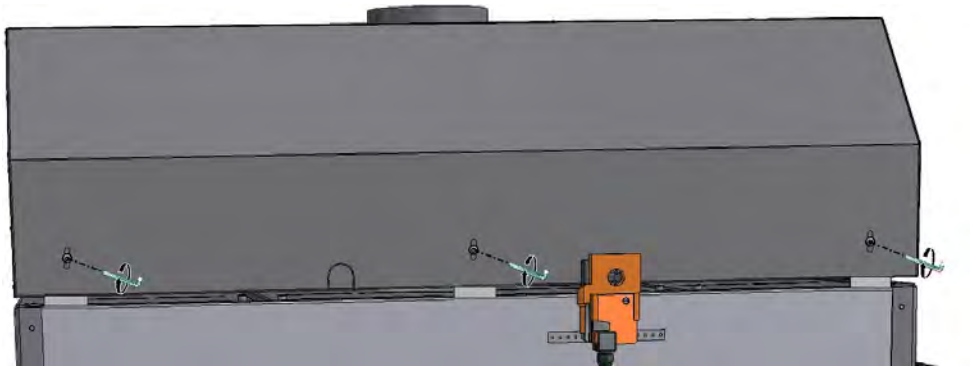


Fig. 47: Example: Positioning and fastening the exhaust hood/s (similar to picture)

Caution – Danger of Falling

Ignoring this can lead to death Danger of falling exists at a height less than 1.00 m above the ground or another sufficiently broad bearing surface (for example, on elevated operating positions and workplaces, working platforms, galleries, landing platforms, footbridges, flying bridges, ramps and stairways). Openings and recesses through which people can fall (for example in floors, platforms, installation openings, hatchways and pits, non-bearing roofs).

4.7.4.2 Setting the Height of the Exhaust Hood

There should always be a slight underpressure under the exhaust hood (if included), in relation to the surrounding air pressure, when the cooling blower (if included) is switched on. For this reason, when an active suction system is used, the suction power should be adjustable (e.g. by using a throttle flap). The distance (2) of the exhaust hood from the furnace sets the admixture air flow.

When starting up, you must ensure that enough fresh air (room ventilation) comes into the room (for example: by opening windows).

The height of the exhaust hood can be continuously set using the screws (1) at the holders all around the hood. Use a suitable tool to remove the screws. Make sure that a uniform clearance is maintained between the exhaust hood and the funace all around the hood.

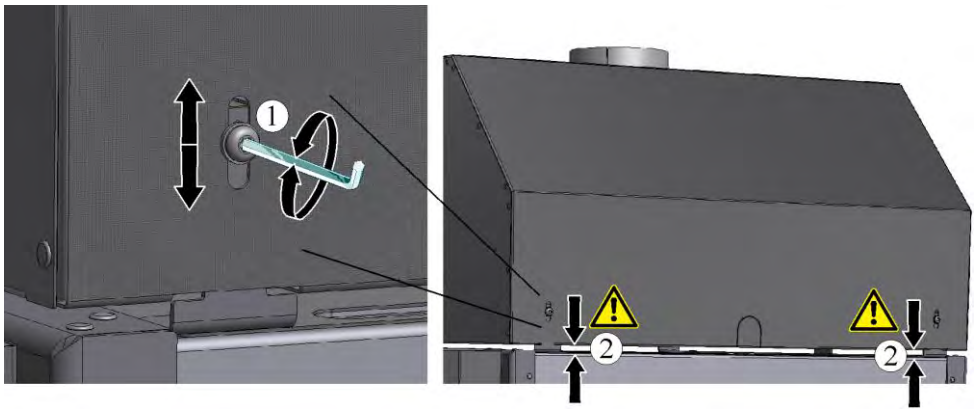


Fig. 48: Setting the height of the exhaust hood (similar to picture)

	**DANGER** **• Fire hazard for components installed under the exhaust air hood.** **• Fire hazard.** • There must be an even gap of **at least 10 mm** all round between the bottom of the exhaust air hood and the top of the furnace. The gap between the bottom of the exhaust air hood and the top of the furnace can be adjusted upward using the screws on the brackets on all sides.

Exhaust air control with exhaust air hood and fresh air fan (optional)

The exhaust can be removed passively by the natural draw of the extended piping or actively by the suction unit provided by the customer.

A passive or active suction system must be able to draw off the air flows and temperatures produced by the furnace. Any bottleneck or backing up in the direction of the furnace is not permissible.

There should always be a slight underpressure under the exhaust hood, in relation to the surrounding air pressure, when the cooling blower (1) is switched on. For this reason, when an active suction system is used, the suction power should be adjustable (e.g. by using a throttle flap). The admixture air flow can be set by the distance (2) of the exhaust hood to the furnace.

When starting up, you must ensure that enough fresh air (room ventilation) comes into the room (for example: by opening windows).

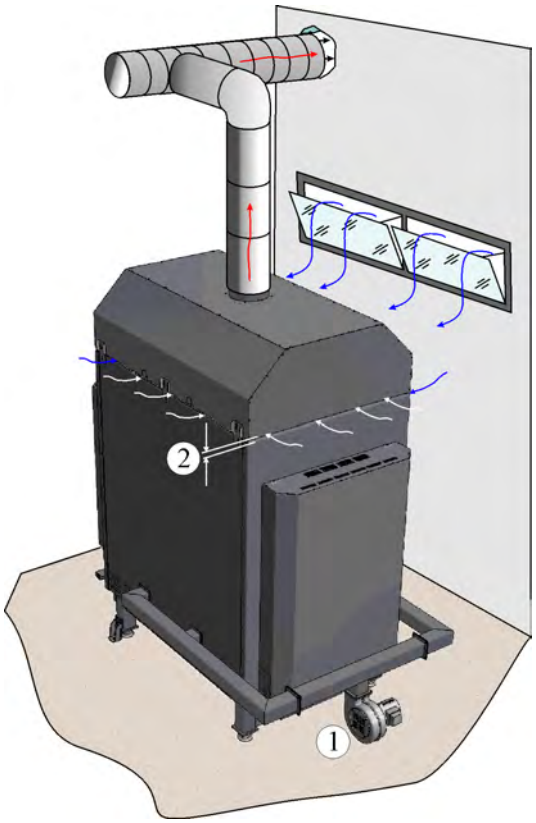


Fig. 49: Example: Venting exhaust air removal through an exhaust hood (similar to picture)

4.7.5 Connecting the Furnace to the Power Supply

The customer must ensure that the surface has adequate load-bearing capacity and that the necessary energy (electricity) is provided.

- The furnace must be installed according to its intended use. The power connection must correspond to the values on the furnace's type plate.
- The power socket must be close to the furnace and be easily accessible. The safety requirements are not met if the furnace is not connected to a socket with a protective ground contact.
- With **230 V** furnace models pay attentions that:
  the distance between the circuit breaker and the power socket that the furnace is connected to is as short as possible. NO power board or extension cable is used between the power socket and the furnace.
- The power cable must not be damaged. Do not place any objects on the power cable. Lay the cable so that no one can stand on it or trip over it.
- Power cables may be replaced only with similar, approved cables.

Note

Before connecting the power, make sure that the power switch is set to "**Off**" or "**0**".

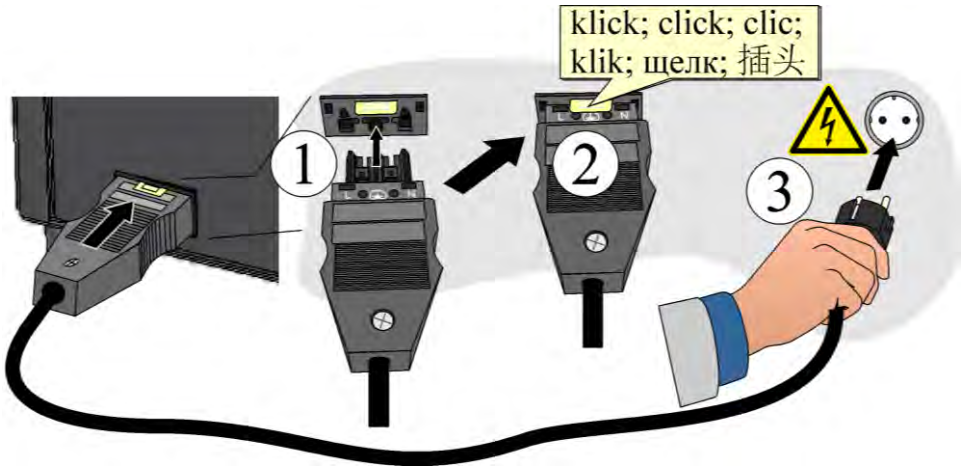


Fig. 50: Furnace up to 3600 kW (the power cable is supplied) (similar to picture)

1. Plug the supplied connection cable with snap-in coupling into the rear wall of the furnace.
2. Then connect the power cable to the power supply. Use only a grounded socket.

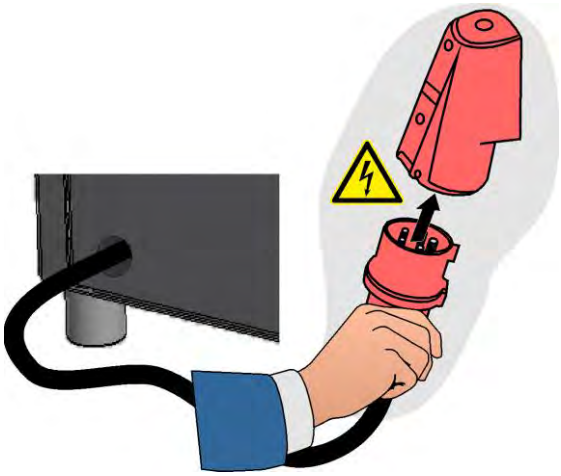


Fig. 51: Furnace from 3.600 W (CEE plug) (similar to picture)

1. Connect the power cable to the power supply. Use only a grounded socket.

Check the ground resistance (acc. to VDE 0100); see also accident prevention regulations. Electrical systems and equipment according to DGUV V3.

Power Connection without Plug-In Power Line:

The power line must have a fixed connection in the switchgear cabinet, either at the available terminals or, in models without a separate switchgear, to the main switch. When carrying out this work pay attention to the specs on the type plate: network voltage and type, and maximum power consumption.

The fuse protection and the cross-section of the required power connection depend on the surrounding conditions, the length of the line and how it is installed. For this reason, the type of protection and how it should be installed must be decided by a qualified electrician.

- The power cable must not be damaged. Do not place any objects on the power cable. Lay the cable so that nobody can step on it or trip over it.
- The power line may only be replaced by an approved, equivalent line.
- Ensure that the connection line of the furnace is protected.

This protection must be compliant with locally applicable standards and regulations.

Ensure that the protective conductor terminal is correct.

When several phases are involved, they must be connected with a clockwise rotating field in the sequence L1, L2, L3.

Before you switch on the furnace for the first time make sure that **a clockwise rotating field is in place**. This is a prerequisite for the smooth functioning of the furnace.

Warning - Danger of Electric Shock!

Work on the electrical equipment may be done only by qualified, authorized electricians.

The customer must supply the necessary preconditions such as the load-bearing capacity of the bearing surface and a source of electric power.

- Make sure that the power lines are adequately dimensioned and secured corresponding to the furnace's parameters.
- Ensure that the connection line to the furnace/switchgear is protected.
- **A residual current circuit breaker (RCCB) cannot be used with the following components:**
- Testing of the earth resistance (compliant with VDE 0100); see also the accident prevent regulations.
- Electric facilities and operating equipment compliant with DGUV V3.

You can provide the wiring and electrical connections using the enclosed wiring schematic. The electrical equipment of the machine is shown in the schematic.

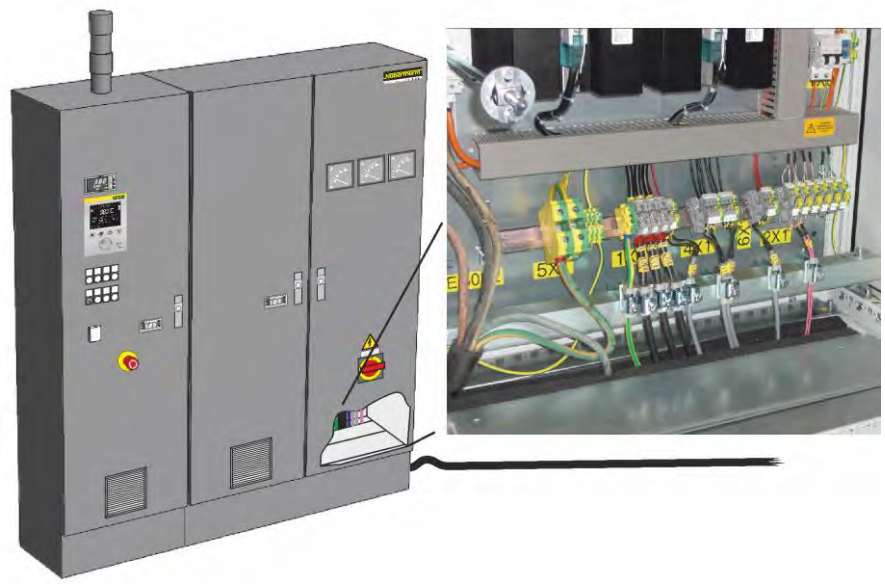


Fig. 52: Example: Power connection

Note

The national regulations of the respective country of operation apply.

NOTICE

- **Danger from incorrect voltage**
- **Damage to the furnace.**
- Check voltage before connecting and commissioning the furnace.
- Compare the voltage with the details on the type plate.

4.8 Commissioning

Read the section on "Safety". When the furnace is put into operation, the following safety information must also be observed to prevent serious injury, damage to the furnace, and damage to other property.

Make sure that the instructions and information in the instruction manual and the controller instructions are observed and followed.

Before starting the furnace for the first time, make sure that all tools, foreign parts, and transportation securing equipment have been removed.

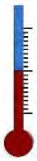
Before you switch on the furnace, make sure that you know what to do in case of faults or emergencies.

Before placing materials in the furnace, check whether they could harm or destroy the insulation or the heating elements. Materials that could damage the insulation include: alkalis, alkaline earths, metal vapors, metal oxides, chlorine compounds, phosphorous compounds, and halogens. **If applicable, read the labels and instructions on the packaging of materials that you use.**

Note

Before starting the furnace for the first time, allow it to acclimatize at its installation location for 24 hours.

4.9 Recommendations for Heating the Furnace for the First Time



Heat the furnace to dry out the bricks and to get a protective oxide layer on the heating elements. There may be some unpleasant odors while the furnace is heating. This is due to binder being emitted from the insulation material. It is advisable to ventilate the room in which the furnace is located well during the first heating phase.

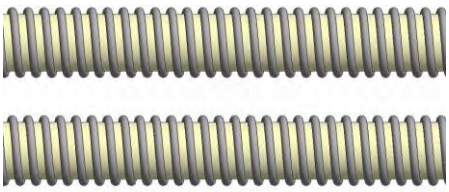
- Half open the air inlet valve/flap (see "Operation")
- Close the door (see "Operation")
- Switch on the furnace/controller with the power switch (see "Operation")
- Open the exhaust air flap (if present) (see "Operation")
- Heat the empty furnace, if necessary with new furnace furniture (shelves and props) to 500 °C in 6 hours, and then heat at full power and keep this temperature for one hour before allowing the furnace to cool naturally. Read the controller instructions for how to enter temperatures and times.

The formation of a layer of oxide is necessary for the correct function of the heating element.

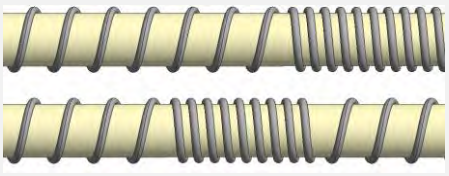
This procedure is for the first start-up and must be repeated after **every replacement** of heating elements.

The duration of the oxidation firing can be found in the section entitled "Recommendation for Heating the Furnace for the First Time".

Nest formation is a natural process and requires no correction. Considerable nest formation, however, can influence temperature distribution.



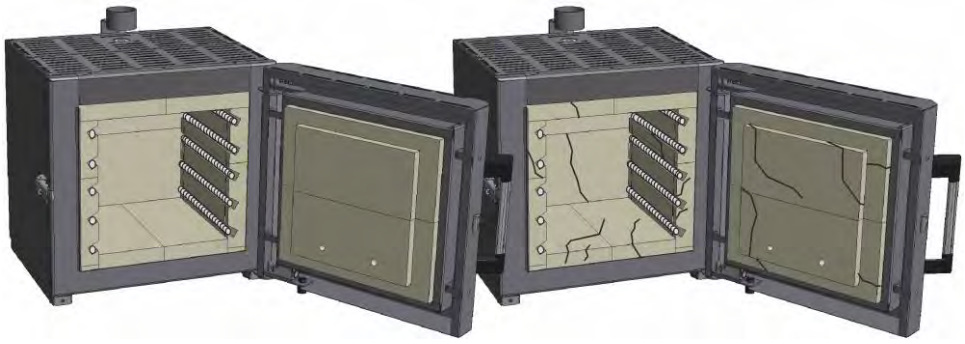
Before



After (nest formation)

Insulation

The furnace insulation is made from high-grade fireproof material. Due to thermal expansion, cracks in the insulation will occur after a few heating cycles. These have no influence on the function, safety or quality of the furnace. The refractory bricks (insulation) are of a particularly high quality. Due to the manufacturing process small holes or cavities may occur. These are quite normal and underline the quality features of the bricks. These holes or cavities are not a reason for complaint.



before **after**

Fig. 53: Example: Cracks in the insulation after a few warm-up cycles.

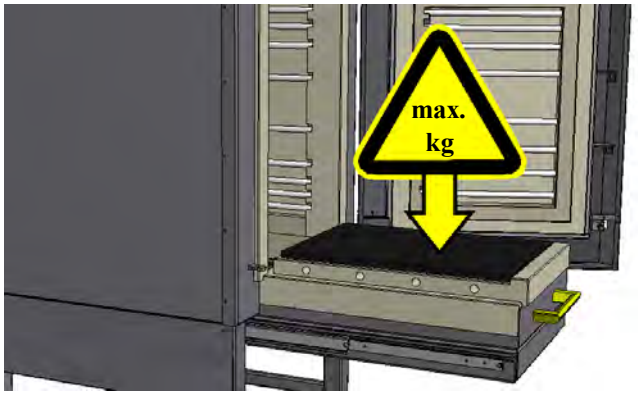
Note

New kiln furniture (e.g. shelves and props) should be heated once to dry them out (as described above). When cold, heating elements are extremely brittle. Take great care when filling, emptying and cleaning the furnace.

The door must be locked during firing. To extract emitted gases and vapors more quickly and to shorten the cooling phase after firing, the air inlet valve or flap (model-related) can be completely or partially opened.

4.10 Loading/Charging

- Only operate the furnace when all the protective equipment and safety-related systems, e.g. removable protective equipment, EMERGENCY-OFF equipment, noise insulation, suction equipment, are in place and functional!
- Only materials whose characteristics are known may be heated. Consult all available safety-related material data sheets.
- Loading a very large quantity of product into the furnace chamber can substantially lengthen the warm-up times.
- When the furnace is being loaded be sure to avoid point loads on the bogie. It has been certified for a charge of 10 kg/dm^2 charging surface of the bogie. Depending how the bogie is driven, smaller charge quantities are also possible since, for example, a rubber-tired bogie which is loaded to the limit is much more difficult to drive than one on tracks.
- During any movements of doors and bogie, the operator must ensure that nobody can be accidentally injured. The position of the operator must be selected so that he can keep an eye on all moving parts. It is prohibited to spend any time in the furnace.
- Before every start the operator must be sure that there are no people in the furnace chamber.
- It is prohibited to sit or stand on the bogie while it is in motion.
- If it can be at all avoided, do **not** open the furnace when it is hot. When it is necessary to open the furnace at a high temperature, the time should be kept to an absolute minimum. Personnel must wear the appropriate protective clothing, and the workspace must be adequately ventilated as stated in the section entitled "Safety". The housing or its paneling can discolor (especially if the furnace is opened while hot), but this does not impair the functionality of the furnace. We recommend leaving the load in the furnace until it is completely cooled off.
- The connection of a gassing system (additional equipment) can enable the furnace chamber to be purged with reducing gases, but a defined atmosphere cannot be achieved in the furnace chamber. Caution: Escaping protective gas exposes people to the danger of suffocation.
- It is absolutely necessary that all the metallic components extending from the furnace are properly grounded while the furnace is operating. This can be necessary, for example, if the furnace is equipped with bores for the introduction of thermocouples.
- When charging the furnace with drawer (NW 150(H) – NW 300(H)) pay attention to the **maximum** charge weight. If this is ignored, Nabertherm accepts no liability for damage or injuries.



NW 150(H) max. 75 kg
NW 200(H) max. 100 kg
NW 300(H) max. 150 kg

Fig. 54: Maximum charge weight (NW 150(H)/NW 200(H)/NW 300(H))

The maximum load bearing capacity of the furnace base (filling weight) is very dependent on the temperature. We recommend approx. 50 % of the furnace volume in kg as the loading limit.

Example: N 650 = 650 liters furnace volume (see "Technical Data") corresponds to approx. 325 kg maximum load bearing capacity of the furnace base

Fig. 55: Recommendation: Maximum load bearing capacity of the furnace base

4.10.1 Tips for Potters

Furnace loading

Open the furnace door carefully.

Use only materials whose properties and melting temperatures are known. Read the relevant safety data sheets.

When charging the furnace, make sure that the door collar and the heating elements are not damaged. Avoid touching the heating elements when charging the furnace as otherwise the elements could be destroyed.

Large quantities of material in the furnace can substantially lengthen the heating-up time.

For good firing results and even temperature distribution, we recommend that the pots be distributed evenly among the individual shelves.

When the furnace is full, close the door carefully. Close the door slowly so as not to damage the insulation. Make sure that the door is closed properly.

If it can be at all avoided, do **not** open the furnace when it is hot. When it is necessary to open the furnace at a high temperature, the time should be kept to an absolute minimum. Wear the appropriate protective clothing, and ensure adequate ventilation; see "Safety".

Stainless steel sheet can discolor (especially if the furnace is opened while hot), but this does not impair the functionality of the furnace.

The volume of air fed to the furnace can be adjusted with the air inlet valve or flap (model-related). The air inlet valve/flap is located on the base of the furnace.

After the chemically bound water has been expelled from the ceramics during the firing (max. 600 °C (1112 °F)), the air inlet flap or valve (model-related) of the furnace must be closed to prevent drafts and to ensure good temperature uniformity in the upper temperature range.

Alternatively, the air inlet flaps/valves can be operated with an electric drive system that is controlled fully automatically via the controller.

By default, the models in the chamber furnace series N 140 E(LE) – N 280 E(LE), N 100(H) – N 300(H) and NW 150(H) – NW 300(H) have a **semi-automatic, electromagnetic controlled air inlet flap**.

With this function it is possible to dry the ceramics at low temperatures before the actual firing begins with the air inlet flap closed (good temperature distribution in the furnace).

Before the program starts, the air inlet flap must be opened manually. During the process, the air inlet flap can be closed once in a desired program segment via extra function 1 of the controller (see separate controller instructions). **The air inlet flap must be re-opened manually before the next firing.**

When ceramics are being fired, gases, vapors, and moisture occur that may cause corrosion on the furnace. To ensure optimum removal of the exhaust gases to the atmosphere, ideally the inlet air opening and exhaust air flap (if present) should remain open to 650 °C (1202 °F) and then be closed to achieve good temperature distribution.

Our chamber furnaces are not suitable for use as drying cabinets.

To reduce the cooling phase after a firing, the inlet air opening (and the exhaust air flap if present) may be opened completely or partially.

Using the shelves and props included with the delivery

By default, furnace models **without SiC bottom tile/s** have three ceramic shelves (A) to prevent damage to the "soft" bottom of the furnace (e.g. indentations). Furnace models **with bottom heating** but **without SiC bottom tile/s** also have three props (B) to prevent heat accumulating between the bottom heating and a subsequently inserted shelf (accessory)**.**

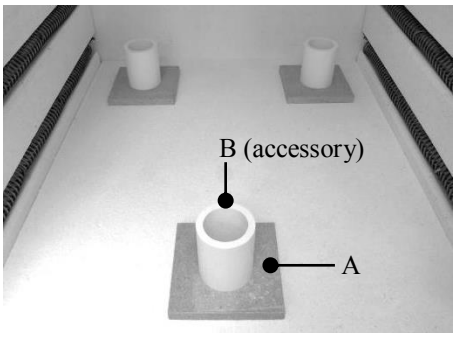
Nabertherm accepts no liability for damage to the bottom of the furnace or to heating elements if these shelves and props are not used. Damaged shelves and props must be replaced immediately (see "Accessories").

A = 691600956

Ceramic shelves supplied with furnaces without SiC bottom tile/s.

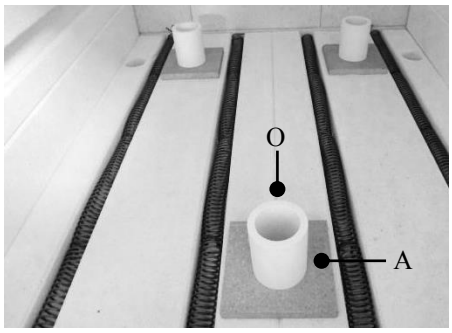
B = 691600185

Ceramic props supplied with furnaces with bottom heating but without SiC bottom tile/s.



Furnace bottom **without** bottom heating (without SiC bottom tile)
Furnace model N 40 E – N 100 E

A = Ceramic shelf
B = Prop (not included in delivery - accessory)



Furnace bottom **with** bottom heating (without SiC bottom tile)
Furnace model N 140 LE – N 280 E

A = Ceramic shelf
B = Prop (included in delivery)

Fig. 56: Example: Ceramic shelves to protect the bottom of the furnace (similar to picture)

Arrangement of the Shelves and Props (Accessories)

With shelves to size … we recommend that the props be arranged in a triangular pattern to ensure stability.

First, place three props (B) in a triangular pattern on top of the ceramic shelves (A) (only furnaces without an SiC bottom plate). The ceramic shelves must have been placed evenly on the floor of the furnace beforehand. The distance between the props (B) depends on the size of the shelves and should be as large as possible to ensure stability.

Place the shelf (C) on top of the props. Now place the pots to be fired in the furnace and distribute them as evenly as possible. If a second layer is required, place props on the shelf to get the required distance between the shelves.

Notice: When inserting the shelves, make sure that the door collar and the heating elements are not damaged. Avoid touching the heating elements when inserting the shelves as otherwise the elements could be destroyed.

The bottom of the furnace is made from high-quality refractory material, however, this material is extremely sensitive to impact and pressure.

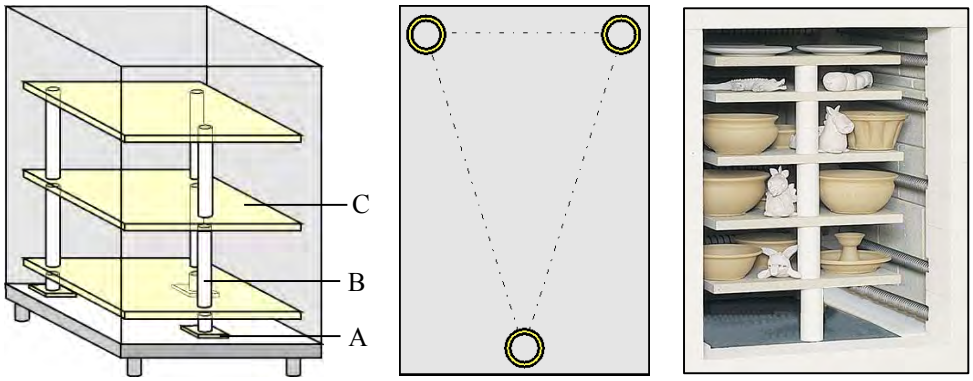


Fig. 57: Example 1: Individual shelves (similar to picture)

Vibration may occur due to movements of the drawer (NW 150 – NW 300/H) or the bogie (NW 440 – NW 1000/H). A four-point pattern of the props and shelves (C) ensures more stability of the complete arrangement together with the objects to be fired.

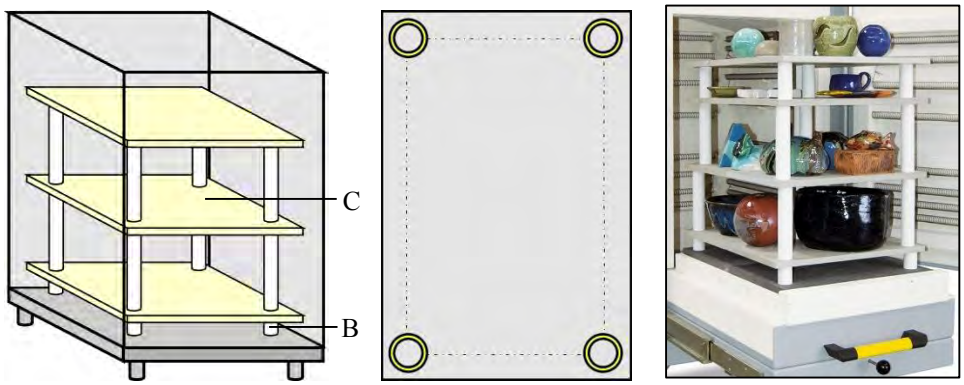


Fig. 58: Example 2: Individual shelves with furnace model NW … (similar to picture)

In the case of furnace models with several individual shelves (C) in one level, we recommend that props (B) be arranged in a triangular pattern for each shelf to ensure stability.

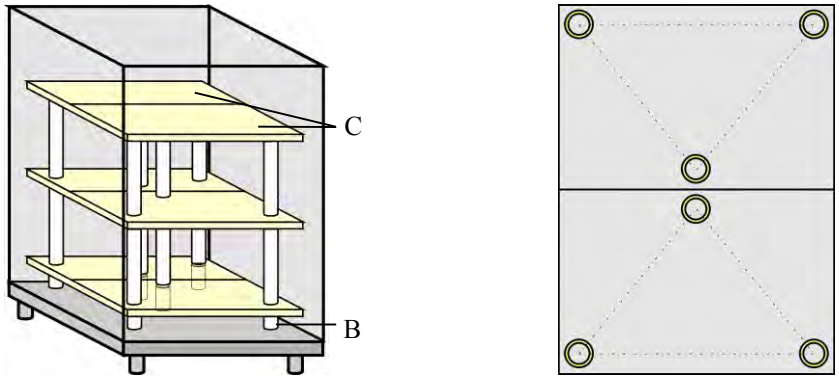


Fig. 59: Example 1: Several individual shelves on one level (similar to the picture)

Note

The temperature specifications given by clay and glaze producers must be observed. They will be happy to provide you with suitable firing curves for the products.

So that your pottery, which was made with a lot of effort and love, is not destroyed, the following principles should be observed:

- Allow pottery to dry slowly – not in a heated room or in the sun.
- Dry pottery away from drafts - drafts cause uneven drying and drying cracks.
- Loosely cover outstanding parts (e.g. handles) with paper or plastic film, as they dry faster than the rest of the pot. If you don't do this, cracks may occur at the joint.
- Allow the pottery to dry for at least one week - longer in cool basements.
- Clay shrinks when it dries; in other words, the volume is reduced due to the loss of water. Objects that stick to a surface crack when they dry - therefore, always place your pottery on fresh, clean surfaces.
- Turn your pottery often as the top dries quicker than the bottom.
- Handle dry pottery carefully with both hands and don't lift it by the edges. Pottery is very fragile in this state.

4.10.1.1 Preset programs for ceramic applications

With Controllers B400/410, C440/450 and P470/480 the following programs are preset and can be started directly.

Note

In all cases, observe the information and references from the producers of raw materials that may require preset programs to be changed or adjusted. There is no guarantee that preset programs will produce optimum results. The programs set in the factory may be overwritten for personal purposes.

Program 01

Program name: Biscuit firing, normal ("BISCUIT NORMAL 900")

				Manual air inlet flap[1]	Semi-automatic air inlet flap[2]	Automatic air inlet flap[3]
Segment	**Start**	**Target**	**Time**		**Extra 1**	
1	0 °C	600 °C	360 min	Open manually	Open manually (0)	Opens automatically (1)
2	600 °C	900 °C	20 min	Close manually	Closes automatically (1)	Closes automatically (0)
3	900 °C	900 °C	20 min	-	0	0
4	900 °C	0 °C		-	0	0

Program 02

Program name: Biscuit firing, slow ("BISCUIT SLOW 900")

				Manual air inlet flap[1]	Semi-automatic air inlet flap[2]	Automatic air inlet flap[3]
Segment	**Start**	**Target**	**Time**		**Extra 1**	
1	0 °C	600 °C	480 min	Open manually	Open manually (0)	Opens automatically (1)
2	600 °C	900 °C	20 min	Close manually	Closes automatically (1)	Closes automatically (0)
3	900 °C	900 °C	20 min	-	0	0
4	900 °C	0 °C		-	0	0

Program 03

Program name: Glaze firing, earthenware ("GLAZE FIRING 1050")

				Manual air inlet flap[1]	Semi-automatic air inlet flap[2]	Automatic air inlet flap[3]
Segment	**Start**	**Target**	**Time**		**Extra 1**	
1	0 °C	300 °C	180 min	Open manually	Open manually (0)	Opens automatically (1)
2	300 °C	1050 °C	20 min	Close manually	Closes automatically (1)	Closes automatically (0)
3	1050 °C	1050 °C	20 min	-	0	0
4	1050 °C	0 °C		-	0	0

Program 04

Program name: Glaze firing, stoneware ("GLAZE FIRING 1150")

				Manual air inlet flap[1]	Semi-automatic air inlet flap[2]	Automatic air inlet flap[3]
Segment	**Start**	**Target**	**Time**		**Extra 1**	
1	0 °C	300 °C	180 min	Open manually	Open manually (0)	Opens automatically (1)
2	300 °C	1150 °C	20 min	Close manually	Closes automatically (1)	Closes automatically (0)
3	1150 °C	1150 °C	20 min	-	0	0
4	1150 °C	0 °C		-	0	0

Program 05

Program name: Glaze firing, stoneware ("GLAZE FIRING 1250")

				Manual air inlet flap[1]	Semi-automatic air inlet flap[2]	Automatic air inlet flap[3]
Segment	**Start**	**Target**	**Time**		**Extra 1**	
1	0 °C	300 °C	180 min	Open manually	Open manually (0)	Opens automatically (1)
2	300 °C	1250 °C	20 min	Close manually	Closes automatically (1)	Closes automatically (0)
3	1250 °C	1250 °C	20 min	-	0	0
4	1250 °C	0 °C		-	0	0

[1] Air inlet flap us opened and closed manually.

[2] In the case of furnaces with a semi-automatic air inlet flap, the flap is closed when the extra function (Extra 1) is activated.

[3] In the case of furnaces with an automatic air inlet flap, the flap is opened when the extra function (Extra 1) is activated.

Note

If one of the programs described above has a higher maximum temperature than that of your furnace, this program will not be preset.

In the case of furnaces with no extra function to close the air inlet flap semi-automatically, the flap can only be opened and closed manually.

4.10.2 Bisque Firing

When the greenware is completely dry, it is bisque fired; that is, it is fired in the furnace at between approx. 900 °C and 950 °C. The first firing – for unglazed pottery (terracotta) the only firing – changes the physical and chemical properties of the clay. It becomes "bisque ware" (like a clay brick) and is hard and cannot be dissolved in water.

During the bisque firing the pots in the furnace can touch each other. They can be stacked (also inside each other) as long as they are not too heavy or do not prevent each other from shrinking. Tiles or flat plates should be placed directly on the shelves to prevent distortion. It really depends on the size of the objects whether they are stacked on several shelves or if a few larger pieces fill the entire furnace. But the chamber should not be "overloaded" to ensure sufficient air circulation. For the firing it is important that you know what happens to the pottery. It loses a lot of water and shrinks. If the furnace temperature is raised too quickly, the steam does not have enough time to escape and objects can crack and damage the furnace. Therefore, the furnace should be heated slowly to about 650 °C at approx. 100 °C to 150 °C per hour. Chemically bound water escapes from the clay until about this temperature. From this time you can heat the furnace to the final temperature at full power. Nabertherm controllers handle this task fully automatically.

The controller instruction manual contains all the details.

Because of the large mass and the good insulation, it takes several hours for the furnace to cool; be patient. You should open the lid a little only when the furnace has reached about **100 °C**.

When the furnace is completely open, many people are amazed to find that there have been several changes to the pottery. The pieces are smaller, they are lighter in color, the clay has a different color, the bisque ware is hard and you can now lift a pot by its handle without fear of it breaking off.

4.10.3 Glaze Firing

Usually, the glaze firing is the highest temperature firing. The temperature range for earthenware (usually red or brown clay) is about 1040 °C to 1080 °C. For stoneware (usually white clay) the furnace has to reach at least 1200 °C. The glazes must be adapted to suit the temperature range.

The top of the shelves should be painted with a separating agent (batt wash) before a glaze firing. This coating should be renewed from time to time.

Check the areas where the pottery is to stand - they must be free of glaze. Pottery with a glazed base must be placed on stilts or triangular rods for the firing. Glazed pottery should be handled very carefully and should not be touched at the edges. The pots must not touch in the furnace - the glaze would fuse together (there should be a few centimeters between the pots). There must also be a gap of at least 2 cm to the heating elements.

Always use only glazes in one melting range (e.g. 1050 °C) in a firing. Heat the furnace to about 500 °C at reduced power (approx. 180 °C per hour, see also controller instructions) (water escapes from the glaze), and then heat to the final temperature at full power. Hold this temperature for about 30 minutes so that the glaze melts evenly throughout the furnace.

Only open the lid or door when the temperature has dropped to **below 50 °C**. Many glaze cracks are the result of opening the lid too soon.

You can grind any glaze drops on the bottom of the pottery or the shelves with a grinding stone or an angle grinder - paying attention to all the safety regulations.

Do not use very runny glazes to avoid damaging the shelves, the furnace insulation or the heating elements and the furnace itself.

You can obtain firing and glazing accessories and specialist literature from a specialist dealer in your neighborhood. We will be happy to provide you with addresses.

4.10.4 Reduction Firing

In a reduction firing, oxygen in the furnace is consumed by means of a foreign substance. However, since oxygen is needed to maintain the protective oxide layer on the heating elements NO reduction firings should be carried out in an electrically heated furnace.
Under certain circumstances, high concentrations of gases can settle in the insulation and destroy it.
If it is unavoidable, after each reduction firing the furnace must be fired with a normal atmosphere to replace the protective oxide layer on the heating elements.
No warranty claims will be accepted for damage caused by reduction firings.

5 Operation

5.1 Controller

B400/C440/P470

Fig. 60: Control field B400/C440/P470 (similar to picture)

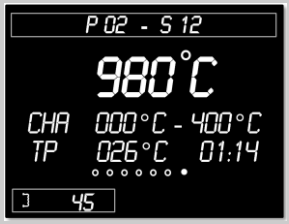
No.	Description
1	Display
2	Control keys for "Start/Hold/Stop", "Menu" selection, "Back" function and information menu selection
3	Jog dial
4	USB interface for a USB stick

Note

See the separate operating instructions for a description of how to enter temperatures and times and to "start" the furnace.

5.2 Operation, Display and Switch Elements (depending on design)

5.2.1 Turning on the Controller/Furnace

Switching on the Controller		
Steps	**Display**	**Comments**
Turn on the power switch		Turn on the power switch by setting it to "**I**" (power switch type differs depending on features/furnace model)
The overview screen appears. After a couple of seconds, the temperature is displayed.		If the temperature is displayed at the controller, the controller is ready to operate.

5.2.2 Turning off the Controller/Furnace

Turn off the controller		
Steps	**Display**	**Comments**
Turn off the power switch		Turn off the power switch by setting it to "**O**" (power switch type differs depending on features/furnace model)

All the necessary settings for perfect functions have already been made at the factory.

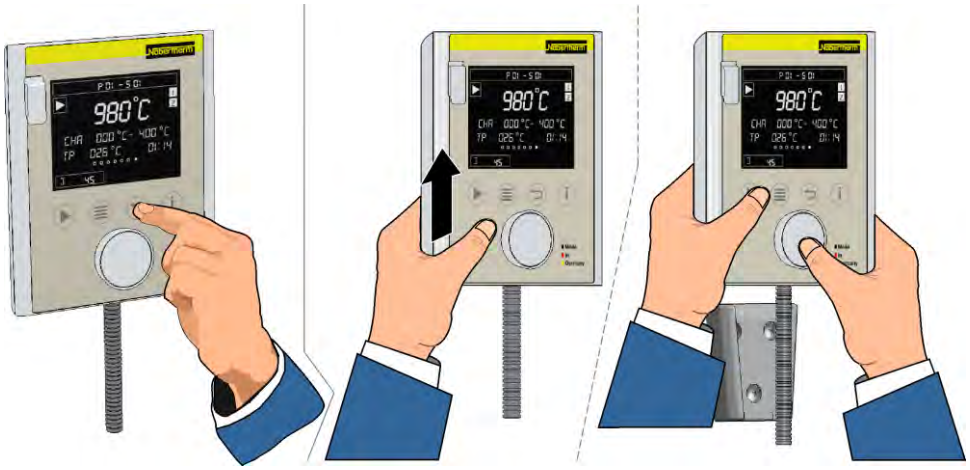
Note

Make sure that the doors of the control box are always locked and bolted. Otherwise dirt can be expected to shorten the useful life of the installed electrical switching components.

5.3 Handling the Controller

The controller can simply be removed from the holder for especially ergonomic handling and more comfortable operation.

After use, replace the controller in its holder.



Simple operation directly on the controller	Easy and ergonomic handling by removing the controller from its holder

Fig. 61: Handling the controller (similar to picture)

Make sure that the controller is placed correctly in the holder. If this is ignored, the controller may be damaged or destroyed. Nabertherm accepts no liability if the controller is not handled properly.

Fig. 62: Place the controller in the holder on the furnace (similar to the picture)

5.3.1 Over-Temperature Limiter with Manual Reset and Adjustable Cut-Off Temperature (Additional Equipment)

Fig. 63: Over-temperature limit controller with manual reset 2132i

Note

See additional operating instructions for description and function

5.4 Opening and Closing the Door

5.4.1 Furnace with Adjustable Quick Release

Open door (with adjustable quick release)

Open the quick release as shown in the figure below. Pull the handle lightly to open the door. It is advisable to open the door completely to fill the furnace.

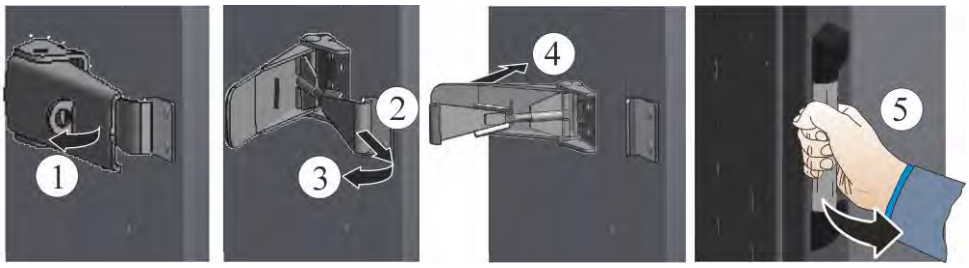


Fig. 64: Open the door (similar to picture)

Close door (with adjustable quick release)

Close the door of the furnace carefully (do not slam it shut). Close the quick release as shown in the figure below.

When the door is closed, make sure that it is closed evenly all around. Check the quick release and, if necessary, adjust the snap lock (A) with a few turns so that it can be closed effortlessly.

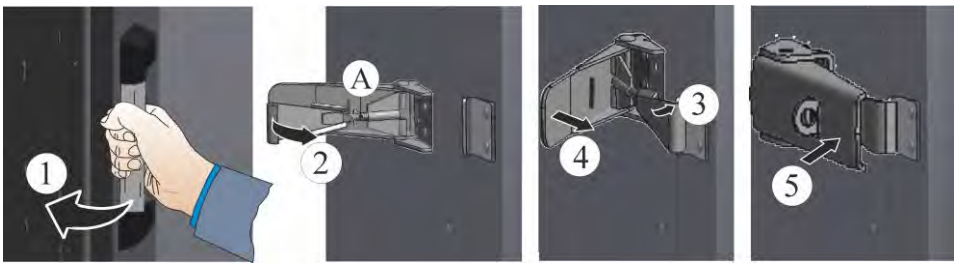


Fig. 65: Close the door (similar to picture)

5.4.2 Furnace with quick release (Variant A)

Opening and Closing the Swinging Door

Turning to the left, loosen locks (1) of the swinging door and swing away towards the furnace housing (2).

Pull the door handle (3) to open the swinging door. The swinging door must be fully open to charge the furnace. The door is closed in the reverse sequence. Press the swinging door carefully against the furnace collar (**do not let it swing shut**). The weight of the swinging door can cause damage to the furnace or the door collar.

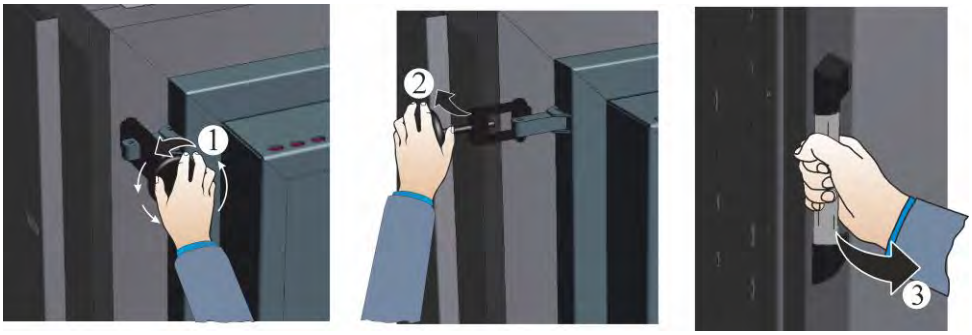


Fig. 66: Opening the swinging door

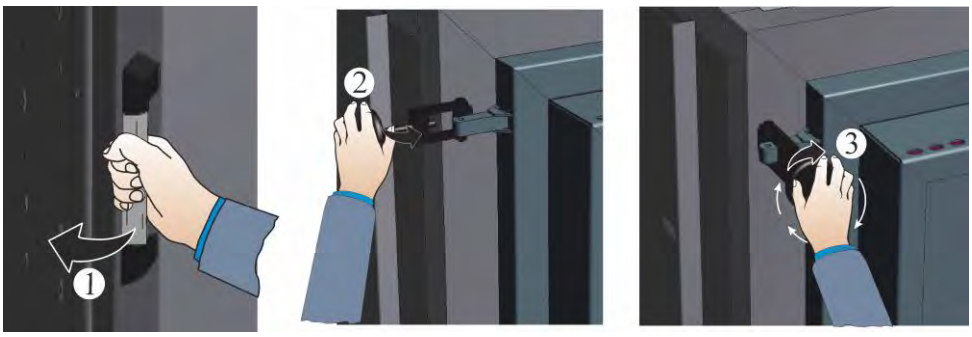


Fig. 67: Closing the swinging door

5.4.3 Furnace with quick release (Variant B)

Opening and Closing the Swinging Door

Loosen the locks (1) on the swing door in an anticlockwise direction and swing them towards the furnace door hinges (2).

Pull the door handle (3) to open the swinging door. The swinging door must be fully open to charge the furnace. The door is closed in the reverse sequence. Press the swinging door carefully against the furnace collar (**do not let it swing shut**). The weight of the swinging door can cause damage to the furnace or the door collar.

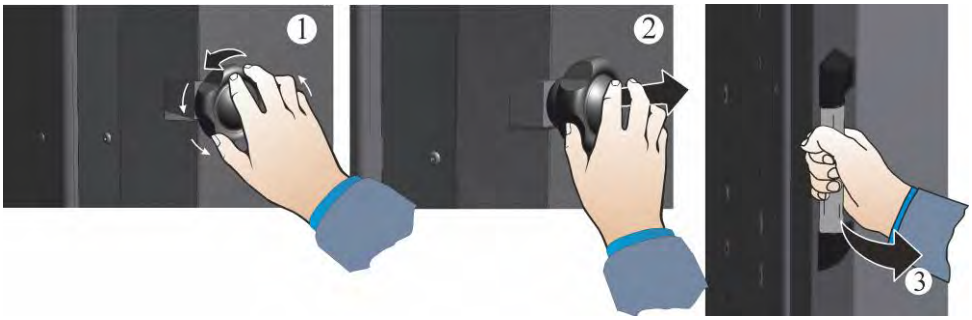


Fig. 68: Opening the swinging door

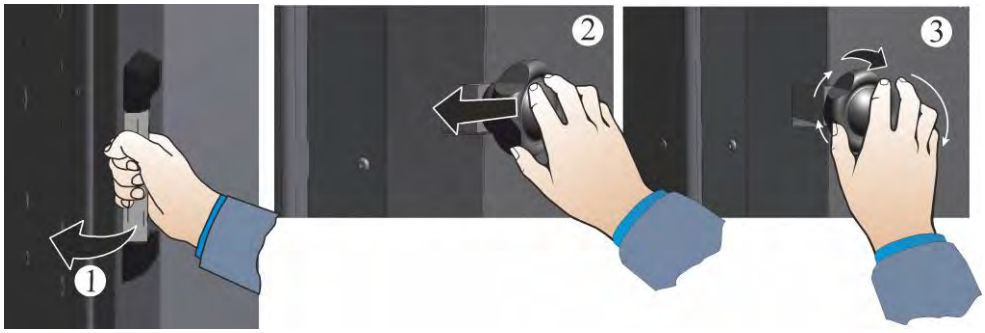


Fig. 69: Closing the swinging door

5.5 Driving the Bogie in and out

NW 440 - NW 1000/H

After the complete opening of the swinging door, the bogie can be charged completely outside the furnace. Pull out the draw bar (1) (on the side of the furnace housing) and insert it into the holder (2) of the bogie. Pull out the bogie for charging. The bogie heater automatically connects to the power source when the bogie is driven in.

Always remove the draw bar from its holder on the bogie before closing the door and putting it back in its holder on the furnace housing.

Caution: When charging the bogie pay attention to weight distribution and the upper load limit (see section "Loading/Charging“).

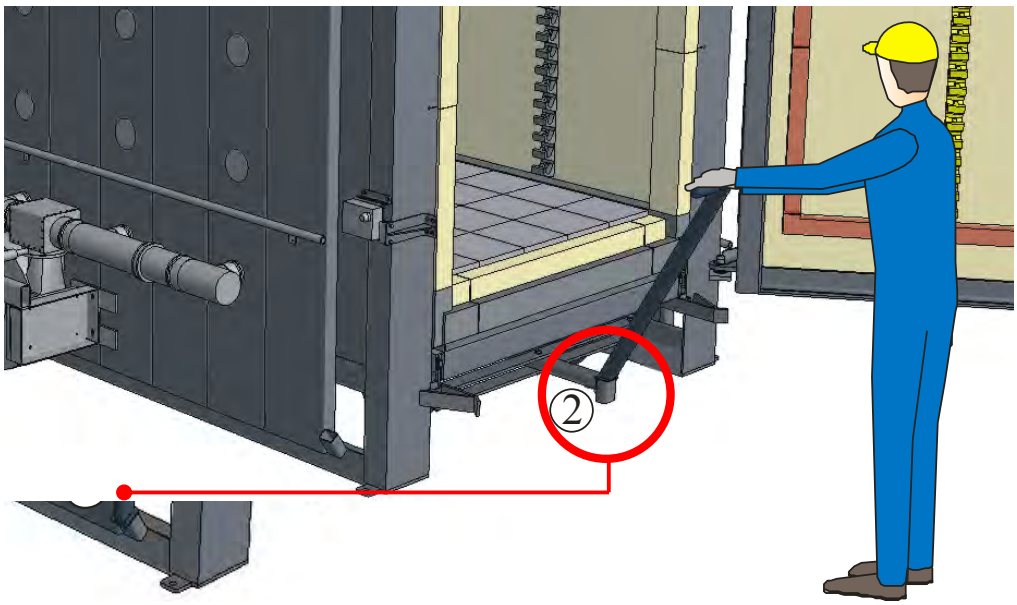


Fig. 70: Inserting the draw bar

To separate the electric contacts between the bogie and the furnace, press the **top of the pedal** (A) vigorously with your foot and pull the drawbar at the same time (see bottom figure).

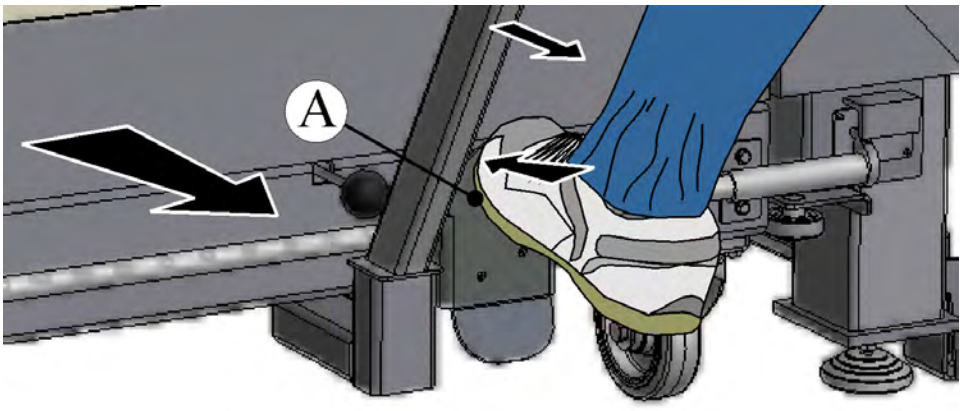


Fig. 71: Driving the bogie out (similar to the picture)

To press the bogie into the electric contacts easier (between the bogie and the furnace), first push the bogie into the furnace as far as it will go. Then, press the **bottom of the pedal** (B) vigorously with your foot. The bogie is pressed into the electric contacts (see bottom figure).

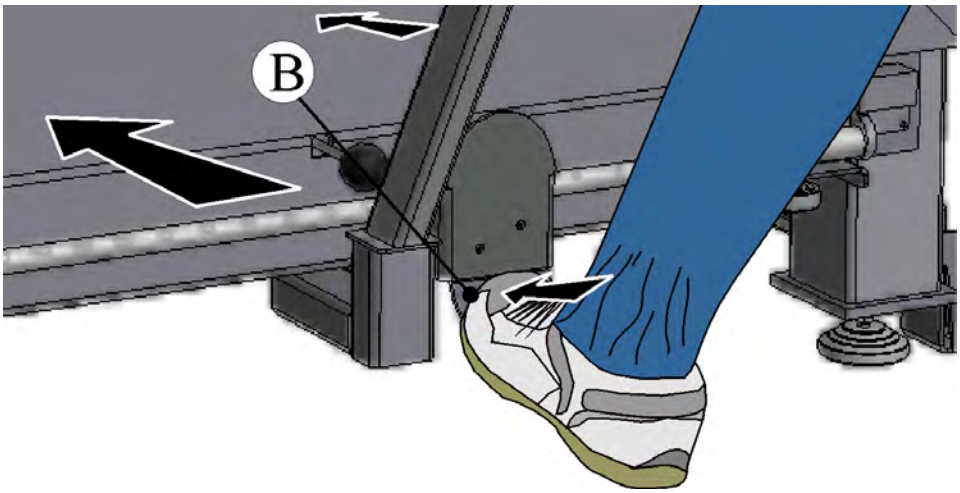


Fig. 72: Driving the bogie in (similar to picture)

5.6 Exhaust-Air Flap (Depending on the Model)

Motorized Exhaust-Air Flap(s) (additional equipment)

This furnace has (motor-driven->optional) adjustable exhaust air flap/s. Exhaust air flaps are used to extract exhaust air caused by the process safely from the furnace. The furnace is also supplied with fresh air via the air inlet valve/flap or a fresh air fan (optional).

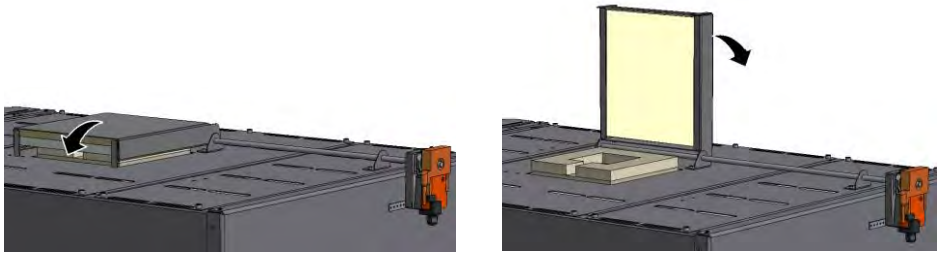
If it is necessary only to extract the exhaust air from the furnace, and no air exchange is wanted, it is sufficient to open the exhaust air flap/s.

Constant air exchange is ensured if the air inlet valve/flap and the exhaust air flap/s are opened.

Do not open just air inlet valve/flap (or switch on a fresh air fan -> optional), as, in this case, it is not possible to generate a defined state in the furnace.

Caution

Operating the furnace with the flaps open can change the temperature conditions in the furnace chamber. If the batch is sensitive to temperature fluctuations it may be advisable to run a test for temperature homogeneity to optimize the process.



Exhaust-air flap closed Exhaust-air flap open

Fig. 73: Controlling the flow of exhaust air (similar to picture)

Note

Control/Regulation of the motorized actuator are described in a separate instruction manual for the switchgear

5.7 Air Inlet Valve/Flap (Model-Related)

The volume of air fed to the furnace can be adjusted with the air inlet valve or flap (model-related). The air inlet valve/flap is located on the base of the furnace.

After the chemically bound water has been expelled from the ceramics during the firing (max. 600 °C (1112 °F)), the air inlet flap or valve (model-related) of the furnace must be closed to prevent drafts and to ensure good temperature uniformity in the upper temperature range.

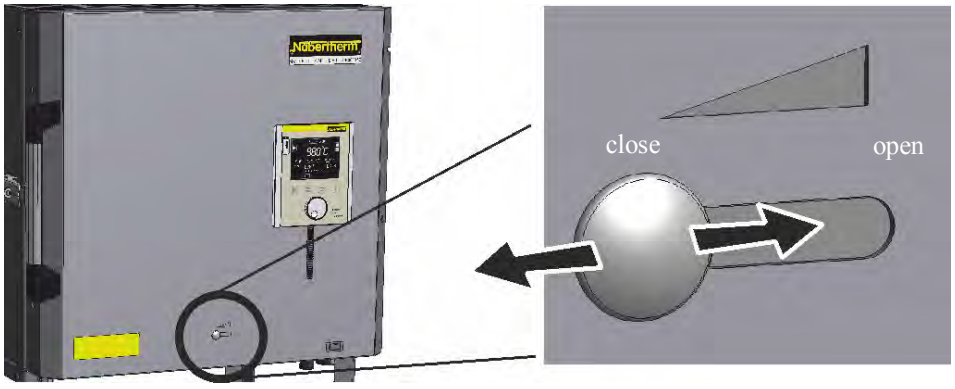
Alternatively, the air inlet flaps/valves can be operated with an electric drive system that is controlled fully automatically via the controller.

By default, the models in the chamber furnace series N 140 E(LE) – N 280 E(LE), N 100(H) – N 300(H) and NW 150(H) – NW 300(H) have a **semi-automatic, electromagnetic controlled air inlet flap**.

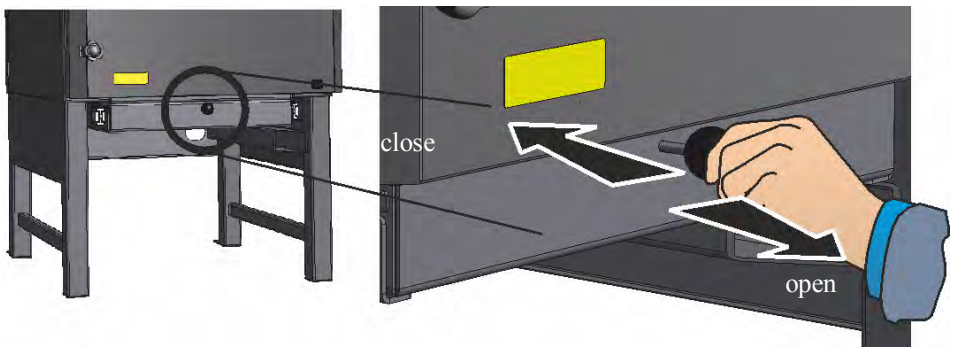
With this function it is possible to dry the ceramics at low temperatures before the actual firing begins with the air inlet flap closed (good temperature distribution in the furnace).

Before the program starts, the air inlet flap must be opened manually. During the process, the air inlet flap can be closed once in a desired program segment via extra function 1 of the controller (see separate controller instructions). **The air inlet flap must be re-opened manually before the next firing.**

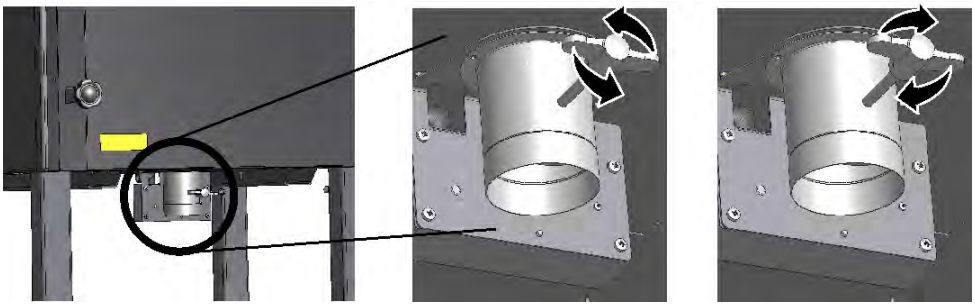
Air inlet



Air inlet



Air inlet flap



Air inlet

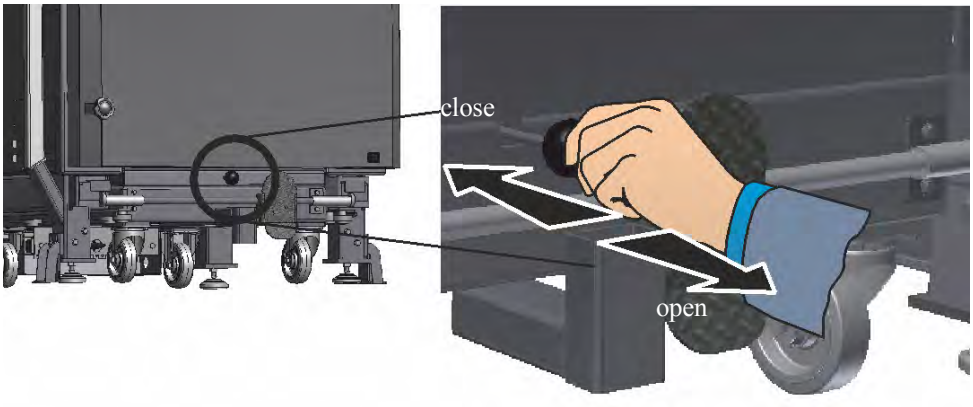


Fig. 74: Regulate the fresh air feed using the air inlet valve or flap (model-related)

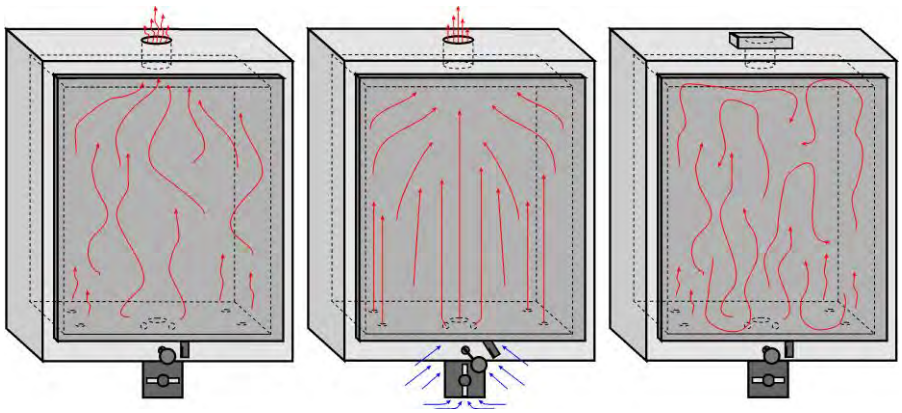
5.7.1 Schematic description of fresh air supply

When ceramics are being fired, gases, vapors, and moisture occur that may cause corrosion on the furnace. To ensure optimum removal of the exhaust gases to the atmosphere, ideally the inlet air opening and exhaust air flap (if present) should remain open to 650 °C (1202 °F) and then be closed to achieve good temperature distribution.

Our chamber furnaces are not suitable for use as drying cabinets.

To reduce the cooling phase after a firing, the inlet air opening (and the exhaust air flap if present) may be opened completely or partially.

Exhaust air (open) is extracted from the furnace (low air flow)	**Exhaust air** (open), constant air exchange (high air flow)	**Exhaust air flap** (if present) closed. No air exchange



Air inlet closed	**Air inlet** open	**Air inlet** closed

Fig. 75: Schematic description of fresh air supply

5.8 Fresh Air and/or Cooling Blower (Additional Equipment)

It is possible to accelerate cooling by switching on the cooling blower and opening the exhaust-air flaps. The rpm control and the associated air quantity can be controlled or regulated using the switchgear and control box in combination with the entered program. See the section "Operational, Display and Switching Elements".

- The switching on of the forced cooling must always be appropriate for the characteristics of the product, switching the forced cooling on at Tmax is impermissible and endangers both the furnace and the charge.
- We recommend keeping the exhaust-air flaps closed at furnace temperatures > 1,000 °C.
- From temperatures lower than 800 °C an active cooling can be used with a smaller variable.
- High cooling speeds enabled by opening the exhaust-air flaps or by using the fresh-air fans at high temperatures result in increased wear and tear on the insulation and the firing auxiliaries.
- A high variable of the fresh-air fans at high temperatures can lead to burns in the vicinity of the exhaust-air flap and the areas above it.

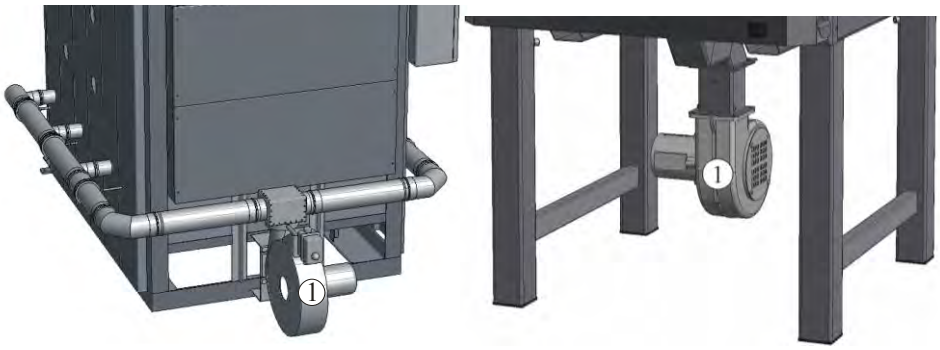


Fig. 76: Fresh air and/or cooling blower

5.8.1 Operating the Fresh-Air Flap and/or Cooling Fan with Semi-Automatic Air Inlet Flap (Accessory)

During a heat treatment program, you can call up special functions via the programming of the extra relay. Depending on the required function (see table), the extra relays are set in the corresponding segment during programming and are activated automatically while the program is running:

Extra 1	Extra 2	Function
x		Opening the air inlet flap
	x	Starting the fresh-air fan/cooling fan

Fig. 77: Configuring the extra functions via the controller

Note

Control/Regulation of the fresh air and/or cooling blower are described in a separate instruction manual for the switchgear.

6 Servicing, Cleaning, and Maintenance

Warning - Dangers During Normal Operation!

Cleaning, lubrication and maintenance work must be performed by authorized experts following the maintenance instructions and occupational safety regulations! We recommend that the maintenance and repair work be carried out by the service team of Nabertherm GmbH. The consequence of non-adherence is personal injury, death or substantial property damage!

Warning - Danger of Electric Shock!

Only qualified and authorized electricians may work on electric equipment.

During maintenance work, furnace and switchgear must be kept voltage-free to prevent accidental start-ups (padlock) and all the movable parts of the furnace must be secured (furnace with lift door: Insert safety bolts).

- Close off a generously dimensioned workspace (perimeter chains, warning signs) before carrying out any work on the furnace.
- Inform personnel and put someone in charge.
- Operators may only correct malfunctions which are obviously due to an operating error!
- Furnace equipped with lift door The safety bolts on the lift door track to the left and right of the lift door must be inserted before anyone enters the furnace chamber.
- The responsible employee/supervisor must be immediately informed of any faults or damage found in the furnace. Interrupt production until the damage has been rectified. Any shortcomings discovered in electrical systems/assemblies/operating equipment must be corrected without delay.
- Wait until the furnace chamber and its attachments have cooled down to room temperature.
- The furnace must be visually checked for damage at regular intervals. In addition, the furnace interior must be cleaned if necessary (e.g. vacuumed) **Warning:** When cleaning, do not contact the heating elements to avoid breaking them.
- While working on the furnace, both the furnace and the workroom must be supplied with additional fresh air.
- Protective equipment removed during the maintenance work must be re-installed after the work is done.
- Do not make any changes or modify the furnace in anyway. This also applies to the installation and setting of safety equipment as well as for the welding of bearing components.

- Warning regarding hanging loads in the workshop (e.g. cranes). Working beneath a suspended load (e.g. raised furnace, switchgear) is prohibited.
- The functionality of safety switches as well as any including end-switches must be checked at regular intervals (DGUV V3) or corresponding national regulations of the individual country of installation.
- To ensure a perfect temperature regulation of the furnace the thermocouple must be checked for damage before each process (visual check).
- Screws of the element holders (see section "Replacing the Heating Elements") may require re-tightening. The voltage to the furnace and/or switchgear must be cut off before performing this work. Regulations (DGUV V3) or corresponding national regulations where the furnace is installed must be observed.
- In the switchgear there are one or several switch contactors. The contacts of these switch contactors are wearing parts and must therefore be regularly maintained or replaced in compliance with (DGUV V3) or corresponding national regulations where the furnace is installed.
- In the switchgear cabinet (if included) there are ventilation screens with integrated filter mats. These must be cleaned or replaced at regular intervals to ensure adequate ventilation and venting of the switchgear! During operation the switchgear cabinet door must always be firmly locked.
- Only original Nabertherm parts may be used as replacement parts. Otherwise, the declaration of conformity or installation as well as the warranty will expire.
- Nabertherm accepts no responsibility for any damage caused by the use of non-original parts.
- The seal between the bogie and the furnace (sand pocket) must be filled with quartz sand, grain size 1-3 mm, before starting up the furnace (see section on maintenance "Sand Pocket (refilling the quartz sand)". The fill level must be check at short intervals (approx. after 2 firings). **Caution: Observe the safety advisory "Warning – Entering the Furnace Chamber of Lift-Door Furnaces".**

Caution – Danger of Falling

Ignoring this can lead to death Danger of falling exists at a height less than 1.00 m above the ground or another sufficiently broad bearing surface (for example, on elevated operating positions and workplaces, working platforms, galleries, landing platforms, footbridges, flying bridges, ramps and stairways). Openings and recesses through which people can fall (for example in floors, platforms, installation openings, hatchways and pits, non-bearing roofs).

6.1 Furnace Insulation

The refractory bricks (insulation) are of a particularly high quality. Due to the manufacturing process small holes or cavities may occur. These are quite normal and underline the quality features of the bricks. These holes or cavities are not a reason for complaint.

This furnace is lined with boards consisting of AES wool (alkaline earth silicon wool). This insulation provides excellent insulation characteristics at high temperatures. The boards can be cut to exactly the right size using a hacksaw. Good resistance to temperature shocks allows this furnace to be used with sharp temperature changes. Low heat retention. Can be exposed to direct flame contact. No reaction with bricks with high aluminum content within the range of typical application temperatures. Very low heat conductivity. Removed from the classification as a carcinogenic material as defined in Comment Q of Directive

97/69/EG. Removed from manufacture and utilization prohibition specified in Annex IV No. 22 of the German Ordinance on Hazardous Substances.

Specifications	
Designation	AES wool
Removed from the classification as a carcinogenic material as defined in Comment Q of Directive 97/69/EG.	
Removed from manufacture and utilization prohibition specified in Annex IV No. 22 of the German Ordinance on Hazardous Substances.	
Waste from this material can generally be disposed of at dumps certified for this purpose. Refer to the European Waste Catalog (EWC) compliant with EU Directive 2000/532. National and regional regulations must be observed.	
Not classified as a hazardous good in the relevant international transport regulations (ADR, RID, IATA,IDMG)	
Safety data sheet compliant with Directive 91/155/EWG	
Characteristics	
Non-combustible, economical insulation effect, excellent insulation characteristics at high temperatures, excellent thermal insulation characteristics and thermally stable.	

The following points must be observed when working with insulation:

- During work dust must be reduced to a minimum.
- Contact with skin and eyes should be avoided. The impact of fibers on skin or eyes can lead to mechanical irritation which, in turn, causes reddening and itchiness.
- Loose-fitting working apparel with long sleeves, gloves and goggles should be worn when processing larger quantities of mineral wool.
- When working inside furnaces lined with mineral wool, workers should also wear half/quarter masks fitted with P2 filters.

The furnace and its operating supplies must be regularly inspected in line with the rules issued by the Accident Prevention & Insurance Association (DGUV V3) or in compliance with the relevant national regulations of the country in which the furnace is operated!

The furnace is lined with microporous insulation panels. The raw material (inorganic substances, such as highly dispersed silica) is non flammable and fulfills the requirements of DIN 4102; Fire Classification A1. This ensures precisely controlled energy output and increases heat retention.

The material can be processed and shaped with all woodworking machines and also by hand. It can be sawn, drilled, punched, and ground.

The main requirements for modern insulation technology are vibration stability, high long-term temperature stability, and a constant level of insulation.

Specifications	
Description	Microporous insulation material
Building material class according to DIN 4102	A1, non-flammable
Classification temperature	1000 °C
Continuous use temperature	650 °C

Specifications	
Binder volatilization	from 250°C
Gross density	230 kg/m^3 +/- 10%
Color:	Gray
Cold bending strength:	0.16 N/mm^2
Properties	
Microporous insulation material: low coefficients of thermal conductivity, good insulation properties, non flammable, controlled energy output, low weight and volume.	

The following points should be observed when working with this product:

Keep dust to a minimum.

Sensitive to all wetting liquids, such as water, gasoline, oil.

The furnaces and their equipment must be checked regularly according to the national regulations in the country in which they are installed.

Note

Data sheets and safety data sheets can be requested as needed from Nabertherm GmbH.

6.2 Shutting Down the Furnace for Servicing, Cleaning, and Maintenance

Warning - Dangers During Normal Operation!

Cleaning. lubrication and maintenance work must be performed by authorized experts following the maintenance instructions and occupational safety regulations! We recommend that the maintenance and repair work be carried out by the service team of Nabertherm GmbH. The consequence of non-adherence is substantial property damage, personal injury, or death!

Wait until the furnace chamber and its attachments have cooled down to room temperature.

- The furnace must be completely emptied.
- Inform operating personnel, appoint supervisory staff.
- Switch off power switch (position "O/OFF") → Switchgear

- Lock the power switch in OFF position with a padlock to prevent an accidental start-up.
- Attach a warning sign on the power switch against re-start (for example: "Danger Maintenance Work - Do not switch the furnace on")
- The protective functions of safety equipment must not be disabled.
- A generously dimensioned maintenance work area must be closed off.
- Make sure that no live voltage is present.
- Make sure the system is voltage-free (dead). The absence of voltage must be determined by an electrician or by a person with electro-technical training. The absence of voltage must be determined at the workplace on all poles.
- Ground and short-circuit the workplace.

- Cover any neighboring parts which are live.

Warning - Dangers During Normal Operation!

Do not touch any object without first having checked its temperature.

Warning - Danger of Electric Shock!

Only qualified and authorized electricians may work on electric equipment. During maintenance work, furnace and switchgear must be kept voltage-free to prevent accidental start-ups (switch off the furnace at the power switch) and secure all the movable parts of the furnace. Follow the specifications in the DGUV V3 or corresponding national regulations where the furnace is installed. Wait until the furnace chamber and its attachments have cooled down to room temperature.

Caution – Danger of Falling

Ignoring this can lead to death Danger of falling exists at a height less than 1.00 m above the ground or another sufficiently broad bearing surface (for example, on elevated operating positions and workplaces, working platforms, galleries, landing platforms, footbridges, flying bridges, ramps and stairways). Openings and recesses through which people can fall (for example in floors, platforms, installation openings, hatchways and pits, non-bearing roofs).

Note

Maintenance work must be performed by authorized personnel following the maintenance instructions and the accident prevention regulations. We recommend that the maintenance and repair work be carried out by the service team of Nabertherm GmbH.

6.3 Regular Maintenance Tasks – Heating Elements/Furnace Chamber

A	B	C			D					E		F
		1	2	3	T	W	M	Q	J	X 1	X 2	
Heating elements	Visual check: Oxide layer formation, crack formation, rotation around own axis, untwisting of the wrap, nest formation			•				•			•	
Heating elements	Replace	•							•		•	
Run through the heating elements	Clean			•					•		•	No later than when the heating elements are replaced
Run through the heating elements	Replacement		•						•		•	Recommended no later than when the heating elements are replaced

A	B	C			D					E		F
		1	2	3	T	W	M	Q	J	X 1	X 2	
Connect the heating elements	Wiring to the connection ends, corrosion tendency drill ends traces of burning)			●					●		●	
Support tubes	Visual check, correct position, sag, crack formation		●					●			●	
Support tubes	Replace		●						●	●		As necessary
Bearing bricks	Visual check of correct fit, crack formation			●					●	●		
Power heating elements	Check the load capacity of the heating group								●		●	

Note

Since SiC plates expand continuously, they should be replaced after about 3-5 years. Otherwise there is a risk that the collar bricks will be pushed outwards. In this case, we will not accept warranty claims.

Symbols:	
A = Component/Position/Function / **B** = Measure / **C** = Spare Part Stocks / **D** = Maintenance Interval / **E** = Performed by / **F** = Comment	
Spare part stocks:	**1** = Stocks urgently recommended **2** = Stocks recommended / **3** = As required, not relevant
Maintenance Interval **Note:** If environmental conditions are severe, the maintenance intervals must be shorter.	**D** = Daily, before each start of the furnace **W** = Weekly **M** = Monthly / **Q** = Quarterly **Y** = Yearly / ● = Check, replace
Implemented by:	**X1** = Operating personnel **X2** = Specialist personnel

6.4 Regular Maintenance Tasks – Heating Elements/Bogie

A	B	C			D					E		F
		1	2	3	T	W	M	Q	J	X 1	X 2	
Heating elements	Visual check: Oxide layer formation, crack formation, rotation around own axis, untwisting of					●					●	

A	B	C			D					E		F
		1	2	3	T	W	M	Q	J	X 1	X 2	
	the wrap, nest formation											
Heating elements: Overhead terminals/braided straps	Visual inspection follow-up								●		●	
Heating elements	Replace, check the firmness of the electric connections	●							●		●	
Overhead terminals/braided straps	Replace, check the firmness of the electric connections	●							●		●	
Connect the heating elements	Check wiring to the ends of the connections, corrosion tendency drill ends (traces of burning), check the firmness of the electric connections								●		●	
Run through the heating elements	Clean			●					●		●	No later than when the heating elements are replaced
Run through the heating elements	Replacement		●						●		●	Recommended no later than when the heating elements are replaced
Wiring in the connection area	Correct insulation			●					●		●	
Support tubes	Visual check, correct position, sag, crack formation										●	
Support tubes	Replace		●						●		●	As necessary
Power heating elements	Check the load capacity of the heating group								●		●	
Blade contact strip	Visual check, correct position, sag, crack formation, scorch spots, copper paste		●					●			●	

Symbols:

A = Component/Position/Function / **B** = Measure / **C** = Spare Part Stocks / **D** = Maintenance Interval / **E** = Performed by / **F** = Comment

Spare part stocks:	**1** = Stocks urgently recommended **2** = Stocks recommended / **3** = As required, not relevant
Maintenance Interval **Note:** If environmental conditions are severe, the maintenance intervals must be shorter.	**D** = Daily, before each start of the furnace **W** = Weekly **M** = Monthly / **Q** = Quarterly **Y** = Yearly / ● = Check, replace
Implemented by:	**X1** = Operating personnel **X2** = Specialist personnel

6.5 Regular Maintenance Tasks – Insulation Furnace Chamber

A	B	C			D					E		F
		1	2	3	T	W	M	Q	J	X 1	X 2	
Door and labyrinth seal	Check for damage and loose parts							●		●		
Collar	Visual check for crack formation, loose segments			●				●		●		
Openings for fresh air	Check insulation for cracks		●					●		●		
Air distribution pipes	Visual check, crack formation / deformation, air discharge direction	●						●		●		
Walls	Visual check for crack formation, surface, chemical corrosion			●				●		●		
Wall offset (furnace interior)	Visual check for crack formation			●				●		●		
Wall offset (furnace interior)	Vacuum clean			●	●					●		
Exhaust gas outlet	Visual check of							●		●		
Exhaust gas outlets	Replace penetration pipes		●					●			●	
Ceiling	Cracks and ceiling suspension			●				●		●		
Exhaust-air flaps	Check inserts, correctness of the seal			●				●		●		
Exhaust-air flaps	Replacement	●		●				●			●	
Exhaust-air flap space	Check fiber block and penetration pipe, especially the edge of the penetration pipe			●				●		●		

A	B	C			D					E		F
		1	2	3	T	W	M	Q	J	X 1	X 2	
Heating elements	Visual check: Oxide layer formation, crack formation, rotation around own axis, untwisting of the wrap, nest formation			●				●			●	
Heating elements	Replace	●							●		●	
Run through the heating elements	Clean			●					●		●	No later than when the heating elements are replaced
Run through the heating elements	Replacement		●						●		●	Recommended no later than when the heating elements are replaced
Connect the heating elements	Wiring to the connection ends, corrosion tendency drill ends traces of burning)			●					●		●	
Support tubes	Visual check, correct position, sag, crack formation		●					●			●	
Support tubes	Replace		●						●	●		As necessary
Bearing bricks	Visual check of correct fit, crack formation			●					●	●		
Power heating elements	Check the load capacity of the heating group								●		●	

Symbols:	
A = Component/Position/Function / **B** = Measure / **C** = Spare Part Stocks / **D** = Maintenance Interval / **E** = Performed by / **F** = Comment	
Spare part stocks:	**1** = Stocks urgently recommended **2** = Stocks recommended / **3** = As required, not relevant
Maintenance Interval **Note:** If environmental conditions are severe, the maintenance intervals must be shorter.	**D** = Daily, before each start of the furnace **W** = Weekly **M** = Monthly / **Q** = Quarterly **Y** = Yearly / ● = Check, replace
Implemented by:	**X1** = Operating personnel **X2** = Specialist personnel

6.6 Regular Maintenance Tasks – Insulation Bogie

A	B	C			D					E		F
		1	2	3	T	W	M	Q	J	X 1	X 2	
Labyrinth seal	Check for damage							●		●		
Seal fiber strip	Check correct seal with furnace housing		●					●		●		
Underside of floor	Check for heat "spots"			●					●	●		
SiC/mullite tiling	Check for correct position and for deformations		●					●		●		
Table	Vacuum clean			●			●			●		
Heating chamber	Vacuum out						●			●		

Symbols:	
A = Component/Position/Function / **B** = Measure / **C** = Spare Part Stocks / **D** = Maintenance Interval / **E** = Performed by / **F** = Comment	
Spare part stocks:	**1** = Stocks urgently recommended **2** = Stocks recommended / **3** = As required, not relevant
Maintenance Interval **Note:** If environmental conditions are severe, the maintenance intervals must be shorter.	**D** = Daily, before each start of the furnace **W** = Weekly **M** = Monthly / **Q** = Quarterly **Y** = Yearly / ● = Check, replace
Implemented by:	**X1** = Operating personnel **X2** = Specialist personnel

6.7 Regular Maintenance Tasks – Mechanics Bogie

A	B	C			D					E		F
		1	2	3	D	W	M	Q	J	X 1	X 2	
Rubber wheels	Functional check of light running on floor, visual check of rubber on wheels								●	●		
Blade contact strip	Visual check, correct fit, sag, crack formation, scorch spots, copper paste		●					●			●	
Ball bearing inlet guide	Functional test			●					●	●		

Symbols:
A = Component/Position/Function / **B** = Measure / **C** = Spare Part Stocks / **D** = Maintenance Interval / **E** = Performed by / **F** = Comment

Spare part stocks:	**1** = Stocks urgently recommended **2** = Stocks recommended / **3** = As required, not relevant
Maintenance Interval **Note:** If environmental conditions are severe, the maintenance intervals must be shorter.	**D** = Daily, before each start of the furnace **W** = Weekly **M** = Monthly / **Q** = Quarterly **Y** = Yearly / ● = Check, replace
Implemented by:	**X1** = Operating personnel **X2** = Specialist personnel

6.8 Regular Maintenance Tasks – Housing

A	B	C			D					E		F
		1	2	3	D	W	M	Q	J	X 1	X 2	
Furnace lid	Visual check of cables, motors, thermocouples for thermal influence								●		●	
Control thermocouples	Protective pipe, check position and clamp stone	●				●				●		
Control thermocouples	Replace	●							●		●	
Housing surface	Check for burns (exhaust air boxes)			●					●	●		
Safety switch ("door contact")	Correct switching point		●				●				●	
Safety switch door lock	Check functionality		●				●				●	
Seal of housing	Visual inspection			●					●	●		
Blade contact strip	Visual check, correct position, sag, crack formation, scorch spots, copper paste		●					●			●	

Symbols:	
A = Component/Position/Function / **B** = Measure / **C** = Spare Part Stocks / **D** = Maintenance Interval / **E** = Performed by / **F** = Comment	
Spare part stocks:	**1** = Stocks urgently recommended **2** = Stocks recommended / **3** = As required, not relevant
Maintenance Interval **Note:** If environmental conditions are severe, the maintenance intervals must be shorter.	**D** = Daily, before each start of the furnace **W** = Weekly **M** = Monthly / **Q** = Quarterly **Y** = Yearly / ● = Check, replace

Implemented by:	**X1** = Operating personnel **X2** = Specialist personnel

6.9 Regular Maintenance Tasks – Switchgear

A	B	C			D					E		F
		1	2	3	T	W	M	Q	J	X 1	X 2	
Air suction filter	Clean or replace filter mat		●			●				●		Ignoring this can lead to the failure of electronic devices. We accept no liability in case of a production stoppage.
Contactors	Check for scorching			●				●			●	
Contactors	Replacement	●							●		●	
USV battery	Replacement		●								●	
Control box	Vacuum out										●	
Switch cabinet cooling unit	Follows the manufacturer's maintenance instructions										●	
Check functionality of over-temperature protection	Set the shut-down value under the actual value and have it shut down.							●		●		
Check the precision of the over-temperature protection (calibrate)	The pre-set shut-down temperature is checked with a certified temperature transmitter.								●		●	
Check the temperature display (calibrate)	The pre-set shut-down temperature is checked with a certified temperature transmitter.								●		●	
Check the firmness of all screwed terminal positions.	Contactors, terminals, etc.								●		●	
Check all connections for smoke residues									●		●	
Switchgear: Lamps and signals	Check functionality			●				●			●	
Fuses	Replace after blow	●								●		
Semi-conductor fuses	Replace after blow	●								●		

Symbols:

A = Component/Position/Function / **B** = Measure / **C** = Spare Part Stocks / **D** = Maintenance Interval / **E** = Performed by / **F** = Comment	
Spare part stocks:	**1** = Stocks urgently recommended **2** = Stocks recommended / **3** = As required, not relevant
Maintenance Interval **Note:** If environmental conditions are severe, the maintenance intervals must be shorter.	**D** = Daily, before each start of the furnace **W** = Weekly **M** = Monthly / **Q** = Quarterly **Y** = Yearly / ● = Check, replace
Implemented by:	**X1** = Operating personnel **X2** = Specialist personnel

Note

If used, over-temperature limiters with manual or automatic reset (see "overview of the furnace") must be checked regularly to ensure that they function as intended. To check whether the over-temperature limiters respond, start the furnace and set the required set point on the temperature control unit below the set point of the controller. For more information, see the operating instructions for over-temperature limiter with automatic reset/over-temperature limiter with manual reset.

Warning - Danger of Electric Shock!

Work on the electrical equipment may be done only by qualified, authorized electricians.

6.10 Regular Maintenance Tasks – Electrical Testing

A	B	C			D					E		F
		1	2	3	T	W	M	Q	J	X 1	X 2	
Insulation resistance check									●		●	
High-voltage check	If possible								●		●	
Protective conductor	Correct fit of protective conductor at the connections between the system parts and covers								●		●	
Check function	All electrical components								●		●	

Symbols:	
A = Component/Position/Function / **B** = Measure / **C** = Spare Part Stocks / **D** = Maintenance Interval / **E** = Performed by / **F** = Comment	
Spare part stocks:	**1** = Stocks urgently recommended **2** = Stocks recommended / **3** = As required, not relevant

Maintenance Interval **Note:** If environmental conditions are severe, the maintenance intervals must be shorter.	**D** = Daily, before each start of the furnace **W** = Weekly **M** = Monthly / **Q** = Quarterly **Y** = Yearly / ● = Check, replace
Implemented by:	**X1** = Operating personnel **X2** = Specialist personnel

Note

The switching system must be serviced at regular intervals by an electrician. **Circuit breakers and wearing parts must be checked regularly, depending on environmental conditions and frequency of use, and replaced after no more than a year**.

Note

Operating furnaces with heating transformers can trigger an upstream fault-current circuit breaker due to the EMC filter circuitry. For this reason, fault-current circuit breakers should not be used as protection switchgear.

Note

The filters for the control cabinet ventilation must be cleaned at regular intervals in order to ensure good air circulation. Depending on the type and variant of the ventilation system, 2 or 3 filters may be present in other areas in the switching cabinet. The door of the switching system must be kept closed and locked (otherwise the lifetime of the electronic devices will be shortened by contamination).

Note

If the furnace has an uninterruptable power source (UPS), you must be sure that the rechargeable battery has an operating life of roughly 2 years when operating in an ambient temperature up to +40 °C. A higher ambient temperature or long down-times (furnace is shut down) shorten the life of the battery. The rechargeable battery is an ageing part and, depending on the ambient conditions, must be replaced every 1 to 2 years.

6.11 Regular Maintenance Tasks – Documentation

A	B	C			D					E		F
		1	2	3	T	W	M	Q	J	X 1	X 2	
Type plate	Readable condition								●	●		
Instruction Manual	Ensure it is kept at the furnace			●					●	●		
Instructions for components	Ensure they are kept at the furnace			●					●	●		

Symbols:
A = Component/Position/Function / **B** = Measure / **C** = Spare Part Stocks / **D** = Maintenance Interval / **E** = Performed by / **F** = Comment

Spare part stocks:	**1** = Stocks urgently recommended **2** = Stocks recommended / **3** = As required, not relevant
Maintenance Interval **Note:** If environmental conditions are severe, the maintenance intervals must be shorter.	**D** = Daily, before each start of the furnace **W** = Weekly **M** = Monthly / **Q** = Quarterly **Y** = Yearly / ● = Check, replace
Implemented by:	**X1** = Operating personnel **X2** = Specialist personnel

⚠ DANGER

- **Danger from electric shock.**
- **Danger to life.**
- Work on the electrical equipment may be performed only by qualified electricians or by technicians authorized by Nabertherm.
- Disconnect the furnace

6.12 Cleaning Products

Follow the procedure for shutting down the furnace system (in the "Operation" section). Then the power plug must be pulled out of the socket. Wait until the furnace cools down naturally.

Use commercially available detergent which is either water-based or non-combustible and free of any solvents to clean the housing of any deposits; use a vacuum cleaner for the interior.

Follow the labeling and the instructions on the packaging of the detergent.

Wipe the surface with a damp, lint-free cloth. The following detergents can also be used:

This list must be completed by the operator.	
Component and location	**Detergent**
Outer surfaces (frames *)	Use commercially available detergent which is either water-or non-combustible and free of any solvents for cleaning *)
Outer surface (stainless steel)	Stainless still cleaner
Interior	Carefully clean with a vacuum cleaner (avoid the heating elements)
Insulation materials	Carefully clean with a vacuum cleaner (avoid the heating elements)
Door seal (if included)	Use commercially available detergent which is either water-or non-combustible and free of any solvents for cleaning
Instrument panel	Wipe the surface with a damp, lint-free cloth. (e.g. glass cleaner)

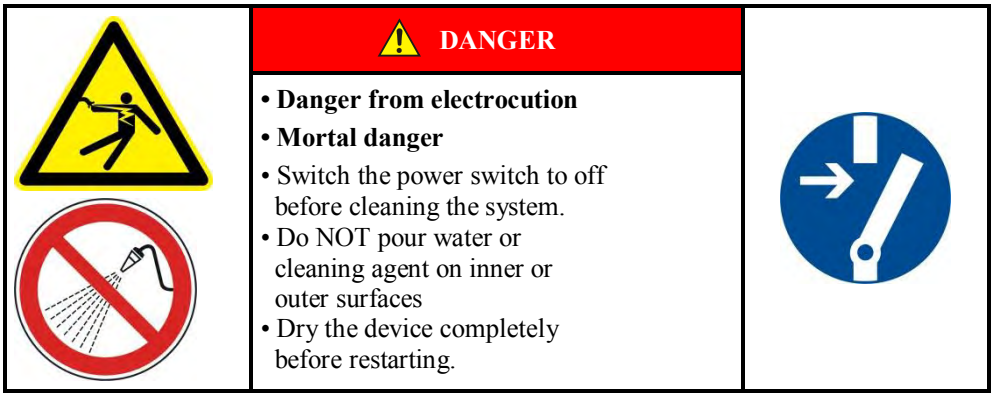
This list must be completed by the operator.	
Component and location	**Detergent**
*)	You must be sure that the cleaner does not damage the water-soluble and, hence, environmentally safe paint (the clear should be tried first on an interior, normally unseen location).

Fig. 78: Detergent

Do the cleaning from beginning to end without breaks to protect the surfaces.
Remove the detergent completely from the surfaces by wiping them with a damp, lint-free cloth.
After cleaning all the supply lines, check all the connections for leaks, loose connections, abrasion and damage; report any shortcomings found immediately!
Please follow the section entitled "Environmental Protection Rules and Regulations"

Caution

The furnace, the furnace chamber and attached components must **NOT** be cleaned using a high-pressure cleaner.



7 Malfunctions

Work on the electrical system may be done only by qualified, authorized electricians. Operators may only rectify faults that are obviously due to operating errors.

Call your local electrician for faults that you cannot localize.

If you have any questions, problems, or requirements, contact Nabertherm GmbH. By mail, phone, or e-mail -> See "Nabertherm Service".

Phone advice is free and non-binding for our customers – all you pay is the phone costs.

In case of mechanical damage, send an email containing the above information and a digital photo of the damaged part and a photo of the complete furnace to the following address: -> see "Nabertherm Service".

If a fault cannot be rectified with the described solutions, contact our service hotline directly.

Have the following information at hand when you phone. This makes it easier for our customer service to answer your questions.

7.1 Error Messages of the Controller

ID+ subID	Text	Explanation	Remedy
Communication errors			
01-01	Bus zone	The communication connection to a controller module is malfunctioning	Check whether the controller module is securely seated. Are the LEDs on the controller modules red? Check the cable between the operating unit and the controller module. The plug of the connecting cable in the operating unit is incorrectly plugged in.
01-02	Bus communication module	The communication connection to the communication module (Ethernet/USB) is malfunctioning	Check whether the communication module is securely seated Check the cable between the operating unit and the communication module
Sensor errors			
02-01	TC open		Check the thermocouple, thermocouple terminals and cable Check the contact of the thermocouple cable in connector X1 on the controller module (contacts 1+2)
02-02	Beyond TC range		Check the set thermocouple type Check the polarity of the thermocouple connection
02-03	Reference junction error		The controller module is defective
02-04	Reference junction too hot		The temperature in the switchgear is too high (approx. 70 °C) The controller module is defective
02-05	Reference junction too cold		The temperature in the switchgear is too low (approx. -10 °C)
02-06	Encoder disconnected	Fault on the 4-20 mA input of the controller (<2 mA)	Check the 4-20 mA sensor Check the connection cable to the sensor
02-07	Sensor element defective	The PT100 or PT1000 sensor is defective	Check the PT sensor Check the connection cable to the sensor (cable break / short-circuit)
System errors			
03-01	System memory		Error after firmware updates[1)] Defect in the operating unit[1)]
03-02	ADC error	The communication between the ADC converter and the controller is malfunctioning	Replace the controller module[1)]

ID+ subID	Text	Explanation	Remedy
03-03	System file faulty	The communication between the display and the memory module is malfunctioning	Replace the operating unit
03-04	System monitoring	Execution of the program on the operating unit is malfunctioning (watchdog)	Replace the operating unit The USB flash drive was pulled out prematurely or is defective Replace the controller and switch it on
03-05	Zone system monitoring	Execution of the program on a controller module is malfunctioning (watchdog)	Replace the controller module[1)] Replace the controller and switch it on[1)]
03-06	Self-test error		Contact Nabertherm Service[1)]
Monitoring			
04-01	No heat output	No temperature increase in ramps when the heating output does not equal 100% for 12 minutes and if the temperature setpoint is greater than the current furnace temperature	Acknowledge the error (deenergize if necessary) and check the safety contactor, door switch, heating control and controller.
04-02	Over-temperature	The temperature of the guide zone exceeds the max. program setpoint or the maximum furnace temperature by 50° Kelvin (200 °C or higher) The equation for the shutdown threshold is: maximum program setpoint + zone offset of the master zone + batch control offset [max] (if batch control is active) + over-temperature shutdown threshold (P0268, e.g. 50 K)	Check the solid state relay Check the thermocouple Check the controller
		A program has started at a furnace temperature that is greater than the maximum setpoint in the program	Wait until the temperature of the furnace has dropped before starting the program. If this is not possible, add a wait time as a start segment, followed by a ramp with the desired temperature (STEP = 0 minute duration for both segments) Example: 700 °C -> 700 °C, time: 00:00 700 °C -> 300 °C, time: 00:00 The normal program then starts here. In version 1.14 and later, the actual temperature is also taken into account at the start.
04-03	Power failure	The set limit for restarting the furnace has been exceeded	If necessary, use an uninterruptible power supply

ID+ subID	Text	Explanation	Remedy
04-04	Alarm	A configured alarm has been triggered	
04-05	Self-optimization failed	The measured values are not plausible	Do not perform self-optimization in the lower temperature range of the furnace work area
	Battery weak	A power failure may no longer be processed properly.	Export all the parameters to a USB flash drive Replace the battery (see “Specifications”)

Error messages can be reset by pressing **twice** the jog dial  . If there is another error message, contact Nabertherm Service. Recirculation motors (if included) also remain switched on in case of an error until the temperature falls below the set cut-off temperature.

7.2 Warnings of the Controller

Warnings are not displayed in the error archive. They are only displayed on the display and in the file of the parameter export. Warning do not generally lead to a program crash.

No.	Text	Explanation	Remedy
00	Gradient monitoring	The limit value of the configured gradient monitoring has been exceeded	For the causes of this error, see “Gradient monitoring” The gradient is set too low
01	No control parameters	No “P” value has been entered for the PID parameters	Enter at least one “P” value in the control parameters. This may not be 0
02	Batch element defective	No batch element has been determined with the program running and with batch control activated	Insert a batch element Disable the batch control in the program Check the batch thermocouple and its cable for damage
03	Cooling element defective	The cooling thermocouple is not plugged in or is defective	Plug in a cooling thermocouple Check the cooling thermocouple and its cable for damage If a defect in the cooling thermocouple occurs when controlled cooling is active, the system switches to the thermocouple of the master zone.
04	Documentation element defective	The documentation thermocouple is missing or defective.	Plug in a documentation thermocouple Check the documentation thermocouple and its cable for damage
05	Power failure	A power failure has been detected. Program termination has not occurred	None
06	Alarm 1 - belt	The configured belt alarm 1 has been triggered	Optimization of the control parameters Alarm value too rigid

No.	Text	Explanation	Remedy
07	Alarm 1 - min	The configured min alarm 1 has been triggered	Optimization of the control parameters Alarm value too rigid
08	Alarm 1 - max	The configured max alarm 1 has been triggered	Optimization of the control parameters Alarm value too rigid
09	Alarm 2 - belt	The configured belt alarm 2 has been triggered	Optimization of the control parameters Alarm value too rigid
10	Alarm 2 - min	The configured min alarm 2 has been triggered	Optimization of the control parameters Alarm value too rigid
11	Alarm 2 - max	The configured max alarm 2 has been triggered	Optimization of the control parameters Alarm value too rigid
12	Alarm - external	The configured alarm 1 on input 1 has been triggered	Check the source of the external alarm
13	Alarm - external	The configured alarm 1 on input 2 has been triggered	Check the source of the external alarm
14	Alarm - external	The configured alarm 2 on input 1 has been triggered	Check the source of the external alarm
15	Alarm - external	The configured alarm 2 on input 2 has been triggered	Check the source of the external alarm
16	No USB flash drive inserted		When exporting data, insert a USB flash drive into the controller
17	Import / export of data using the USB flash drive was not successful	The file has been edited using a PC (text editor) and stored in the wrong format, or the USB flash drive was not recognized. You want to import data that are not located in the Import folder on the USB flash drive	Do not edit XML files with a text editor, but always in the controller itself. Format the USB flash drive (format: FAT32) Use another USB flash drive (1-8 GB) In a complete import, all data must be stored in the Import folder on the USB flash drive.
	When importing programs, programs are rejected	The temperature, time or rate are outside the limits	Import only programs that are suitable for the furnace. The controllers differ in the number of the program and number of segments and in the maximum furnace temperature.
	When importing programs, “Error occurred” appears	The complete set of parameters (at least the configuration files) has not been placed in the “Import” folder	If you deliberately omitted files during the import, the message can be ignored. Otherwise, please check the completeness of the import files.
18	“Heating disabled”	If a door switch is connected to the controller, and the door is open, this message appears	-Close the door -Check the door switch

7.3 Malfunctions of the Switchgear

Error	Cause	Remedy
Controller does not light up	Controller is switched off	Switch the power switch to "**I**"
	No power available	Is the power cord plugged into the socket? Check the building fuses. Check the fuse of the controller (if present) and replace it if necessary.
	Check the fuse of the controller (if present) and replace it if necessary.	Switch the power switch on. If the error occurs again, contact Nabertherm Service
Controller displays error	See the separate instructions of the controller	See the separate instructions of the controller
Furnace does not heat	Door / cover is open	Close the door / cover
	The door contact switch is faulty (if present)	Check the door contact switch
	The "wait" or clock icon (series 400 controllers) lights up	The program is waiting for the programmed start time. Set the wait time to 00:00 or disable it
	Error in entering the program	Check the heating program (see the separate instructions of the controller)
	Heating element defective	Have this checked by Nabertherm Service or a qualified electrician.
Very slow heating of the heating space	The fuse(s) of the connection is/are defective.	Check the fuse(s) of the connection and replace if necessary. Notify Nabertherm service if the new fuse fails again immediately.
The program does not jump to the next segment	In one TIME segment in the program input, the wait time is set to INFINITE (series 400 controllers). If batch control is activated, the temperature of the batch is higher than the zone temperatures.	Do not set the wait time to INFINITE
	If batch control is activated, the temperature of the batch is higher than the zone temperatures.	The parameter [LOWER BLOCK] must be set to [NO].
The controller module can not be registered on the operating unit	Addressing error (series 400 controllers)	Perform a bus reset
The controller is not heating in the optimization	No optimization temperature has been set	The temperature to be optimized must be entered (see the separate instructions of the controller)

7.4 Controller Check List

Customer:	
Furnace model:	
Controller model:	
Controller version (see information menu ⓘ):	
Controller serial number	
Furnace serial number	
Error code in the display:	
The following errors are dependent on external influences:	02-05 Ambient temperature too low: <-10 °C (-50 °F) 02-04 Ambient temperature too high: > 70 °C (158 °F)
Detailed error description:	
Export of the service information:	Please export all the data to a USB stick using the function [EXPORT COMPLETELY] Generate a zip file using the ZIP function integrated in Windows (compression) of the exported folder (see the section "Importing and Exporting Data and Parameters") and send them to your contact at Nabertherm Service.
When does this error occur?	At specific point in the program or at certain times of day:
	At specific temperatures:
How long has the error existed?	☐ Error is new
	☐ Error has existed for a long time
	☐ Unknown
Error frequency	☐ Error occurs frequently

		☐ Error occurs regularly	
		☐ Error occurs rarely	
		☐ Unknown	
Substitute controller:	Has a substitute controller already been used?	☐ yes	☐ no
	Did the error continue with the substitute controller?	☐ yes	☐ no
	Checked according to the error search list (see the furnace operating instructions)	☐ yes	☐ no

Please enter the following test program so that the furnace heats up at full power:

Program point	Value
Segment 01- Start Temperature	0 °C
Segment 01- Target Temperature	500 °C
Segment 01- Time	30 minutes
Segment 01- Target Temperature	500 °C

Close door/lid and start the example program

Please check the following items:

- Does the furnace heat (temperature rise)?
- Is the "Heating" symbol displayed?

Please call up the information menu in the heating up phase for further details.

Date: _____ Name: _____ Signature: _____

8 Spare Parts/Wearing Parts

Ordering Spare Parts:

Our Nabertherm Service team is available to you all around the world. Due to our considerable production depth we deliver most spare parts from the warehouse overnight or can make them ready for delivery within short deadlines. You can order Nabertherm spare parts easily and simply directly from the factory. If you fail to find the spare part you are looking for in the spare part list or in the separate spare part list we would be happy to help you. Spare parts can be ordered in writing, by phone or on the Internet -> see the section entitled "Nabertherm Service".

Availability of Spare Parts and Wearing Parts:

Although Nabertherm has many spare parts and wearing parts on stock, we cannot guaranty the short-term availability of all of them. We recommend that certain parts be ordered in advance. If you need any assistance when selecting spare parts and wearing parts, the staff at Nabertherm will be glad to set aside time for you.

Note

Original parts are designed especially for Nabertherm furnaces. Replace parts only with original Nabertherm parts. Otherwise the warranty will be void. Nabertherm accepts absolutely no liability for damage caused by using parts that are not original Nabertherm parts.

Spare Parts/Wearing Parts								
		Part number						
1 Electrical connection / 2 Heating element[1, 2] / 3 Heating element, complete set / 4 Support tubes / 5 Support tubes, complete set / 6 Thermocouple[1] / 7 SiC Bottom shelf[1]								
Model	**1**	**2**	**3**	**4**	**5**	**6**	**7**	▶
N 40 E	230 V / 2.9 kW			-	-	540300006 Type S, 140mm, 0.3 mm	-	❍
N 40 E/R	400 V / 5.5 kW			-	-	540300006 Type S, 140mm, 0.3 mm	-	❍
N 70 LE	230 V / 2.9 kW			-	-	540300006 Type S, 140mm, 0.3 mm	-	❍
N 70 E	400 V / 3.6 kW			-	-	540300006 Type S, 140mm, 0.3 mm	-	❍
N 70 E/R	400 V / 5.5 kW			-	-	540300006 Type S, 140mm, 0.3 mm	-	❍
N 100 E	400 V / 7.0 kW	692252702 Side	602212621	-	-	540300006 Type S, 140mm, 0.3 mm	-	❍
N 140 LE				-	-		-	❍
N 210 LE				-	-		-	❍
N 280 LE				-	-		-	❍
N 140 E	400 V / 9.0 kW	692251013 Side 69226074 Bottom	602211183	-	-	540300006 Type S, 140mm, 0.3 mm	-	❍
N 210 E	400 V / 11.0 kW	692250012 Side 69226001 Bottom	602210012	-	-	540300010 Type S, 275mm, 0.3 mm	-	❍
N 280 E	400 V / 15.0 kW	69225101 Side 69226074 Bottom	602211184	-	-	540300006 Type S, 140mm, 0.3 mm	-	❍
N 500 E	400V / 30.0 kW	69225140 Side 69224038 Sides + 1/2 Bottom 692261125 Bottom	602261041	-	-	540300010 Type S, 275mm, 0.3 mm	691600015 500x350x20 mm	❍

Spare Parts/Wearing Parts								
	Part number							
1 Electrical connection / 2 Heating element[1, 2] / 3 Heating element, complete set / 4 Support tubes / 5 Support tubes, complete set / 6 Thermocouple[1] / 7 SiC Bottom shelf[1]								
Model	**1**	**2**	**3**	**4**	**5**	**6**	**7**	▶
N 100	400V / 9.0 kW	692240001 Sides + +1/2 Bottom 69223000 Back wall 69222000 Door	602210001	692020305 _Door 692020510 _Bottom 692020500 _Side 692020375 _Back wall		540300010 Type S, 275mm, 0.3 mm	691600015 500x350x20 mm	❍
N 150	400V / 11.0 kW	692240002 _Side + 1/2 Bottom 692230002 _Back wall 692220002 _Door	602210002	692020375 _Door 692020510 _Bottom 692020500 _Side 692020420 _Back wall		540300010 Type S, 275mm, 0.3 mm	691600015 500x350x20 mm	❍
N 200	400V / 15.0 kW	692240918 _Side + 1/2 Bottom 692231230 _Back wall 692226740 _Door	602212721	692020410 _Door 692020510 _Bottom 692020500 _Side 692020480 _Back wall		540300010 Type S, 275mm, 0.3 mm	691600015 500x350x20 mm	❍
N 300	400V / 20.0 kW	692240004_s ide + 1/2 Bottom 692250175_s ide 692230004_ Back wall 692220004_ Door	602210004			540300010 Type S, 275mm, 0.3 mm	691600015 500x350x20 mm	❍
N 440	400V / 30.0 kW	692240352_s ide 692261042_ Bottom 692230635_ Back wall 692225215_ Door	602211359			540300010 Type S, 275mm, 0.3 mm	691600015 500x350x20 mm	❍
N 660	400V / 40.0 kW	692251244_s ide 692260789_ Bottom 692230627_ Back wall 692221216_ Door	602211361			540300010 Type S, 275mm, 0.3 mm	691600015 500x350x20 mm	❍
N 1000						540300011 TE Type S 0.3 mm x 295 mm	691600174 230x250x20 mm	❍
N 1500						540300011 TE Type S 0.3 mm x 295 mm	691600174 230x250x20 mm	❍
N 2200						540300011 TE Type S 0.3 mm x 295 mm	691600174 230x250x20 mm	❍

Spare Parts/Wearing Parts								
		Part number						
1 Electrical connection / 2 Heating element[1, 2] / 3 Heating element, complete set / 4 Support tubes / 5 Support tubes, complete set / 6 Thermocouple[1] / 7 SiC Bottom shelf[1]								
Model	**1**	**2**	**3**	**4**	**5**	**6**	**7**	▶
N 100/H	400V / 11.0 kW	692240035_ side + 1/2 Bottom 692230035_ Back wall 692220035_ Door	602210035			540300010 Type S, 275mm, 0.3 mm	691600015 500x350x20 mm	❍
N 150/H	400V / 15.0 kW	692240036_ side + 1/2 Bottom 692230036_ Back wall 692220036_ Door	602210036			540300010 Type S, 275mm, 0.3 mm	691600015 500x350x20 mm	❍
N 200/H	400V / 20.0 kW	692240920_ side + 1/2 Bottom 692231233_ Back wall 692226743_ Door	602212724			540300010 Type S, 275mm, 0.3 mm	691600015 500x350x20 mm	❍
N 300/H	400V / 27.0 kW	692240134_ side + 1/2 Bottom 692250416_ side 692230205_ Back wall 692220194_ Door	602210427			540300010 Type S, 275mm, 0.3 mm	691600015 500x350x20 mm	❍
N 440/H	400V / 40.0 kW	692251267_ side 692261043_ Bottom 692230636_ Back wall 692225216_ Door	602211360			540300010 Type S, 275mm, 0.3 mm	691600015 500x350x20 mm	❍
N 660/H	400V / 52.0 kW	692251268_ side 692261045_ Bottom 692230637_ Back wall 692225217_ Door	602211362			540300010 Type S, 275mm, 0.3 mm	691600015 500x350x20 mm	❍
N 1000/H						540300011 TE Type S 0.3 mm x 295 mm	691600174 230x250x20 mm	❍
N 1500/H						540300011 TE Type S 0.3 mm x 295 mm	691600174 230x250x20 mm	❍
N 2200/H						540300011 TE Type S 0.3 mm x 295 mm	691600174 230x250x20 mm	❍
NW 150						540300010 Type S, 275mm, 0.3 mm	691600015 500x350x20 mm	❍
NW 200						540300010 Type S, 275mm, 0.3 mm	691600015 500x350x20 mm	❍
NW 300						540300010 Type S, 275mm, 0.3 mm	691600015 500x350x20 mm	❍

Spare Parts/Wearing Parts								
	Part number							
1 Electrical connection / 2 Heating element[1, 2] / 3 Heating element, complete set / 4 Support tubes / 5 Support tubes, complete set / 6 Thermocouple[1] / 7 SiC Bottom shelf[1]								
Model	**1**	**2**	**3**	**4**	**5**	**6**	**7**	▶
NW 440						540300010 Type S, 275mm, 0.3 mm	691600015 500x350x20 mm	❍
NW 660						540300010 Type S, 275mm, 0.3 mm	691600015 500x350x20 mm	❍
NW 1000						540300011 TE Type S 0.3 mm x 295 mm	691600174 230x250x20 mm	❍
NW 150/H						540300010 Type S, 275mm, 0.3 mm	691600015 500x350x20 mm	❍
NW 200/H						540300010 Type S, 275mm, 0.3 mm	691600015 500x350x20 mm	❍
NW 300/H						540300010 Type S, 275mm, 0.3 mm	691600015 500x350x20 mm	❍
NW 440/H						540300010 Type S, 275mm, 0.3 mm	691600015 500x350x20 mm	❍
NW 660/H						540300010 Type S, 275mm, 0.3 mm	691600015 500x350x20 mm	❍
NW 1000/H						540300011 TE Type S 0.3 mm x 295 mm	691600174 230x250x20 mm	❍
[1] Quantity as required [2] Support tubes, power cable clamps, and cramps on request								

▶

Symbols

● Can be replaced by the customer with tools and instructions.

❍ Can be replaced by trained personnel with tools and instructions.

NT Nabertherm Service required

▶

Note

Since SiC plates expand continuously, they should be replaced after about 3-5 years. Otherwise there is a risk that the collar bricks will be pushed outwards. In this case, we will not accept warranty claims.

▶

Note

Contact our Nabertherm Service for removing and installing replacement and wear parts. See section on "Nabertherm Service". Work on the electrical equipment may only be performed by qualified and authorized specialist electricians. This applies also to repairs not described below.

8.1 Replacing a Heating Element

Warning - Danger of Electric Shock!

Only qualified and authorized electricians may work on electric equipment. During maintenance work, furnace and switchgear must be kept voltage-free to prevent accidental start-ups (switch off the furnace at the power switch) and secure all the movable parts of the furnace. Follow the specifications in the DGUV V3 or corresponding national regulations where the furnace is installed. Wait until the furnace chamber and its attachments have cooled down to room temperature.

Note

In Germany, the general accident protection guidelines must be observed. The national accident prevention regulations of the country of operation apply.

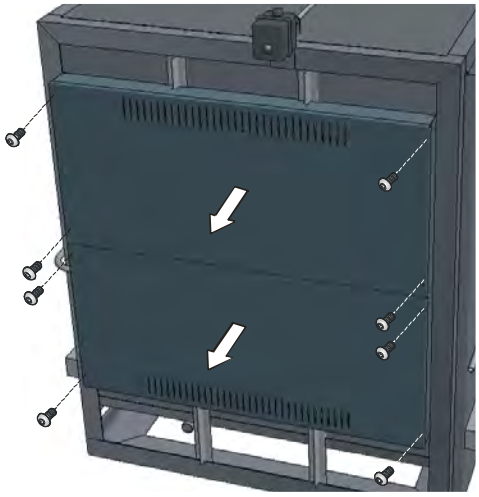
Note

For wiring and electrical connections, see the attached circuit diagram. The electrical equipment of the machine can also be seen in the circuit diagram.

Tip: Because we build many different furnace models, we recommend that you take several photos of the installed heating elements and the switchgear. That simplifies subsequent installation and wiring of new heating elements.

Removing Cover/s

We refuse to accept any responsibility for any and all direct and indirect damages resulting from faulty installation. This also applies to all cases in which generally required installation steps are not described. The replacement of the heating elements requires the cover/s (protective paneling) on the furnace (bogie, depending on model). Use an appropriate tool to remove the screws around the sides of the cover and keep them in a safe place for later use. The number and position of the screws may differ from one furnace model to the next.

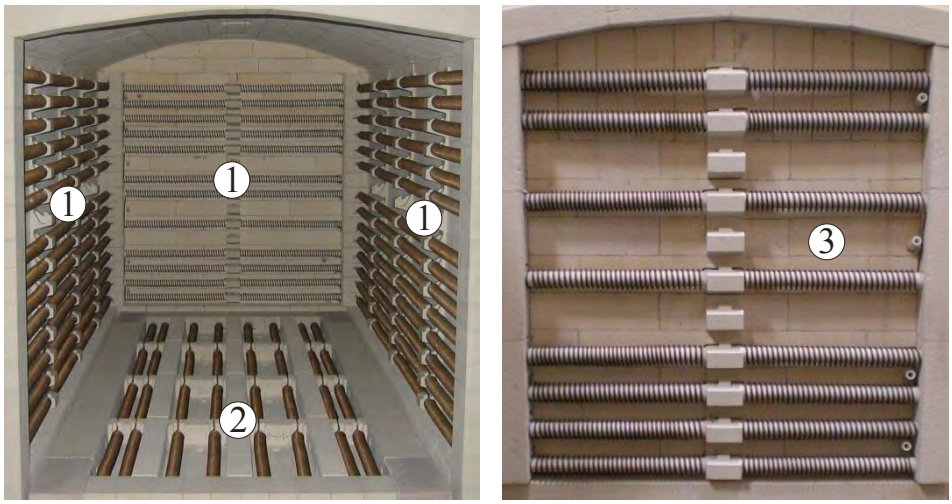


Example: Cover for heating elements in the furnace interior located on the rear side of the furnace

Example: Cover for heating elements in the inner door located on the outer side of the door

Fig. 79: Example: Removing Cover/s

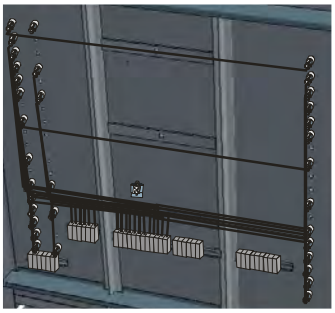
Arrangement of the Heating Elements (depending on model)



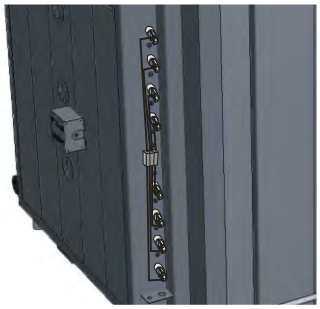
1 Heating elements furnace interior
2 Heating elements bogie (remove base plates) →
3 Heating elements door/lift door

Fig. 80: Example: Heating elements of a bogie hearth furnace (depending on model)

Arrangement of the Connection Terminals(depending on model)



Example: Connection terminals for heating elements in the furnace interior located on the rear side of the furnace



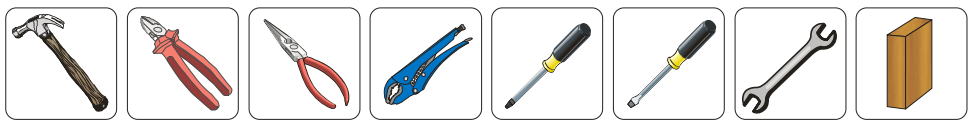
Example: Connection terminals for heating elements in the inner door located on the outer side of the door

Example: Connection terminals for heating elements of the bogie located on the lower side the bogie

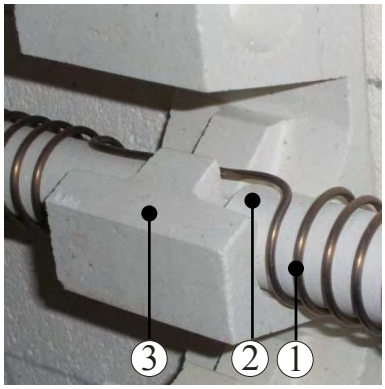
Fig. 81: Example: Connection terminals of the heating elements

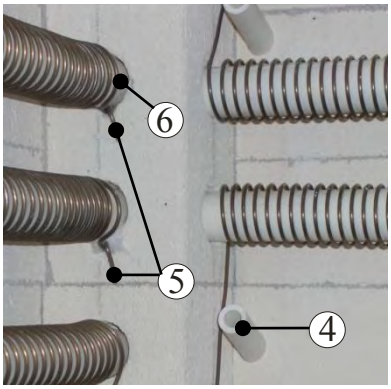
Tools Required by Customer for the Installation

The following tools are required to replace the heating elements. Hammer, cable cutter, long-nose pliers, pipe wrench, screwdriver (depending on the age of the furnace, Phillips screwdriver, flat-tip screwdriver, jaw wrench and a wood block to hammer in the ceramic penetration pipes.



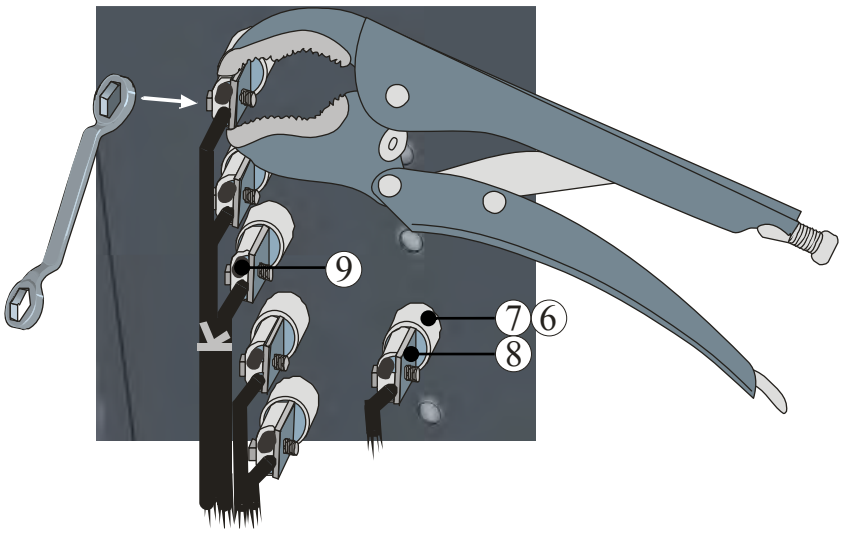
Replacing the Heating Elements (short description)





1 Heating element (heating coil)
2 Support tube
3 Support brick
4 Holding tube
5 Holding clamp/s
6 Fiber wadding

Fig. 82: Designation of the required attachments



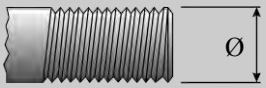
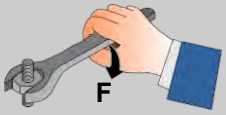
7 Ceramic penetration pipe, **6** Fiber wadding
8 Connection terminal
9 Heating element end (twisted)

Fig. 83: Example: Connection terminal/s

- **Removing the Heating Elements**
- Remove the protective paneling of the electrical connections (raise base plates from the bogie and carefully remove.
- Loosen the connection terminals at the ends of the heating coils. Replace ceramic penetration pipe as necessary.
- Draw out the existing holding clamps and ceramic tubes for holding the heating element in place out of the masonry (old holding clamps are highly fragile. If a holding clamp breaks, the piece still stuck in the masonry must be removed).
- Remove heating coils carefully with the support tubes (Caution: older heating elements are highly fragile)-

- **Installing the Heating Elements**

- Clean firing deposits from heating chamber, support tubes, support bricks, terminals and ceramic penetrations.
- **Warning:** We recommend using new support tubes, terminals and ceramic penetration pipes (soiled support tubes/ceramic penetration pipes result in early failure of the new heating elements).
- The new heating elements have heating element ends (twisted) protected by a lug. Nip the lugs before installation. Install the heating coil with the support tubes
- Insert the holding clamps into the wall masonry. **Warning:** Do not insert staples into the corner bricks! Warning: Never use the old holes for the new holding clamps. This may result in problems with the Fi switch (if included) Depending on the furnace model, ceramic tubes can also be installed as holders instead of holding clamps.
- Insulate the ceramic penetration pipes with a small amount of fiber wadding from outside. Make the electric connections using the connection terminals: Hold the lower part with a pliers and tighten the screw firmly.
- Recommendation: Retighten all the screws of the connection terminals of the heating elements after one week of operation and, thereafter, once a year. Avoid placing any stress, pressure or twist on the heating wire. If you fail to follow this instruction the result is the immediate destruction of the sensitive heating elements.
- If necessary trim any overlaying fibers to somewhat longer than one terminal width (approx. 2-3 cm).
- Check electrical connections and protective lines to ensure they are correctly connected.
- Install protective paneling of the electrical connections (base plates of the bogie hearth furnace (base plates which are damaged or seriously contaminated must be replace by new, equivalent base plates).

Screw tightening torque	
Tighten power cable clamps and screws on the **heating elements** with a defined torque. If this advice is not followed, the heating elements may be damaged.	
Thread diameter Metric thread (M) 	Torque in Nm 
M 4	2.0
M 5	6.0
M 6	8.0
M 7	14.0
M 8	20.0
M 10	39.0

Note

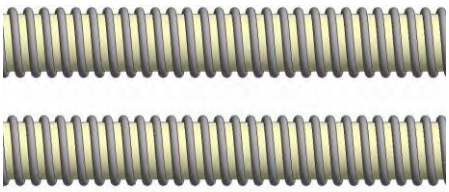
Re-install in reverse sequence.

The formation of a layer of oxide is necessary for the correct function of the heating element.

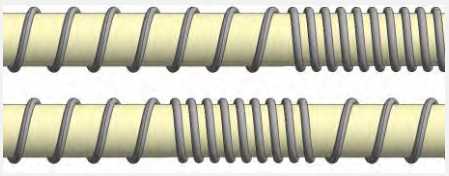
This procedure is for the first start-up and must be repeated after **every replacement** of heating elements.

The duration of the oxidation firing can be found in the section entitled "Recommendation for Heating the Furnace for the First Time".

Nest formation is a natural process and requires no correction. Considerable nest formation, however, can influence temperature distribution.



Before



After (nest formation)

8.2 Replacing a Thermocouple

Warning - Danger of Electric Shock!

Only qualified and authorized electricians may work on electric equipment. During maintenance work, furnace and switchgear must be kept voltage-free to prevent accidental start-ups (switch off the furnace at the power switch) and secure all the movable parts of the furnace. Follow the specifications in the DGUV V3 or corresponding national regulations where the furnace is installed. Wait until the furnace chamber and its attachments have cooled down to room temperature.

You can find the position and labeling of built-in thermal elements in the enclosed attachment to the appendix.

First remove the two screws (A) from the thermal element connection. Remove screw (B) from the thermal holder plate and pull out the thermal element upwards. Insert the new thermal element carefully into the thermal channel (C), mount and connect in reverse sequence. You must make sure that the polarity of the electrical connections (D) is correct*).

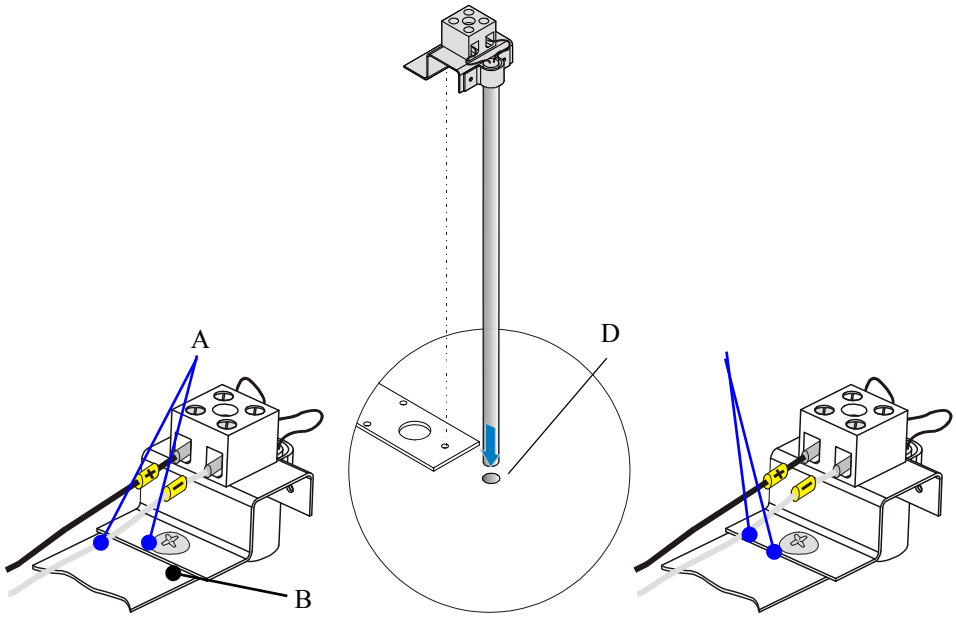


Fig. 84: Thermal element replacement

Note

*) The connections of the connecting lines from the thermocouple to the controller are labeled with ⊕ and ⊖. It is absolutely essential to observe the correct polarity.

⊕ to ⊕ ⊖ to ⊖

Start-Up

Switch on the power switch and check if the furnace is working (see section "Operation").

8.3 Electrical Schematics/Pneumatic Schematics

Note

The documents included do not always contain the electrical schematics and pneumatic schematics.

If you need the respective schematics they can be ordered from Nabertherm Service.

9 Accessories (Options)

9.1 Assembling the Base for Furnace Model N 40 E - N 100 E (Accessory)

Remove the base from the packaging and compare the parts with the list below.

No.	Quantity	Name
A	4	
B	2	
C	2	
D	1	
E	20	

Fig. 85: Parts of the base

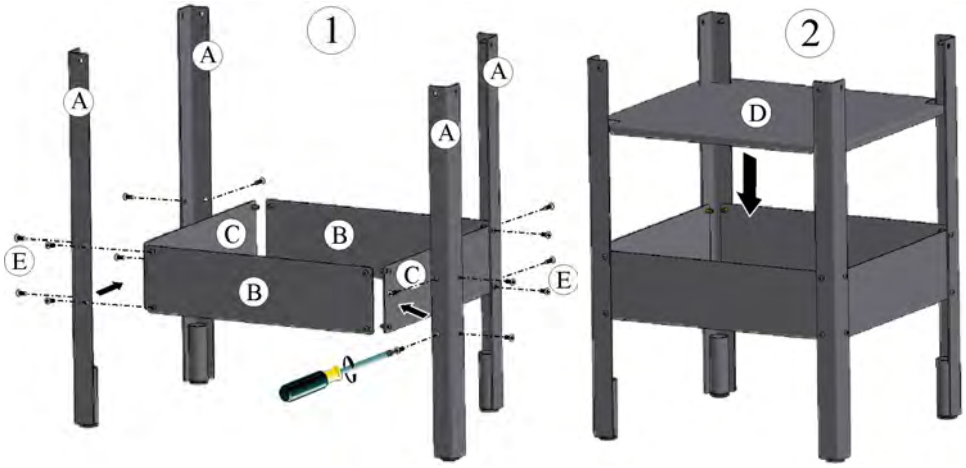


Fig. 86: Assembling the base

Assemble the individual parts (1 and 2) of the base as shown above. When the individual parts have been assembled, tighten the bolts.

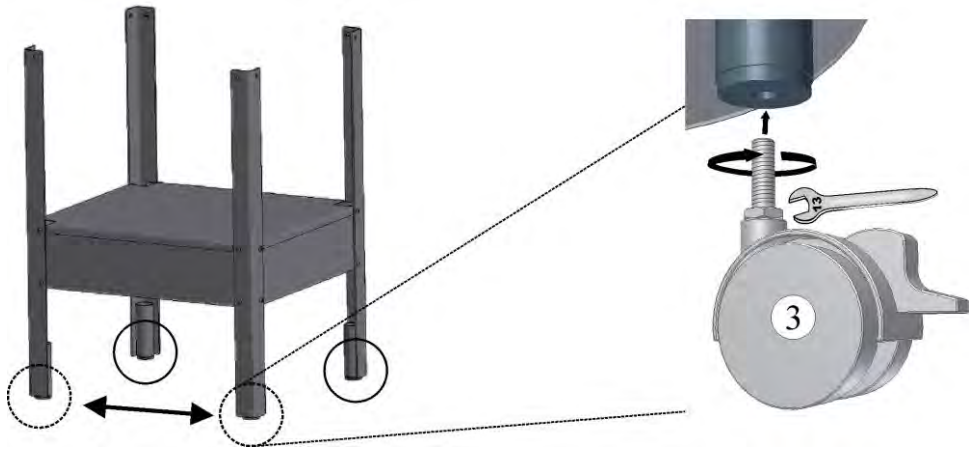


Fig. 87: Assembling the castors (if applicable)

Install the transport casters (3) (if present) beneath the feet of the base.

Assembly recommendation

Compliance with our recommendations does not release users of our products from their personal responsibly in relation to local situations and conditions. However, several general recommendations should be considered:

- Because of the weight of the furnace, we recommend that it be moved by several people while one person is responsible for assembling the base. Hold the furnace until it is firmly bolted to the base. For assistance in installing the furnace, contact Nabertherm GmbH. By mail, phone, or e-mail -> See "Nabertherm Service".
- If the base has a locking brake (4), secure the transport casters on the base (casters with brake facing the furnace door).
- Carefully and slowly place the furnace on the base (5). Make sure that it sits properly on the base.
- Connect the bolts (E) that were delivered to the base and to the threaded holes in the furnace (6). Check that all bolted connections on the bases sit properly.

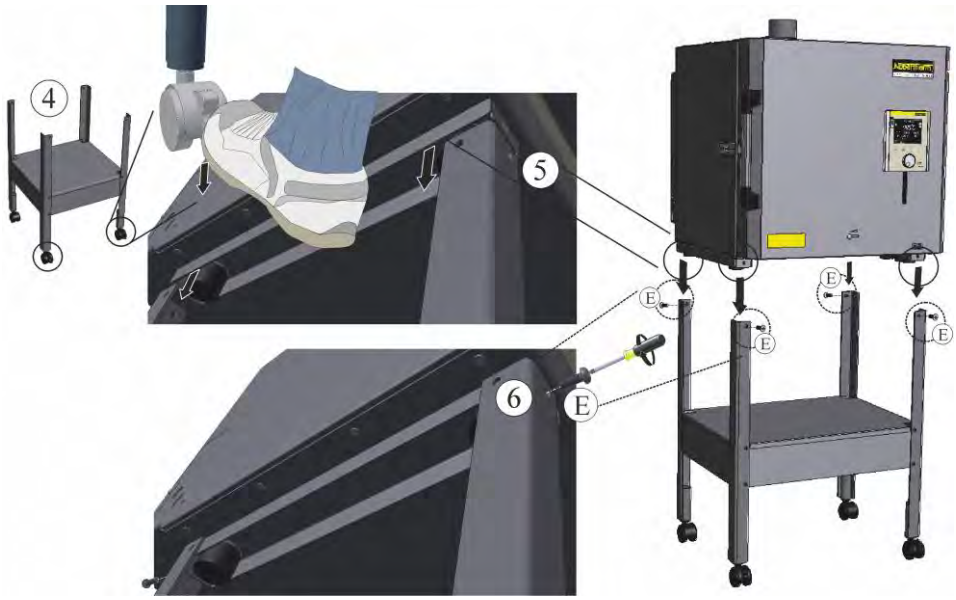


Fig. 88: Screw furnace to base (accessory)

Caution
Nabertherm assumes no liability for damages caused by improper installation.

9.2 Assembling the charging frame (accessory)

The stacked frame is moved into the furnace with a pallet truck (option) and lowered carefully. Suitable for trucks with fork widths to a maximum of 520 mm.

No.	Quantity	Name
A	1	Bottom tile
O	1	Side panel, left
C	1	Side panel, right
D	1	Load-bearing fork
E	10	Bolt M8 x 16 (SW13)
T	max. pallet truck width = 520 mm	

Fig. 89: Individual parts of the charging frame

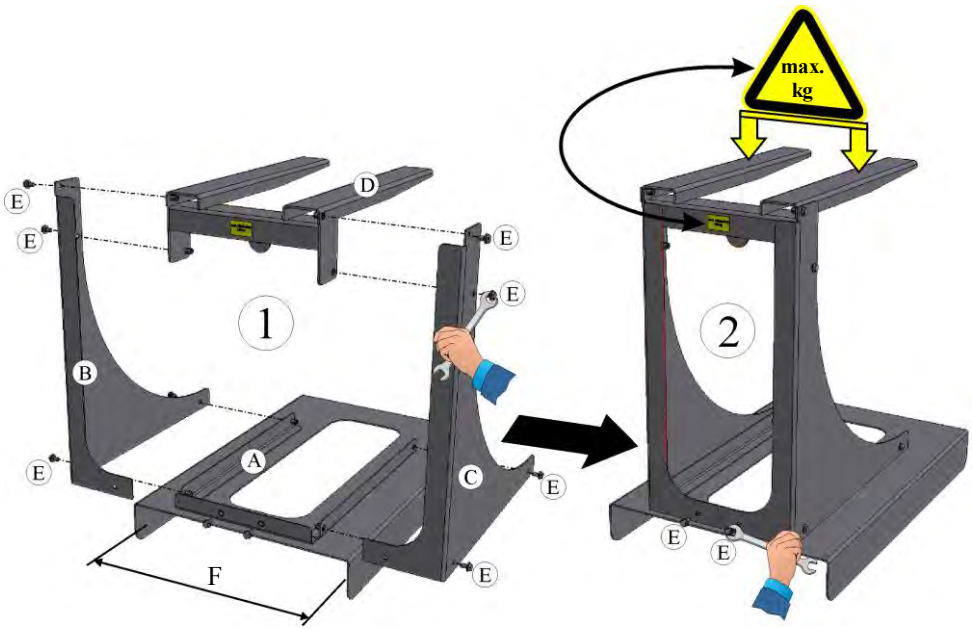


Fig. 90: Assembling the charging frame (accessory)

Place the base plate (A) on even ground. Insert the left (B) and right (C) side panels and fix them in place each with three bolts (E) (M8 x 16, SW 13). Insert the load-bearing fork (D) and fix in place with four bolts (E). Make sure that it is horizontal; it can be adjusted by means of the slotted hole for the bottom bolts.

Note

Observe the maximum distributed load of the charging frame (refer to the label on the frame).

The maximum load bearing capacity of the furnace base (filling weight) is very dependent on the temperature. We recommend approx. 50 % of the furnace volume in kg as the loading limit.

Example: N 650 = 650 liters furnace volume (see "Technical Data") corresponds to approx. 325 kg maximum load bearing capacity of the furnace base

Fig. 91: Recommendation: Maximum load bearing capacity of the furnace base

Caution

Nabertherm assumes no liability for damages caused by improper installation.

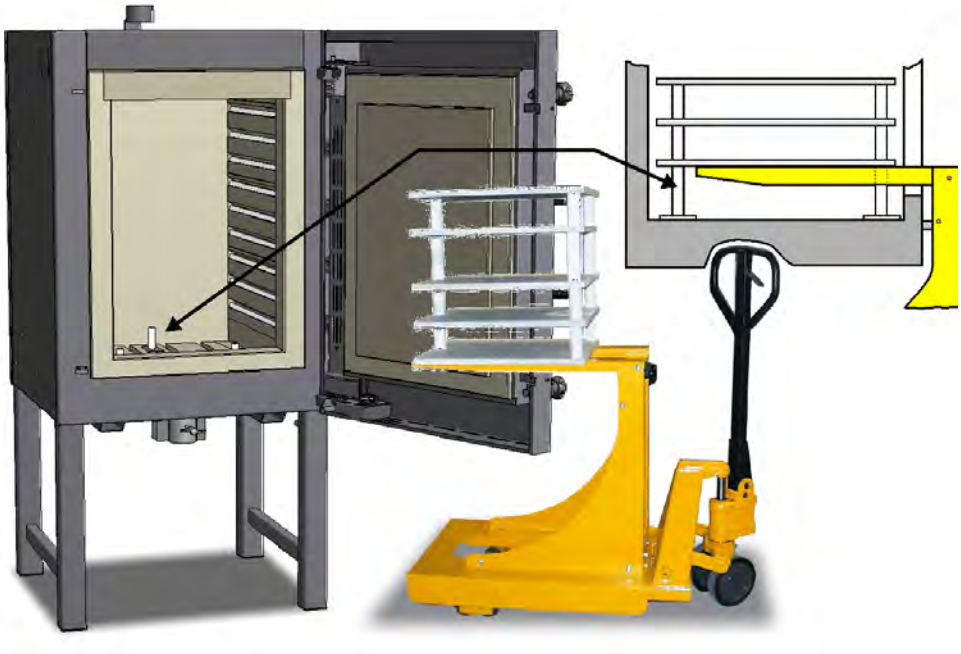


Fig. 92: Example: Charging frame with optional pallet truck

9.3 Shelves/Props

Furnace Furniture/Shelves			
Furnace model	Dimensions in mm	Part number	Figure
N 40 E, N 70 E	340x370x13	691600181	
N 100 E	390x400x15	691600182	
N 100	490x350x17	691600183	
N 150, N 200	490x440x17	691600184	
N 300, NW 300	500x320x18	691600966	
N 140 E, N 500 E, N440; NW 440	550x360x18	691600836	
N 210 E	550x410x18	691600837	
N 280 E	550x440x18	691600838	
N 660, NW 660	560x500x16	691600036	
Ceramic shelves supplied with furnaces without SiC bottom tile.	80x80x10	691600956	
Blanks may be cut from shelves			

Furnace Furniture/Props			
	Dimensions in mm	Part number	Figure
Prop	Ø 40x50	691600185	
Prop	Ø 40x100	691600951	

Note

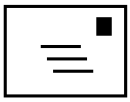
New kiln furniture (e.g. shelves and props) should be heated once to dry them out (as described above). When cold, heating elements are extremely brittle. Take great care when filling, emptying and cleaning the furnace.

The door must be locked during firing. To extract emitted gases and vapors more quickly and to shorten the cooling phase after firing, the air inlet valve or flap (model-related) can be completely or partially opened.

10 Nabertherm Service

Contact Nabertherm Service at any time for maintenance and repair.

If you have any questions, problems, or requirements, contact Nabertherm GmbH. By mail, phone or e-mail.



Mail

Nabertherm GmbH
Bahnhofstrasse 20
28865 Lilienthal/Germany

Phone or Fax

Phone: +49 (4298) 922-0
Fax: +49 (4298) 922-129

Web or E-mail

www.nabertherm.com
contact@nabertherm.de

When you contact us, please have the type plate details of the furnace or controller at hand.

Provide the following details from the type plate:

① Furnace model
② Serial number
③ Article number
④ Year of construction

Fig. 93: Example (type plate)

11 Declaration of Conformity

EC Declaration of Conformity

Compliant with EC Directive 2006/42/EC on machinery, Annex II A

We,

Nabertherm GmbH
Bahnhofstr. 20, 28865 Lilienthal, Germany

hereby declare that the following product:

electrically heated Chamber Furnaces

Model	N 40 E	N 40 E/R	N 70 LE	N 70 E	N70 E/R	N 100 E	
	N 140 E	N 140 LE	N 210 E	N 210 LE	N 280 E	N 280 LE	N 500
	N 100	N 100/H	N 150	N 150/H	N 200	N 200/H	N 300
	N 300/H	N 440	N 440/H	N 660	N 660/H	N 1000	N 1000/H
	N 1500	N 1500/H	N 2200	N 2200/H	NW 150	NW 150/H	NW 200
	NW 200/H	NW 300	NW 300/H	NW 440	NW 440/H	NW 660	NW 660/H
	NW 1000	NW 1000/H					

For all Furnaces: With switchgear 110 – 480 V and Nominal frequency 50/60 Hz.

fulfills all the pertinent provisions contained in Directive 2006/42/EC.

The product named is also compliant with all the provisions of the following directives:

- Directive 2014/35/EU for electrical equipment designed for use within certain voltage limits
- Directive 2014/30/EU on electromagnetic compatibility

The signatories are authorized to compile the relevant technical documents. The address is the stated manufacturer's address.

Any change in the product not approved by the manufacturer invalidates this declaration.

The following harmonized standards were applied:

- DIN EN 60335-1 (10.2012)
- DIN EN 61000-6-1 (10.2007), DIN EN 61000-6-3 (09.2011)

Lilienthal, 01.04.2016

Michael Oberschmidt
Vice President R & D

Thomas Adamek
Quality Management