

Operating Instructions

Rotary Tube Furnaces

RSR ...-.../..

RSR-B ...-.../..

-> 06.2010

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.

The continuous rotating operation of the tube and the option of operating in protective gas deliver optimum results. High-quality insulation materials permit energy-saving operation and short warm-up times thanks to low heat retention and thermal conductivity. Laboratory furnaces attain furnace chamber temperatures of max. 1100 °C (2012 °F) or 1300 °C (2372 °F).

Other Characteristics of this Product are:

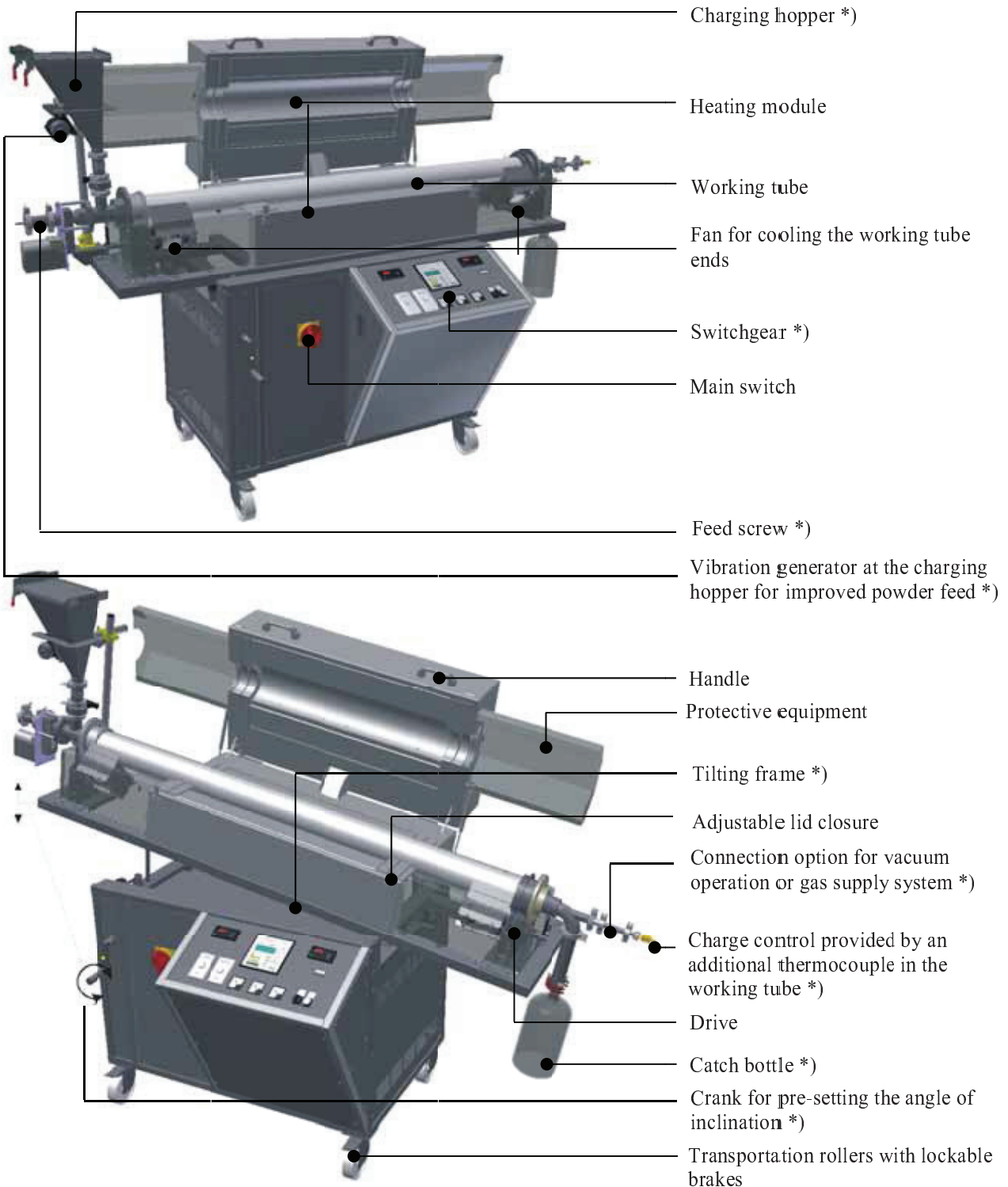
- Tmax 1100 °C:thermocouple type K
Tmax 1300 °C:thermocouple type S
- Designed as table-top model with external switchgear or with switchgear and controller, built into the lower section of the unit, incl. transportation rollers.
- Depending on the process, charge and the required maximum temperature, various working tubes made of quartz, ceramic or metal can be used. (see section "Available Working Tubes")
- Very easy removal of the working tube or reactor thanks to beltless drive and fold-out housing
- Continuously adjustable drive from approx. 1-20 r/min
 - Housing made of textured stainless steel sheets in rust-free design

Additional Equipment (Depending on Model and Design)

- Gas-tight rotary feedthrough to the connection to the gas supply system
- Manual or automatic protective gas system
- Check valve at gas outlet prevents the penetration of entrained air
- Other pipe diameters or heated lengths
- Three-zone regulation for optimizing temperature uniformity
- Display of the temperature in the working tube with measurements supplied by an additional thermocouple
- Charge control provided by an additional thermocouple in the working tube
- Charging hopper made of stainless steel with a lidded powder release opening, also available in gas-tight design
- Electric vibration generator at the charging hopper for optimizing the flow of material into the working tube
- Electrically driven feed screw at the entrance to the working tube with a slope of 20 mm and an adjustable rotation speed between 0.28 and 6 r/min

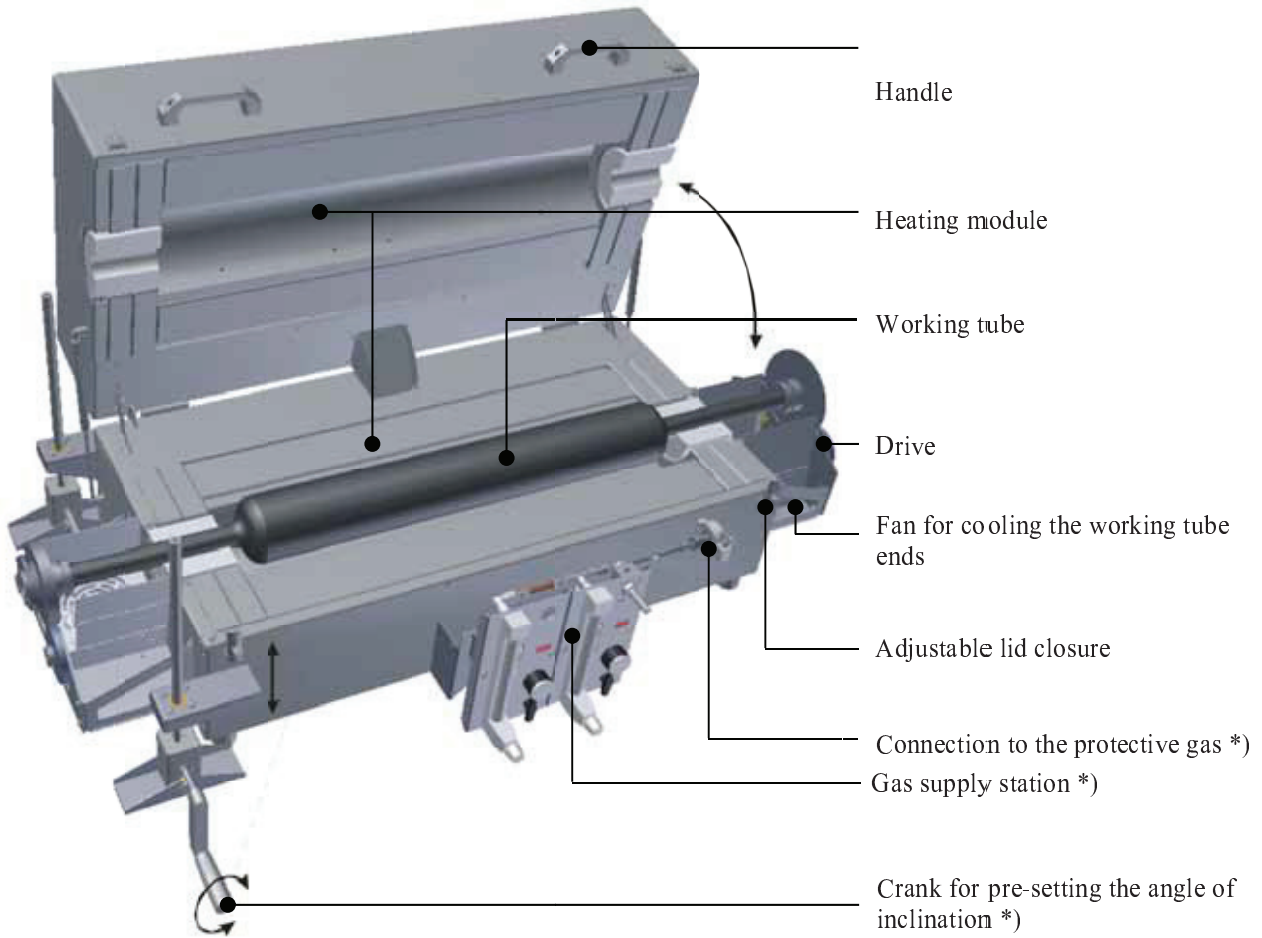
Other available additional equipment can be found in the "Laboratory" catalog.

1.2 Overview of the Complete Furnace



*) = in scope of delivery depending on the design (additional equipment)

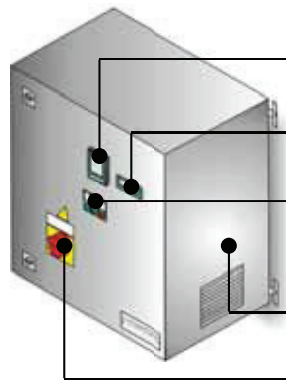
Fig. 1: Example: Overview: Rotary Furnace RSR .../.../.. with tilting frame, switchgear, controller and additional equipment (figure shows custom design).



Switchgear with Controller Designed as:
Floor Cabinet Unit or



Wall Cabinet Unit



- Controller
- Over-temperature limit controller with adjustable shut-down temperature *)
- Switch unit
- Switch cabinet ventilation
- Main switch



*) = in scope of delivery depending on the design (additional equipment)

Fig. 2: Example: Overview: Rotary furnace RSR .../.../... as table-top model for batch operation with external switchgear, tilting frame and gas supply station

1.3 Safeguarding against Dangers Posed by Over-Temperature

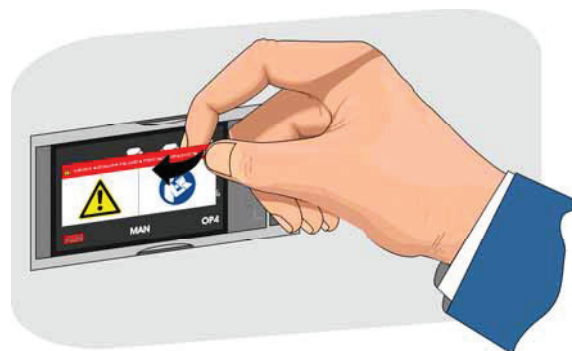
Over-temperature limiters with manual reset/with automatic reset to protect against over-temperature in the furnace chamber are available for Nabertherm GmbH furnaces either as a standard feature (depending on the model series) or as additional equipment (customized design).

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
	<ul style="list-style-type: none"> • 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.




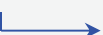
We recommend setting the maximum setpoint temperature of the heating program in the limiter between 5 °C and 30 °C, depending on the physical characteristics of the furnace, below the trigger temperature of the over-temperature limiter with manual reset/with automatic reset. This prevents an unwanted 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. 3: Removing the sticker

1.3.1 Key to the Model Names

Example	Explanation
RSR 120/500/11 	RSR =Rotary tube furnace RSR-B = Batch operation
RSR 120 /500/11 	80 = max. possible tube outer diameter in mm 120 = max. possible tube outer diameter in mm
RSR 120/ 500 /11 	500 = heated tube length in mm 750 = heated tube length in mm 1000 = heated tube length in mm
RSR 120/500/ 11 	11 = Tmax 1100 °C 13 = Tmax 1300 °C

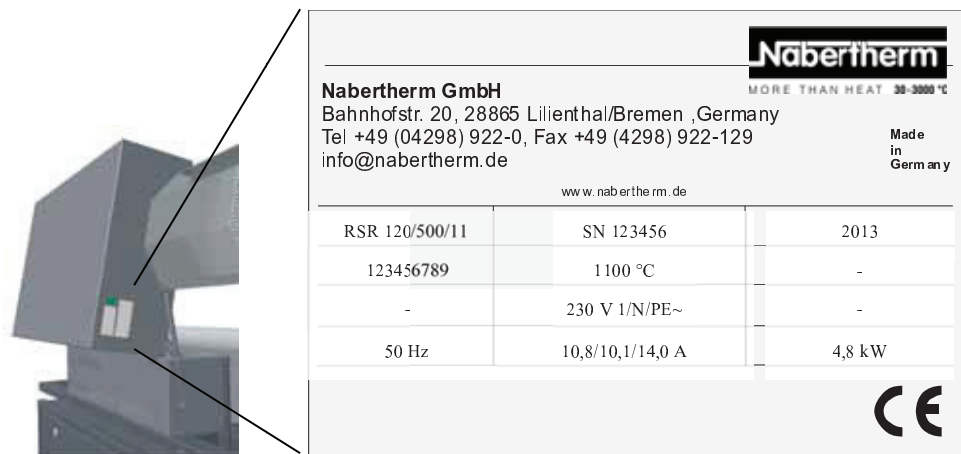
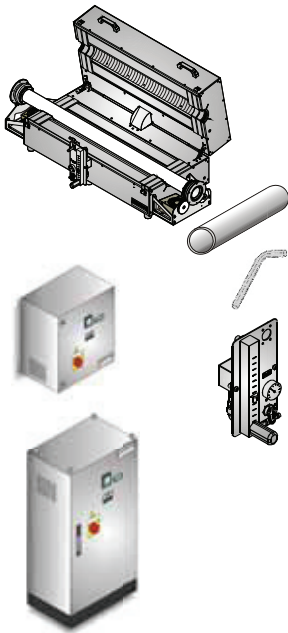


Fig. 4: Example: Model name (type plate)

1.4 Scope of Delivery

The scope of delivery includes:



Furnance Components	Quantity	Comment
Rotary tube furnace Model RSR	1 x	Nabertherm GmbH
Switchgear *)	1 x	Nabertherm GmbH
Standard working tube *)	1 x	Nabertherm GmbH
Hex key	1 x	Nabertherm GmbH
Gas panel *)	1 x	Nabertherm GmbH
Tilting frame	1 x	Nabertherm GmbH
Rotary feedthrough *)	1 x	Nabertherm GmbH
Gas system with gas cooler *)	1 x	Nabertherm GmbH
Tube adapter *)	1 x	Nabertherm GmbH
Other components, variable depending on the particular furnace	- - -	See the shipping papers



Document Type	Quantity	Comment
Operating Instructions for Tube Furnace Model RSR	1 x	Nabertherm GmbH
Operating Instructions for Controller	1 x	Nabertherm GmbH
Schematic Circuit *)	1 x	Nabertherm GmbH
Operating Instructions for Over-Temperature Limit Controller*)	1 x	
Installation Instructions Flange *)	1 x	Nabertherm GmbH
Operating Instructions for Gas Panel *)	1 x	Nabertherm GmbH
Other documents, variable depending on the particular furnace	1 x	Refer to documentation folder

*) = part of the delivery depending on model



Note

Store all documents carefully. 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.

Continuous Rotary Furnace

Model	Tmax °C ³	Outer Dimensions in mm			Tube dimensions in mm				Connected load kW	Electrical connection	Length constant temperature ΔT 10 K	Weight in kg
		W	D	H	Overall length	Length of working area ⁵	Ø Outer	Ø Terminal end ⁵				
RSR 80-500/11	1100	2505	1045	1655	1540	500	76	34	3.7	1-phase	170	555
RSR 80-750/11	1100	2755	1045	1655	1790	750	76	34	4.9	3-phase ²	250	570
RSR 120-500/11	1100	2505	1045	1715	1540	500	106	34	5.1	3-phase ²	170	585
RSR 120-750/11	1100	2755	1045	1715	1790	750	106	34	6.6	3-phase ¹	250	600
RSR 120-1000/11	1100	3005	1045	1715	2040	1000	106	34	9.3	3-phase ¹	330	605
RSR 80-500/13	1300	2505	1045	1655	1540	500	76	34	6.3	3-phase ¹	170	555
RSR 80-750/13	1300	2755	1045	1655	1790	750	76	34	9.6	3-phase ¹	250	570
RSR 120-500/13	1300	2505	1045	1715	1540	500	106	34	8.1	3-phase ¹	170	585
RSR 120-750/13	1300	2755	1045	1715	1790	750	106	34	12.9	3-phase ¹	250	600
RSR 120-1000/13	1300	3005	1045	1715	2040	1000	106	34	12.9	3-phase ¹	330	605

Batch Rotary Furnace

Model	Tmax °C ³	Outer Dimensions in mm			Tube dimensions in mm				Connected load kW	Electrical connection	Length constant temperature ΔT 10 K	Weight in kg
		W	D	H	Overall length	Length of working area ⁵	Ø Outer	Ø Terminal end ⁵				
RSR-B 80-500/11	1100	1145 ⁴	475	390	1140	500	76	34	3.7	1-phase	170	555
RSR-B 80-750/11	1100	1395 ⁴	475	390	1390	750	76	34	4.9	3-phase ²	250	570
RSR-B 120-500/11	1100	1145 ⁴	525	440	1140	500	106	34	5.1	3-phase ²	170	585
RSR-B 120-750/11	1100	1395 ⁴	525	440	1390	750	106	34	6.6	3-phase ¹	250	600
RSR-B 120-1000/11	1100	1645 ⁴	525	440	1640	1000	106	34	9.3	3-phase ¹	330	605

¹ Heating only between two phases

² Heating only between phase 1 and the N-conductor

³ Value Tmax outside the tube. Actually attainable working temperature in tube approx. 50 °C lower.

⁴ Without tube

⁵ Only for reactors (see section "Available Working Tubes")

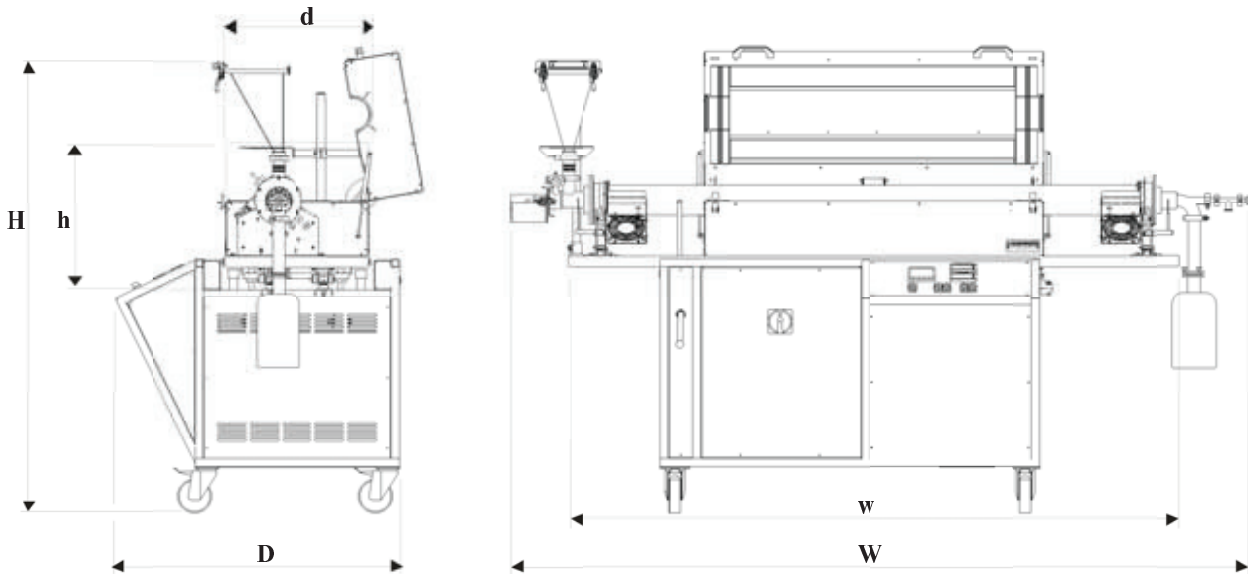


Fig. 5: Dimensions of rotary furnace

Electrical connection	Voltage (V)	1-phase:	3-phase:	Special voltage:
Furnace model		See type plate on furnace		
	Frequency:	50 or 60 Hz		
Thermal protection class	Furnances:	compliant with DIN EN 60519-2 without safety controller: Class 0 (in case of fault, no protection for furnace or charge) with safety controller: Class 2 (in case of fault, furnace and charge protected)		
Protection type	Furnances:	IP20		
	Switchgear cabinet:	IP43		
Ambient conditions for electrical equipment	Temperature: Humidity:	+5°C to 40 °C max. 80% non-condensing		
Weights	Furnace with accessories	Varies (see shipping papers)		
Emissions	Continuous sound pressure level:	< 80 dB(A)		

2.1 Warranty and Liability



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



This Nabertherm system was designed and manufactured after careful selection of the harmonized standards to be observed plus other technical specifications. It therefore corresponds to the state of the art, ensuring the highest possible degree of safety.

Only materials with known characteristics and melting temperatures may be used. Check the material safety data sheets if necessary.

Use of the furnace for any other purpose whatsoever such as processing products other than those intended or handling hazardous substances or substances posing a health hazard constitutes improper use and must be agreed upon with Nabertherm in writing.

Whether or not the materials used in the furnace can potentially corrode or destroy the insulation or heating elements must be ascertained.

For furnaces with over-temperature limit controllers, the cutoff temperature must be set to prevent overheating of the material.

Modifications to system equipment must be agreed upon with Nabertherm in writing. It is not permitted to remove, bypass, or shut down safety devices.

The installation instructions and safety guidelines must be observed. Otherwise, the furnace will not be considered as being used as designated, and all claims against Nabertherm GmbH will be void.

Removal of the fiber plugs, flange and protective cover when hot (> 400°C) is prohibited. The resulting thermal shock will otherwise destroy the working tube and possibly the heating elements as well.

Operating with power sources, products, operating equipment, additives, etc., which are subject to the Ordinance on Hazardous Substances or causing risks to the health of operating personnel in any way is not permitted.



- This furnace is designed for **commercial** use. The furnace must **not** be used for warming animals, wood, grain, etc.
- The heating of food and drink for the purpose of consumption is not permitted.
- The furnace must not be used as a workplace heater.
- Do not use the furnace to melt ice or similar materials.
- Do not use the furnace for metal working.
- Do not use the furnace as a clothes dryer.



Note

See safety instructions in the individual sections.



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 when operating the furnace 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

- all harmful gases are removed from the workplace, for example by an extraction system,
- the extraction system is switched on,
- the workplace is properly ventilated,
- the furnace is operated only in a perfect operating condition and, in particular, that the functions of the safety components are checked regularly.
- the required personal protective equipment is available for and used by the operating, maintenance, and repair personnel.
- these operating instructions, including the supplier documentation, are kept near 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,
- furnace 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,

- a risk assessment is carried out (in Germany, covered by Section 5 of the Occupational Safety Act) to determine any other hazards that may result from the working conditions particular to the furnace's location,
- all other instructions and safety guidelines that have been determined in a risk assessment for the workplace are compiled in an operation manual (in Germany, covered by Section 6 of the Ordinance Regulating the Use of Operating Equipment).
- Only sufficiently qualified and authorized personnel may operate, maintain and repair the system. This personnel must be trained in how to operate the furnace and must confirm their participation in the training with a personal signature. The training program must be documented in detail. In case an operator is replaced, additional training must also take place. The additional training may only be performed by authorized, trained individuals familiar with the system. The additional training must be painstakingly documented and participation must be evidenced by the names and signatures of the participating employees.



Note

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

3.3 Requirements for the Operating Personnel



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.



Only adequately qualified and authorized persons may operate, maintain, or repair the furnace.

Operating personnel are instructed regularly in all aspects of occupational safety and environmental protection and are familiar with all the operating instructions, in particular, safety instructions.

Only trained personnel may operate the control and safety equipment.

The operator should complete these details:

- Operator _____
- The furnace may only be transported by _____
- The furnace may only be installed by _____
- The furnace may only be commissioned by _____
- Initial instructions may only be given by _____
- Malfunctions may only be rectified by _____
- The furnace may only be maintained by _____
- The furnace may only be cleaned by _____
- The furnace may only be serviced by _____
- The furnace may only be repaired by _____
- The furnace may only be shut down by _____

	 DANGER
	<ul style="list-style-type: none"> • 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.

3.4 Protective Clothing



Wear protective goggles.



Everywhere in the vicinity of the furnace, pouring pans, and similar components, wear protective clothing which is resistant to spatters of molten metal.



Protect your hands by wearing heat-proof gloves.



Wear a respirator (P2 or higher) to protect your respiratory tract e.g. when working on the fiber insulation.

3.5 Basic Measures During Normal Operation



Warning! General Hazards!

Before turning on the system, check and be sure that only authorized personnel are in the working zone of the system and that no-one can be injured by operation of the system!!

Before every production start, check and be sure that all safety systems are functioning properly!

Before every production start, check the system for visible damage and be sure that it is only operated in perfect condition! Notify management immediately of any defects found!

Before every production start, remove all materials/objects from the working zone of the system which are not required for production!

The system may only be started from the designated work station (e.g. the PC/control console).

At least once a day (see also Service and Maintenance), the following check tasks must be performed:

- check the system for externally detectable damage,
- check the function of all safety systems (e.g. the EMERGENCY STOP system - if present in the system),
- check all hydraulic or pneumatic hoses for leaks and correct connection (if present in the system),
- check gas or oil lines for leaks and correct connection (if present in the system).



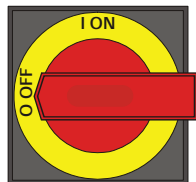
Warning - General hazards! - Furnace opening temperature

Opening the furnace when hot ($>180\text{ }^{\circ}\text{C}$ / $>356\text{ }^{\circ}\text{F}$) is prohibited. The resulting thermal shock can destroy the working tube and possibly the heating elements as well.

3.6 Basic Measures in Case of Emergency

3.6.1 What to do in an Emergency

Furnaces with main switch



Note

In an emergency, **immediately** switch off the voltage supply to the furnace at the **main switch** (position "O/OFF"). Wait until the furnace chamber and attaching parts have cooled to room temperature.

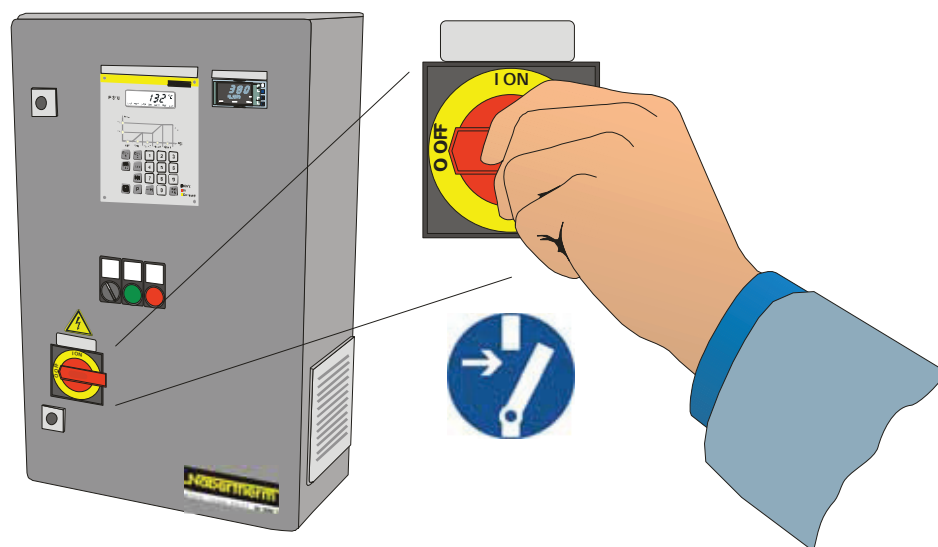




Fig. 6: Disconnect power to the system using the main switch (similar to picture)

Furnaces with power plug



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.

⚠ DANGER		
	<ul style="list-style-type: none"> • 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 	

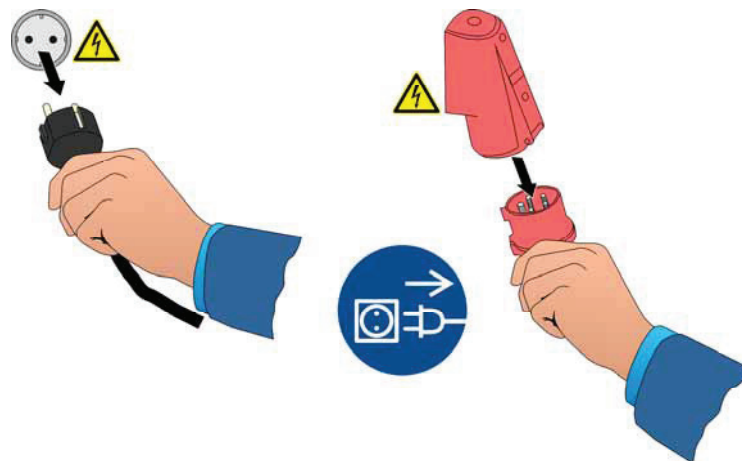
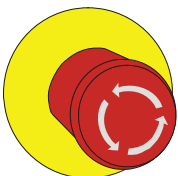


Fig. 7: Pull the power plug (similar to picture)

3.7 Emergency-Off/Emergency-Stop Key

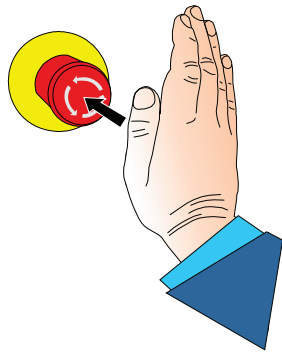


Note

The EMERGENCY STOP button is intended only for emergencies and should not be used to switch off the furnace during normal operation. When the EMERGENCY STOP button has been activated, it must be unlocked manually by turning the knob in an anticlockwise direction (optionally with key) before the furnace can be restarted.



Fig. 8: Bringing the furnace to a stop in an emergency using the safety facility on the operating panel



EMERGENCY STOP button

EMERGENCY STOP buttons are electromechanical switching devices designed to protect people at or near machines. They are used to switch off/stop machines and systems to prevent or reduce imminent or existing risks for people or damage to the machine or the charge.

In an emergency this safety device must be pressed immediately.



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.



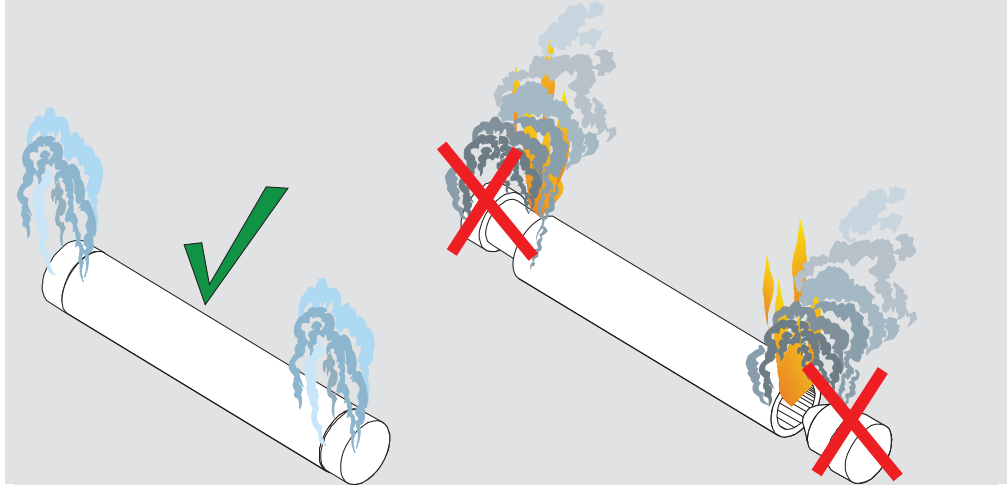
Warning - Danger of Electric Shock!

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



Warning! General Hazards!

In case of unexpected events in the furnace (e.g. severe smoking or annoying odor), fiber plugs at the working tube must **not** be opened or removed. Doing so creates a fire or explosion hazard. Wait until the furnace has naturally cooled down to room temperature.



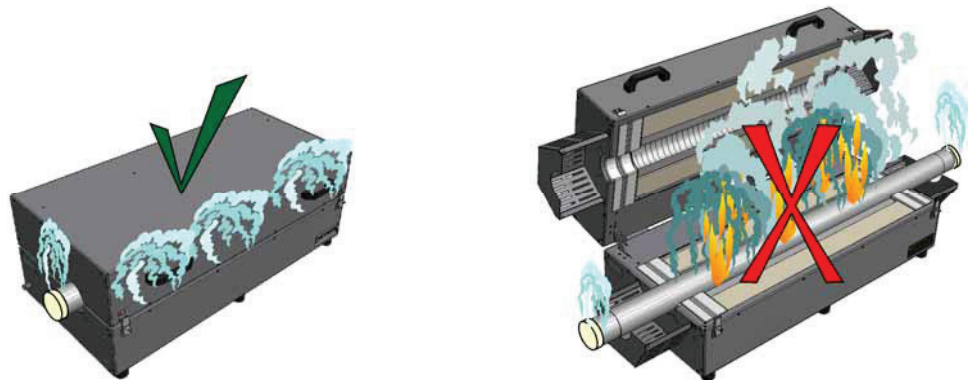
Warning - General hazards!

If unusual processes are occurring in the furnace (e.g., emission of heavy smoke or strong odors), do **not** open or remove the flange at the working tube. Doing so creates a fire or explosion hazard. Wait until the furnace has naturally cooled down to room temperature.



Warning - General hazards!

If unusual processes are occurring in the furnace (e.g., emission of heavy smoke or strong odors), do **not** open the furnace. Doing so creates a fire or explosion hazard. Wait until the furnace has naturally cooled down to room temperature.



3.8 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 off the furnace and make sure it cannot be switched on again inadvertently (lock the main switch and secure it with a padlock), or pull out the power plug.

Clear an adequate area around the furnace to facilitate the repair work.

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

Relieve the pressure on hydraulic equipment before carrying out maintenance or repair work (if applicable).

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 have been re-tightened,
 - Reinstall protective equipment, screens, and filters,
 - Remove all material, tools, and other equipment used for the maintenance or repair work from the working area of the furnace,
 - Remove any liquids that have leaked,
 - Check that all safety functions (e.g. emergency stop button) work properly,
- Power cables may be replaced only with similar, approved cables.

3.9 Environmental Regulations

All statutory duties regarding waste avoidance, proper recycling, and disposal must be observed when work is carried out on and with the furnace.

Problem materials that are no longer needed, such as lubricants or batteries, must not be placed in normal waste disposal systems or allowed to enter the sewage system.

During installation, repair, and maintenance work, substances that are hazardous to water, such as

- lubricating grease and oils
- hydraulic oils
- refrigerants
- solvent-based cleaning fluids must not be allowed to contaminate the soil or enter the sewage system.

These substances must be stored, transported, collected, and disposed of in suitable containers.



Note

The operator must ensure that national environmental regulations are observed.

When it is delivered, this furnace contains no substances that make a hazardous waste classification necessary. However, residues of process materials may accumulate in the furnace insulation during operation. These may be hazardous to health and/or the environment.

- Dismantle the electronic components and dispose of them as electric scrap.
- Remove the insulation and dispose of it as hazardous waste (See Servicing, Cleaning, and Maintenance with Ceramic Fiber Material)
- Dispose of the housing as scrap metal.

3.10 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.

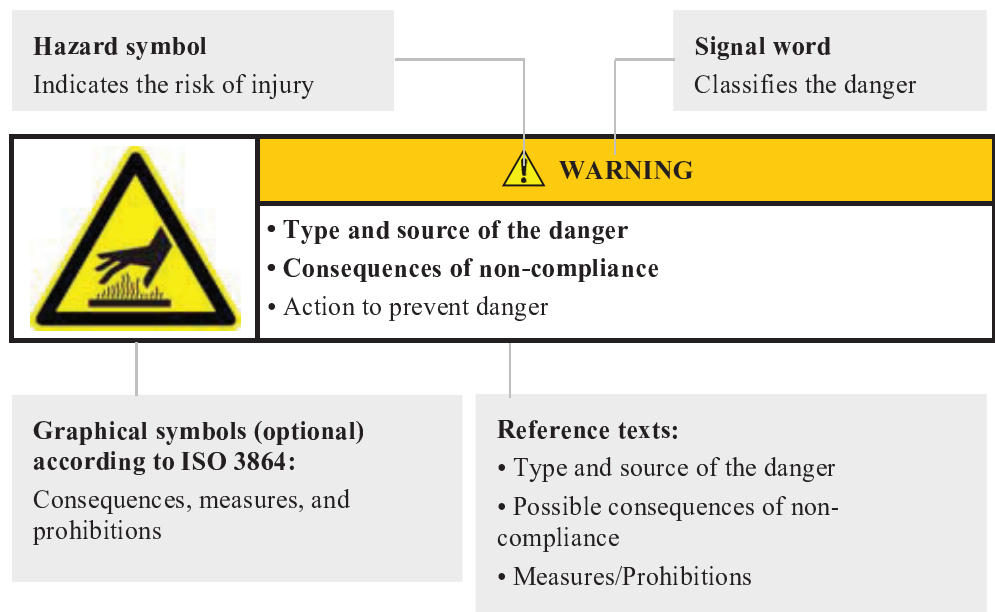
Graphic symbols correspond to **ISO 3864**. In accordance with the American National Standard Institute (ANSI) **Z535.6** the following warning information and words are used in this document:



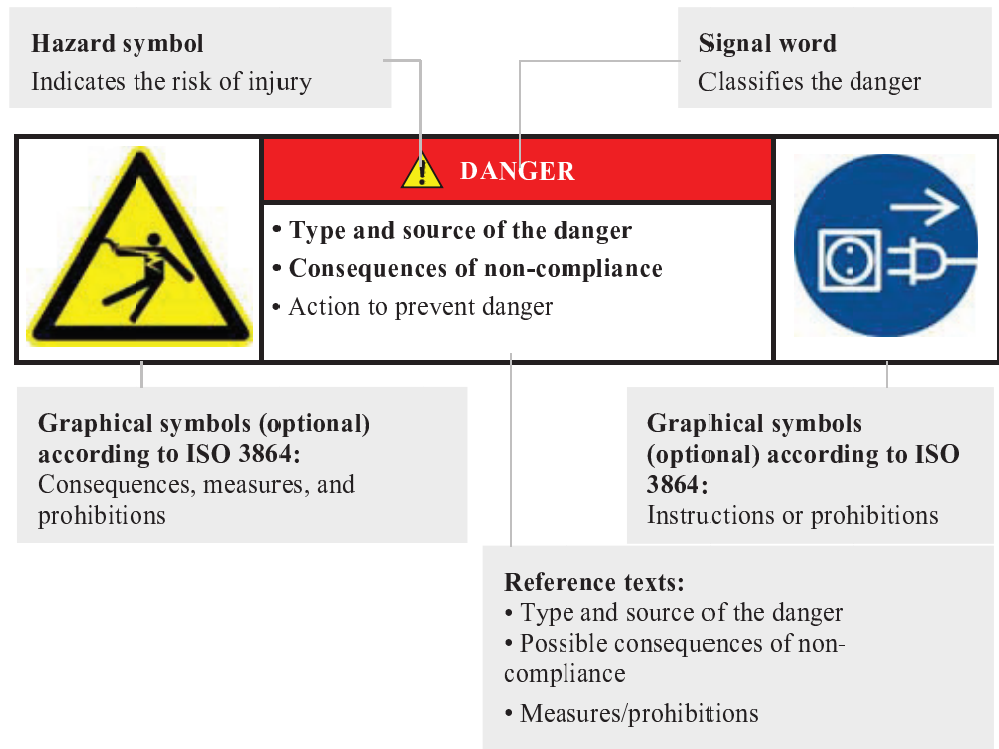
The general hazard symbol, in combination with the words **CAUTION**, **WARNING** and **DANGER** warns about the risk of serious injury. Observe the following information to prevent injury or death.

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



or



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 - Suspended Load**

This symbol warns the operator of potential dangers of suspended loads. Working below a suspended load is strictly forbidden. Ignoring this can lead to fatal injury.

**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.

**Warning - Risk to the Environment**

This symbol warns the operator of the risk to the environment if the following information is not heeded. The operator must ensure that national environmental regulations are observed.

**Warning - Fire Danger**

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

**Warning - Risk of Explosive Substances or Explosive Atmosphere**

These symbols warn the operator of explosive substances or an explosive atmosphere

**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

3.11 General Risks with the Furnace



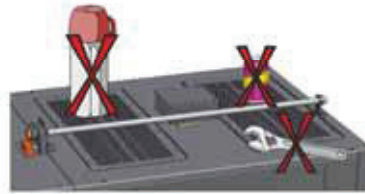
Warning! General Hazards!



- Risk of burning on the furnace housing and on the tube
- The door handle/grip can become very hot during operation; wear gloves.
- Risk of crushing on moving parts (door hinge, rotary tube drive, lifting table, etc.)
- 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.



Warning! General Hazards!

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

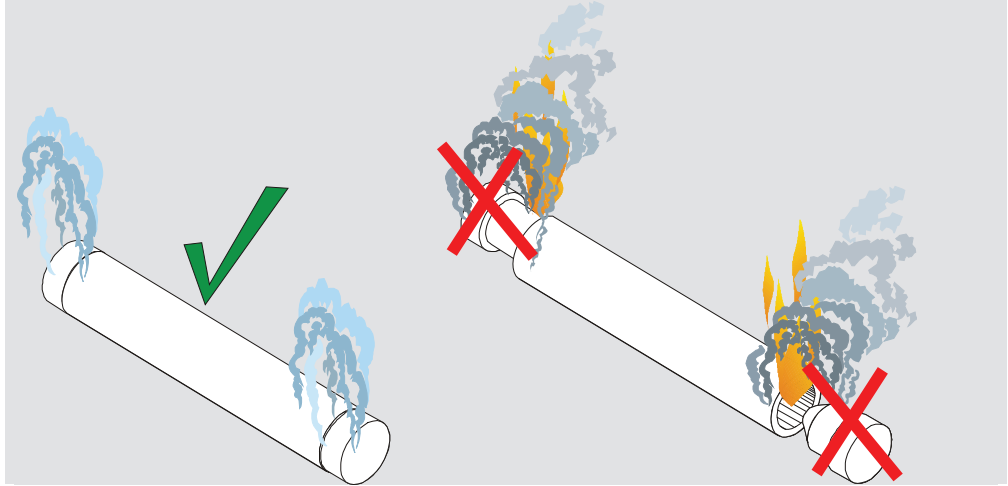


 DANGER	
	<ul style="list-style-type: none">• Danger caused by incorrectly entered cut-off temperature at the over-temperature limiter with manual reset/over-temperature limiter with automatic reset.• Mortal danger• If, as a result of over-temperature from the charge and/or the operating equipment, a 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.



Warning! General Hazards!

In case of unexpected events in the furnace (e.g. severe smoking or annoying odor), fiber plugs at the working tube must **not** be opened or removed. Doing so creates a fire or explosion hazard. Wait until the furnace has naturally cooled down to room temperature.



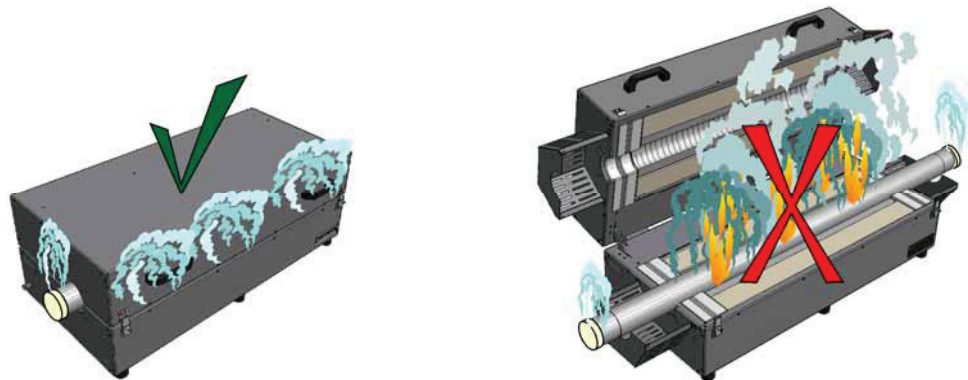
Warning - General hazards!

If unusual processes are occurring in the furnace (e.g., emission of heavy smoke or strong odors), do **not** open or remove the flange at the working tube. Doing so creates a fire or explosion hazard. Wait until the furnace has naturally cooled down to room temperature.



Warning - General hazards!

If unusual processes are occurring in the furnace (e.g., emission of heavy smoke or strong odors), do **not** open the furnace. Doing so creates a fire or explosion hazard. Wait until the furnace has naturally cooled down to room temperature.





Warning - Danger of Electric Shock!

A **protective earthing** of the metal working tube **must** be installed before the first furnace start-up. Danger: Electrocutation.

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. Wear safety footwear and a hard hat.

Safety Instructions

- Forklifts must be operated only by authorized personnel. The operator bears sole responsibility for safe operation and the load.
- 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.
- Use only lifting equipment with sufficient load-bearing capacity.
- 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.
- Unpackaged parts should only be lifted with ropes or straps.
- Attach transportation equipment only to positions intended for this purpose.
- Lifting and securing equipment must conform to the provisions contained in accident prevention regulations.
- Consider the weight of the furnace when choosing lifting and securing equipment. (see Specifications)
- Stainless steel parts (including mounting elements) must always be kept separate from unalloyed steel parts.
- Do not remove corrosion protection until immediately prior to assembly.



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.

4.2 Unpacking

Transporting with a forklift

Do not exceed the maximum permitted load for the forklift.

1. For unloading purposes, our furnaces are delivered on a wooden transport frame. Only transport the furnace packaged and using suitable transportation facilities to avoid possible damage. The packaging should only be removed at the installation location. During transportation, adequate protection to prevent slipping, tipping and damage must be ensured. Transportation and assembly work must be carried out by at least 2 persons. **Do not store the furnace in damp rooms or in the open air.**
2. Drive the forklift prongs under the transport frame of the furnace system, being careful of sensitive parts such as the attachments and lines and removing them if necessary. Make sure that the forks of the forklift are positioned **completely** under the transport frame. Note adjacent materials being transported.







Fig. 9: Forklift prongs are pushed **completely** beneath the transport frame

3. Carefully lift the furnace, paying attention to the center of gravity. When lifting the system, ensure that the ends of the fork and the load itself do not strike nearby stacked materials.
4. Check the furnace for stable position and attach transportation locks if necessary. Drive carefully, slowly, in the lowest position. Do not move along sloping surfaces.
5. Carefully set the furnace down at the installation location. Note adjacent materials being transported. Avoid sudden lowering.

	<p style="text-align: center;">⚠ CAUTION</p> <ul style="list-style-type: none"> • 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. 	
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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.
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.

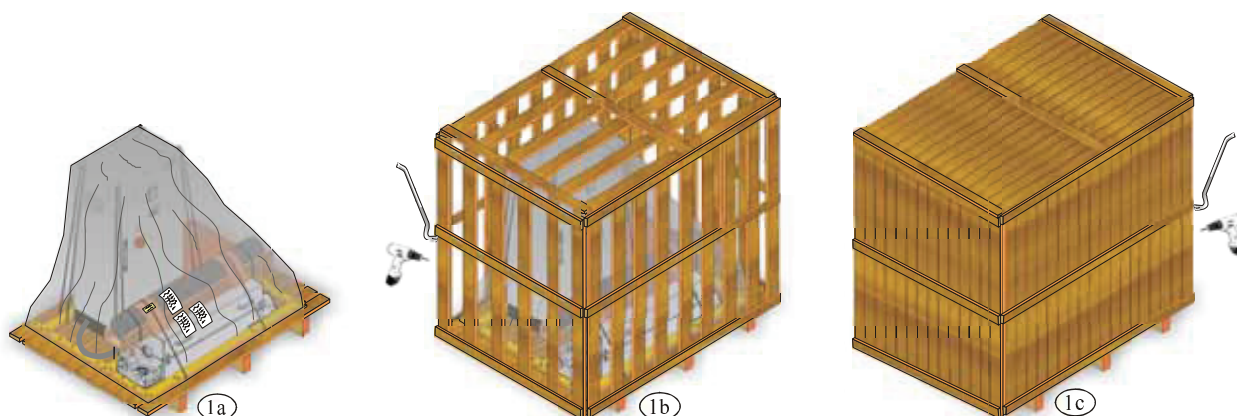


Fig. 10: Packaging unit of the furnace system as: 1a – subframe, 1b – wooden crate or as 1c – wooden box



Use hand guards

1. Check the transportation packaging for possible damage. The packaging varies according to size, weight and destination, and accordingly comes in one of the following forms: on a pallet (subframe), as a wooden crate or as a wooden box (see figures 1a to 1c).

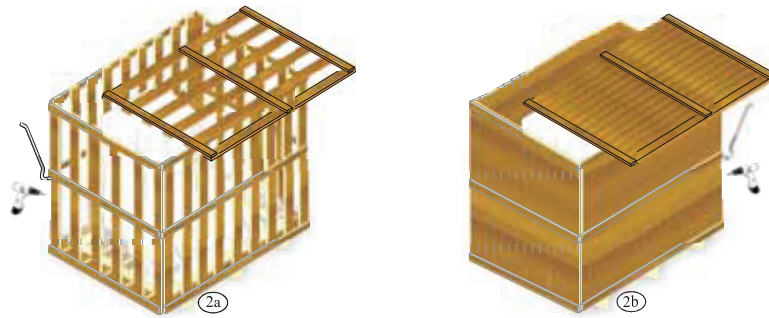


Fig. 11: Remove lid

- 2.. Loosen screws/cramps and then cautiously remove lid upwards.

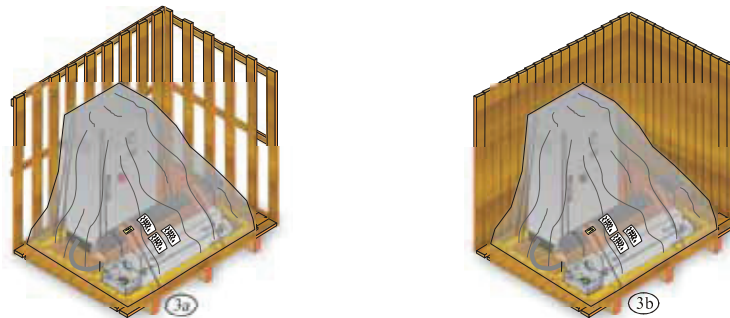


Fig. 12: Remove wooden crate

3. Loosen screws/cramps and then cautiously remove circumferential wooden crate from the subframe.

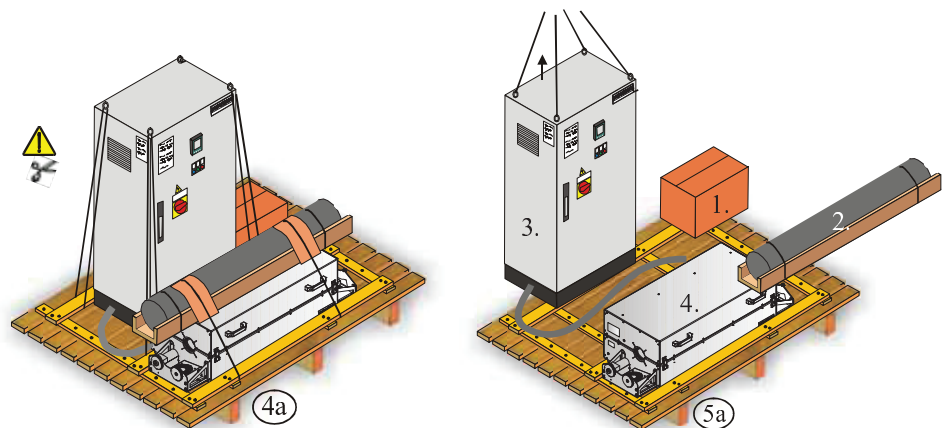


Fig. 13: Picture 4a-5a shows tube furnace model RSR with a horizontal operation model

4. Remove sheeting, straps and other packaging material. When cutting the sheeting and straps (see picture 4a) be careful not to damage cables and neighboring components. Remove small packages first, then the switchgear and finally the furnace (see picture 5a). Compare the delivered items with the delivery note and the order documents, see "Delivery".

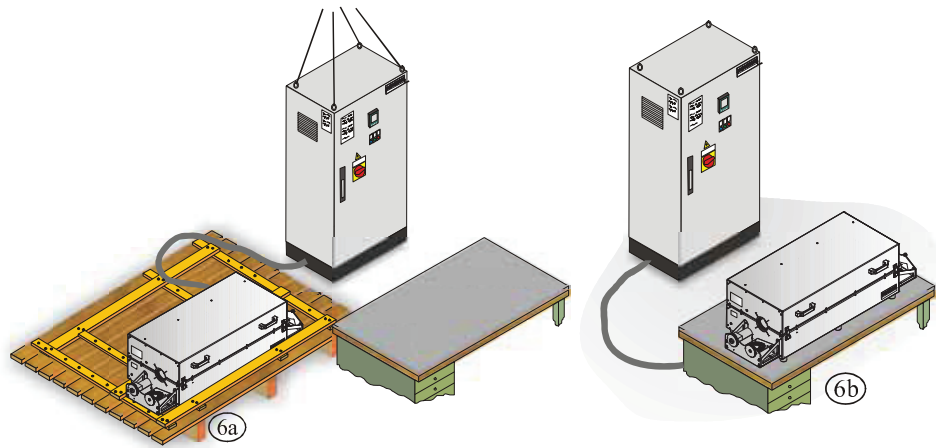
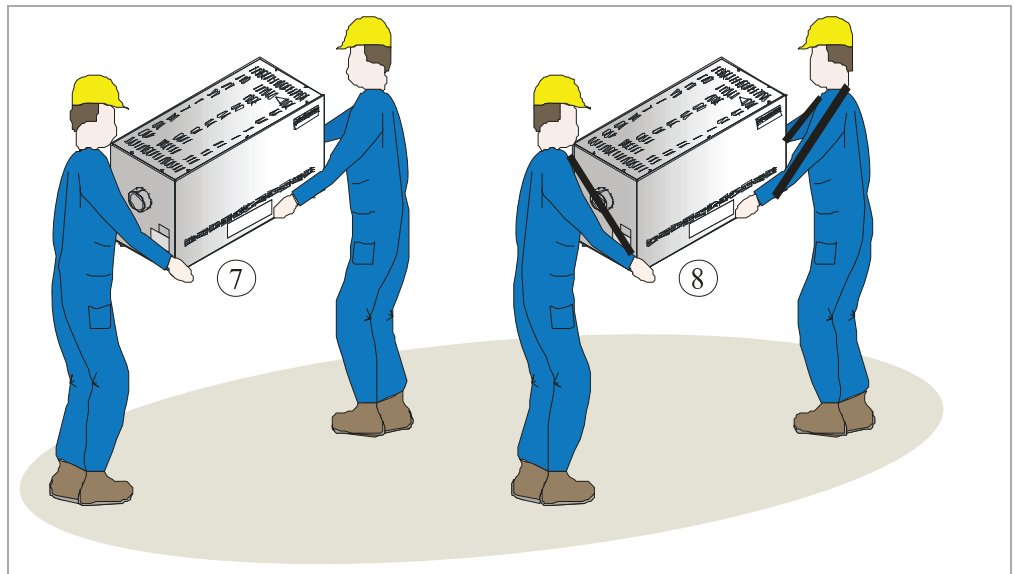


Fig. 14: Picture 6a-6b shows tube furnace model RS/RSR for horizontal operation

5. First lift the switchgear to the installation site (6a), then the furnace (6b). Pay attention to the max. cable length between the switchgear and the furnace. The cable must not be damaged. Lay the cable so that no one can stand on it or trip over it. A damaged cable must be replaced immediately.



6. Hold the furnace securely by the bottom sides to carry it.
7. For furnaces weighing more than 25 kg, transport work must be carried out by at least 2 people. If transport straps are used, they must be attached crosswise only. Ensure that they are secure.






Note

In Germany, the general accident prevention regulations VBG and BGZ must be observed. The national accident prevention regulations of the country of operation apply.



Note

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

	 CAUTION	
	<ul style="list-style-type: none"> • 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. 	

4.3 Transportation Securing Equipment/Packaging



Note
No special transportation securing equipment is available for this furnace

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



Caution - Damage to Components!
 Ceramic tubes are extremely heat-resistant, but easily breakable – therefore handle with care.

4.4 Constructional and Connection Requirements

When setting up the furnace, the following 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. The furnace must be placed on a **noncombustible** base (stone, metal, etc.).
- The carrying capacity of the table must be designed to bear the weight of the furnace incl. accessories.
- The floor covering must consist of non-flammable material, so that hot material falling out of the furnace will not cause the floor covering to ignite.

Despite good insulation, the furnace radiates heat from its external surfaces. If necessary, this heat must be conducted away (**a ventilation engineer must be consulted if required**). In addition, the furnace must be positioned at a minimum safety distance of 0.5 m on each side and 1 m above the furnace away from combustible materials. In individual cases more space must be chosen in order to match the local conditions. The minimum distance away from **noncombustible materials** may be reduced to 0.2 m at the **sides**.

Should gases or vapors escape from the charge, then sufficient air supply and ventilation at the installation location or an appropriate exhaust gas line must be provided.

A suitable exhaust for the burner exhaust must be provided by the customer.

Free-standing cabinet system

The floor must be even and allow the switching system to be installed in a properly level manner.

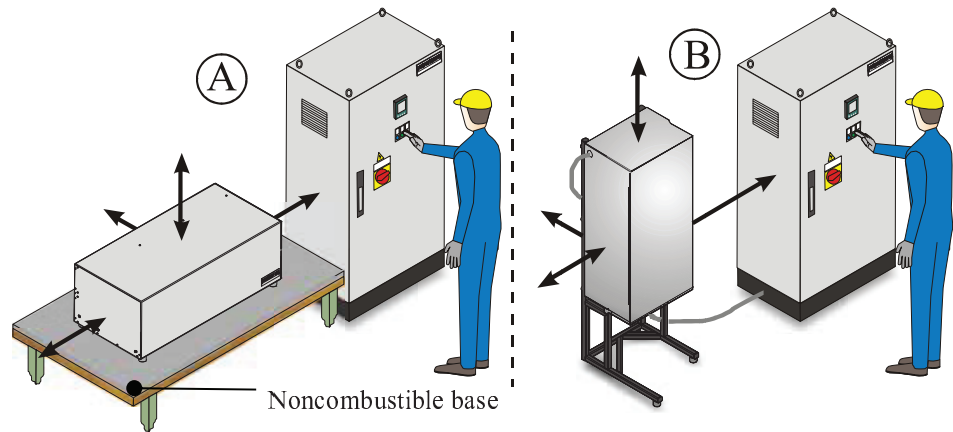


Fig. 15: Installation of a tube furnace with free-standing cabinet system
 A = Tube furnace model with horizontal operation
 B = Tube furnace model with vertical operation

Wall cabinet system

The wall must offer a secure fastening location. The top edge of the cabinet (C) box should have a maximum height of 2.00 m so that all controls can be reached easily.

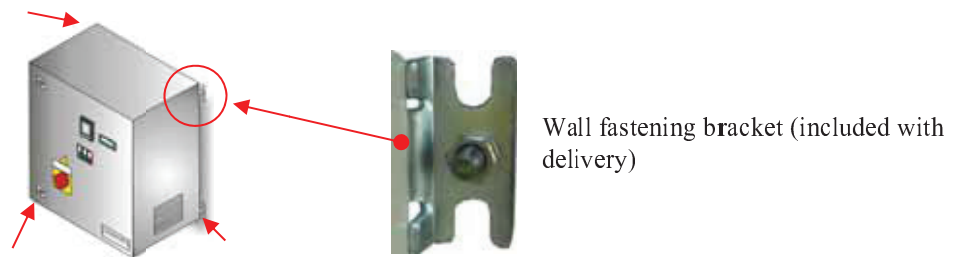


Fig. 16: Example: Wall cabinet system

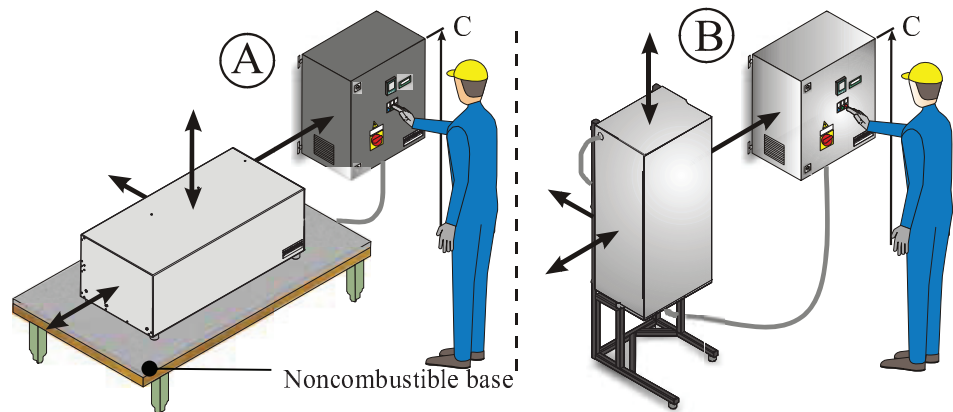




Fig. 17: Installation of a tube furnace with wall cabinet system
 A = Tube furnace model with horizontal operation
 B = Tube furnace model with vertical operation

	 DANGER
	<ul style="list-style-type: none"> • Danger associated with the use of an automatic 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.



The installation location must have sufficient ventilation.

Environmental conditions such as temperature and humidity can be found in the chapter "Technical data". At higher ambient temperatures than specified, we recommend the use of the switch cabinet cooling unit.


The switching system must be easy to access.

Moreover, the switching system must be protected against heat, dust and moisture.



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.

	WARNING
	<ul style="list-style-type: none"> • Overheating • Damage to the device • Do NOT install device in unventilated niches. • Ensure sufficient ventilation for dissipating heat.



Note

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

4.5 Assembly, Installation, and Connection

4.5.1 Venting Exhaust Fumes

We recommend placing the furnace system underneath a suction system in order to discharge the exhaust gases accordingly.

A commercially available metal exhaust gas pipe may be used as the discharge pipe. It must be laid so that it always slopes upwards and must be fastened to the wall or ceiling.

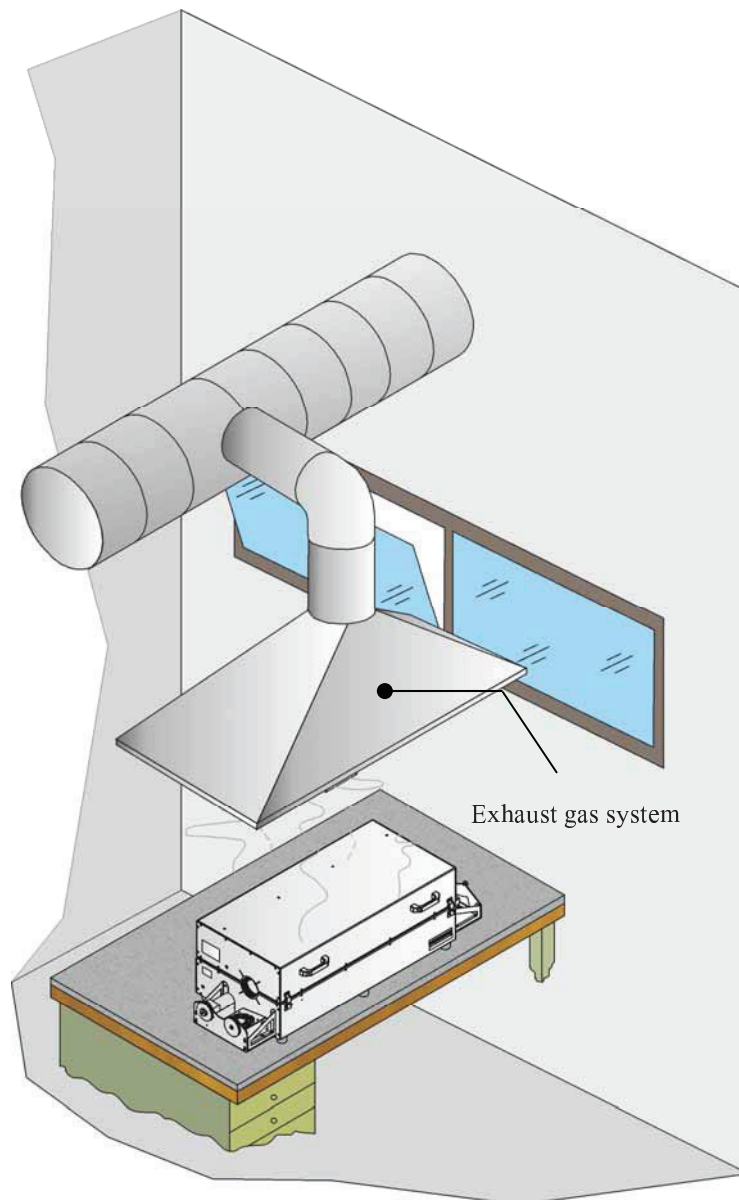


Fig. 18: Assembly of exhaust system (example)



Note

The exhaust gases can only be discharged if the room is aerated via an appropriate supply air opening.



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.

4.5.2 Connecting the Furnace to the Power Supply

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:**

- Speed-controlled drive technology
- Thyristor control of the heating in phase section operation.

Caution: Furnace systems that have a mains filter

Due to the use of mains filters for the purpose of complying with the EMC regulation, fuse protection using residual current circuit breakers is NOT possible.

- Testing of the earth resistance (compliant with VDE 0100); see also the accident prevent regulations.
- Electric facilities and operating equipment compliant with BGV A3.

Power Connection with Plug-In Power Line:

When you plug the power plug into an appropriate socket check the type plate for specifications related to mains voltage, mains type and max. power requirement. The distance between the furnace and the socket should be as short as possible. Extensions must be avoided.

The power plug (furnace with feeder) enables the furnace and control box to be connected and disconnected from the power grid.

The power plug must be easy to reach while the furnace is in operation to be able to pull it quickly in case of emergency (see section entitled "What to do in an emergency").

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.

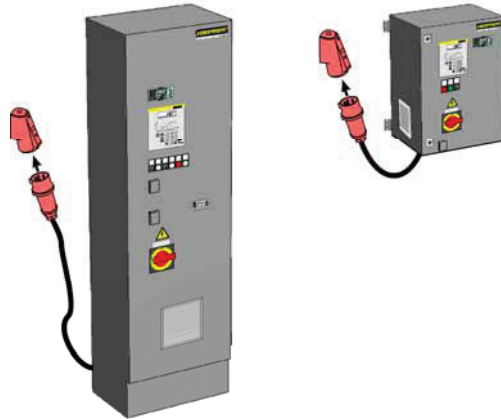


Fig. 19: Power connection **with** power cord

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

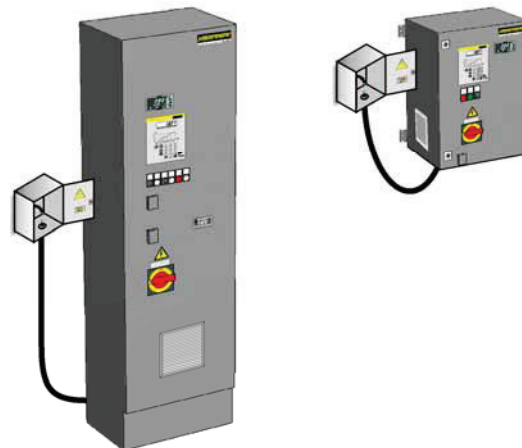




Fig. 20: Power connection **without** power cord

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.

	NOTICE	
	<ul style="list-style-type: none"> • 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. 	

4.5.3 Inserting/Introducing the Working Tube



Warning! Electrical Hazard!

Before inserting or introducing the working tube, ensure that the power switch is set to the "Off" or "0" position.



Warning! Electrical Hazard!

The furnace must not be put into operation without the working tube/protective caps. Otherwise there is a risk of electric shock.



Warning - General hazards! - Furnace opening temperature

Opening the furnace when hot (>180 °C / >356 °F) is prohibited. The resulting thermal shock can destroy the working tube and possibly the heating elements as well.



Caution - Damage to Components!

Ceramic tubes are extremely heat-resistant, but easily breakable – therefore handle with care.

Working Tubes Made of APM

Working tubes made of APM (CrFeAl alloy) must be oxidized during the start-up for optimum operating characteristics.

To generate a protective oxide film heat the furnace to 1000 °C (1832 °F) and hold this temperature for 2 hours. Ensure that there is an adequate supply of oxygen in the tube during the process.

When operating with reduced atmospheres (the use of protective gas) this procedure must be repeated at regular intervals.

Working Tube Made of Quartz

Working tubes made of quartz must be handled with cotton gloves at all times.

Contaminants, such as finger prints, can result in cracks in the material later at high temperatures. Contaminants may only be removed with alcohol (isopropanol).

If vacuum flanges are installed using silicon grease, ensure that the grease only comes into contact with the tube at the ground surface at the end of the tube. When the flanges are removed, the ground surface need not be cleaned.

	WARNING
	<ul style="list-style-type: none"> • Working tube • Danger of burning. • Do NOT touch working tube, load, flange. Wait until the furnace has naturally cooled down to room temperature.

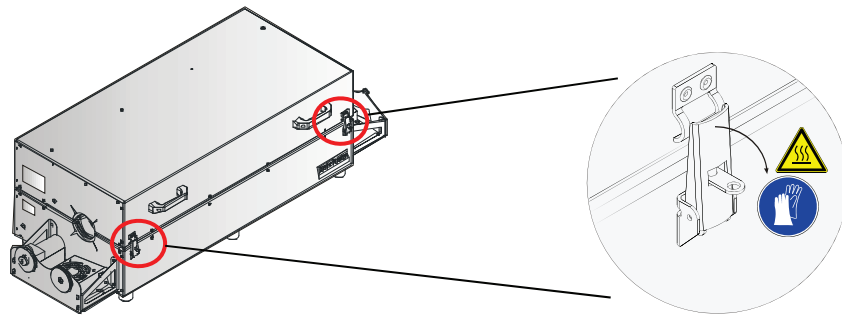


Fig. 21: Open furnace (quick release fastener)

The quick release fasteners on the furnace must be opened. During operation the temperatures of the handles and quick release fasteners can become very hot. Protective gloves must be worn or you must wait until the furnace naturally cools down to room temperature.

Observe the permissible furnace opening temperature whenever you open the furnace.

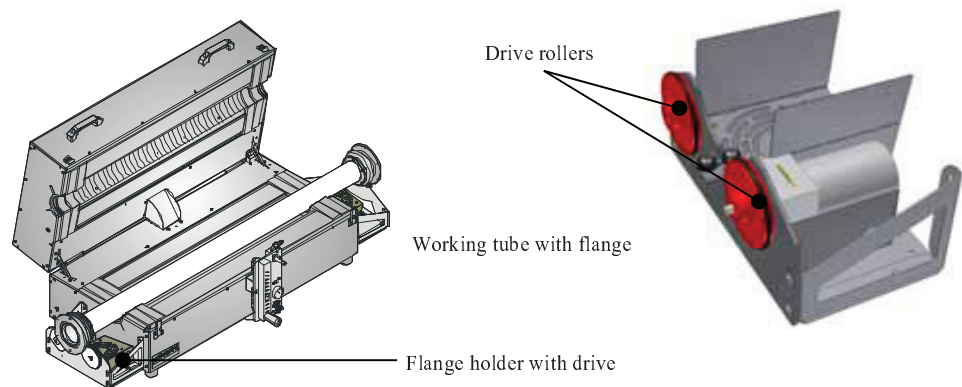


Fig. 22: Insert working tube

Take hold of the handle of the furnace lid and carefully close the furnace, After completely unpacking the working tube, set the working tube carefully into the lower half-dish module. Place the flange of the working tube on the drive rollers of the drive.

Make sure that there is no packaging material in the working tube.

Flange holders must be fitted before the working tube is set down (if not already fitted at the factory). Take hold of the handle of the furnace lid and carefully close the furnace, Depending on the size and the design of the furnace, the lid can be extremely heavy. The furnace must be closed with the quick release fasteners. The furnace may not be started if it has not been closed using the quick release fasteners.

Note

If the furnace is supplied without the working tube at the customer's request, the openings must be secured by protective caps at the factory. Removal of these protective devices and operating the furnace without working tube voids the conformity.

4.5.3.1 Use of Metal Working Tube (APM)



Warning! Electrical Hazard!

Before inserting or introducing the working tube, ensure that the power switch is set to the "Off" or "0" position.



Warning - Danger of Electric Shock!

A **protective earthing** of the metal working tube **must** be installed before the first furnace start-up. Danger: Electrocutation.

	⚠ DANGER	
	<ul style="list-style-type: none"> • Danger: If the working tube is not earthed, there is a danger of electrocution. • Electrocution is deadly • The connection between the working tube and the guide bush must be made by a trained expert using the earthing strap provided. 	

When operating the furnace with metal working tubes you must ensure that they are expertly earthed.

You must ensure that the earthing strap between pipe (1) and the guide bush (2) is expertly installed and connected. The seats of all screws, nuts and washers must be double-checked before start-up.

Both earthing brushes (3) must be checked to ensure their connection with the guide bush. The furnace must **not** be started if the earthing strap between the metal working tube and the guide bush has not been installed. Both earthing brushes (3) must be in contact with the guide bush since, otherwise, the heating system remains deactivated.

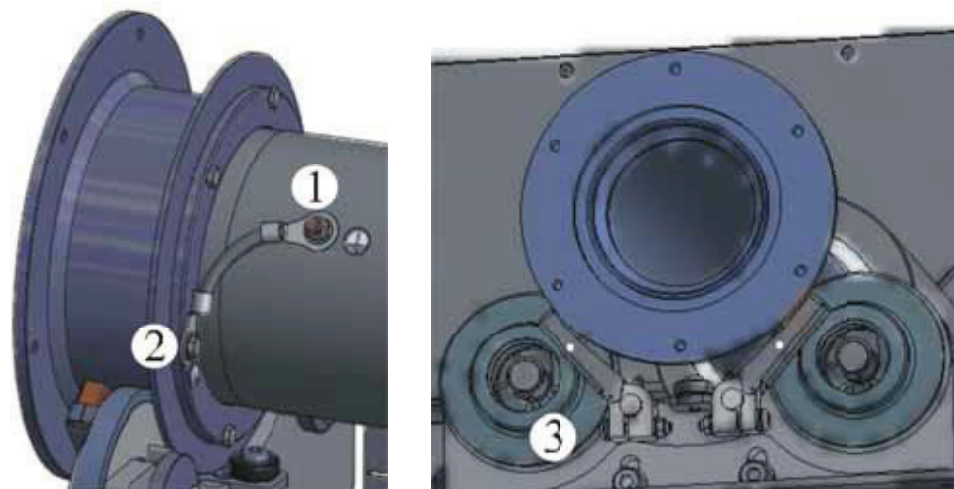


Fig. 23: Earthing strap and earthing brushes

**Note**

The furnace and the metal working tube are supplied with a protective assembly (earthing monitoring/protective earthing). If a protective assembly is removed and the furnace is operated without it, the valid conformity is expires.

4.6 Commissioning

Commissioning of the system may only be performed by qualified personnel observing the safety instructions.

Read the section "Safety" as well. When commissioning the system, the following safety instructions must absolutely be followed - this will avoid life-threatening injury to personnel, system damage, and other property damage.

Make sure that the instructions and notes in the controller instructions are observed and followed.

The system may only be used according to its intended purpose.

Make sure that only authorized personnel are located in the working area of the machine and that no other person is at risk due to the startup of the system.

Before the first start, check whether all tools, external parts, and transportation locks have been removed from the system.

Activate all safety systems (power switch, EMERGENCY STOP button if available) before commissioning.

Incorrectly wired connections can destroy electrical/electronic components.

Follow the special safety measures (e.g. grounding, etc.) for the components at risk.

Incorrect connections can cause unexpected startup of the system.

Inform yourself before starting the system about the proper behavior in case of malfunction and in case of emergency.

Before the first startup, check the electrical connections and control displays.

**Note**

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

**Note**

The furnace must not be put into operation without the working tube/protective caps. Otherwise there is a risk of electric shock.

**Note**

If the furnace is supplied without the working tube at the customer's request, the openings must be secured by protective caps at the factory. Removal of these protective devices and operating the furnace without working tube voids the conformity.

4.7 Recommendations for Heating the Furnace for the First Time



To achieve a protective oxide layer on the heating elements, the furnace must be heated to **100°C below the maximum temperature, depending on the employed working tube** and according to the **heating rates** given below. This temperature must be **maintained** for approx. **1 hour**. This process must be carried out on commissioning, after exchanging the heating elements or to regenerate the oxide layer. Odor pollution may occur during heating; this is due to the escape of binder from the insulating material. We recommend ventilating the furnace location well during the first heating phase.



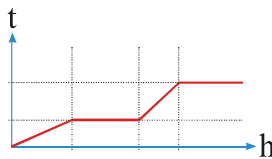
Dangers during normal operation!

When warming up the furnace the following warming-up rates, which vary depending on the working tube, must be observed unless explicitly otherwise stated.

Failing to observe these rates results in the destruction of the working tube and, possibly, of the heating elements.

Maximum permissible warming-up rates:

Depending on the application and temperature various working tubes are available. The technical specifications of the different working tubes can be found in the following table:



Material	Tube Outer Ø mm	Max. Warm-Up Rate K/h	Tmax Atmosphere * °C	Tmax in Vacuum °C	Gas-Tight
C 530 (Sillimantín)	< 120	unlimited	1300	not possible	no
	from 120	200			
C 610 (Pytagoras)	< 120	300	1400	1200	yes
	from 120	200			
C 799 (99.7 % Al ₂ O ₃)	< 120	300	1800	1400	yes
	from 120	200			
Quartz	all	unlimited	1100	950	yes
CrFeAl alloy (APM)	all	unlimited	1300	1100	yes

Working Tubes Made of APM

Working tubes made of APM (CrFeAl alloy) must be oxidized during the start-up for optimum operating characteristics.

To generate a protective oxide film heat the furnace to 1000 °C (1832 °F) and hold this temperature for 2 hours. Ensure that there is an adequate supply of oxygen in the tube during the process.

When operating with reduced atmospheres (the use of protective gas) this procedure must be repeated at regular intervals.

Working Tube Made of Quartz

Working tubes made of quartz must be handled with cotton gloves at all times. Contaminants, such as finger prints, can result in cracks in the material later at high temperatures. Contaminants may only be removed with alcohol (isopropanol).

If vacuum flanges are installed using silicon grease, ensure that the grease only comes into contact with the tube at the ground surface at the end of the tube. When the flanges are removed, the ground surface need not be cleaned.

5 Operation

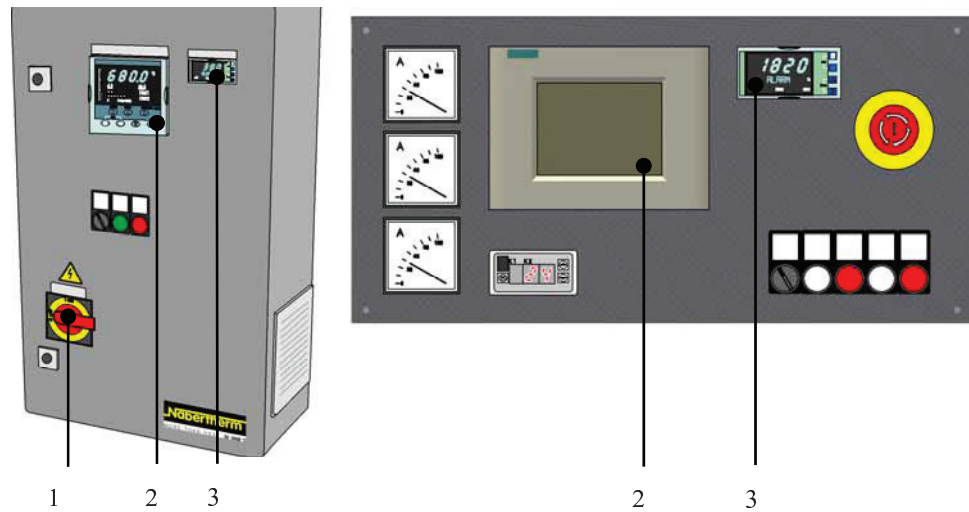
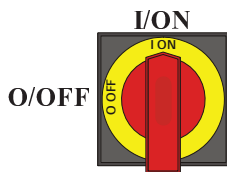




Fig. 24: Furnace system with controller



1. The power switch (1) is used to switch the control current on (I/ON) or off (O/OFF). When the control current is switched on, the heating chamber temperature is indicated in the LED display on the controller (2).
2. The desired heating and cooling program is set on the controller (2). See separate instructions for a description of the controller.
3. The temperature of the over-temperature limit controller (3) (optional) must be set 30°C higher than that of the controller. See separate operating instructions for a description of the over-temperature limit controller (TWB).

Caution

Continuous operation at maximum temperature can lead to increased wear of the heating elements and the insulation material. We recommend operating at approx. 50 °C below the maximum temperature.

 DANGER	
	<ul style="list-style-type: none"> • 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.

5.1 Over-Temperature Limiter with Manual Reset and Adjustable Cut-Off Temperature

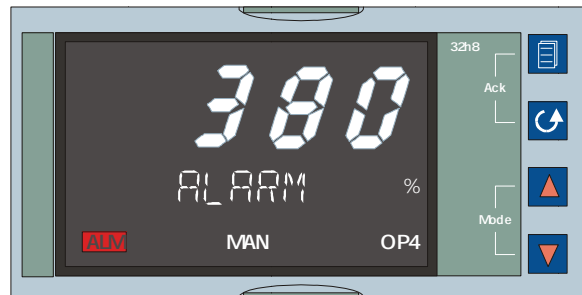















Fig. 25: Over-temperature limit controller with manual reset 32h8i

Key	Description	Display
	<p>The over-temperature limit controller with manual reset monitors the temperature in the furnace chamber. The display shows the last trigger temperature that was set. If the temperature in the furnace chamber exceeds the set trigger temperature, the heating is switched off to protect the furnace and the load. An alarm text appears at the over-temperature limit controller.</p> <p>When the temperature in the furnace chamber falls below the value set on the over-temperature limit controller, the following buttons have to be pressed to release the heating so that the furnace can continue to operate:</p> <p>Enable heating:</p>	<p>330 °C</p> <p>ALARM</p> <p>...</p>
 	<p>Simultaneously press  and . The alarm message of the overtemperature limiter is reset and the heating thereby enabled.</p>	
	<p>Setting the triggering temperature:</p> <p>Press  1x until "A1 H1" appears in the display</p>	<p>330</p> <p>A1 HI</p>
 	<p>Using the buttons  , set the desired triggering temperature (example 380°C)</p> <p>Increase the value with  (330 ... 379, 380)</p> <p>Decrease the value with  (380 ... 331, 330)</p> <p>Wait 2 seconds until the set triggering temperature is automatically applied (display flashes 1x).</p> <p>In input mode, if no entry or change is made within approx. 30 seconds, the mode is exited automatically.</p>	<p>380</p> <p>330</p> <p>A1 HI</p>
	<p>Input ended.</p>	
	<p>For further information on operation, see separate Eurotherm 32h8i operating instructions</p>	

5.2 Loading/Charging

Charging the Furnace

Only materials whose characteristics and melting temperatures are known may be heated. Consult any available safety-related material data sheets.

When charging the furnace make sure that the working tube or the heating elements are not damaged. Absolutely avoid touching the heating elements when inserting/introducing the working tube. This can result in the immediate destruction of the heating elements.

When a very large charge is loaded into the working tube the warm-up times can be substantially longer.

Personnel must wear the appropriate protective clothing, and the workspace must be adequately ventilated as stated in the section entitled "Safety".

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

Batch Operation

- The quick release fasteners on the furnace must be opened. During operation the temperatures of the handles and quick release fasteners can become very hot. Protective gloves must be worn or you must wait until the furnace naturally cools down to room temperature.
- Observe the permissible furnace opening temperature whenever you open the furnace.
- Open the flange on one side of the tube end.
- Hold the reactor diagonally and put in the desired amount of load through the open tube end into the reactor.
- Hold the reactor horizontally and shake it slightly left to right so that the load is uniformly distributed in the reactor
- Set the reactor carefully into the furnace.
- Take hold of the handle of the furnace lid and carefully close the furnace, Depending on the size and the design of the furnace, the lid can be extremely heavy. The furnace must be closed with the quick release fasteners. The furnace may not be started if it has not been closed using the quick release fasteners.
- As necessary, it is possible to connect, for example, vacuum pumps (with quartz tubes to maximum 950 °C) or gas panels to the working tube (available as options).
- We recommend leaving the load in the furnace until it is completely cooled off.



Warning - Danger of Electric Shock!

For the protection of the operator and the furnace the heating program must always be stopped before the furnace is charged. Ignoring this warning can result in electric shock.

Through-Put Operation

- Open the flange on one side of the tube end so that the whole tube diameter is available for charging.
- Set the inclination of the furnace using the tilting frame to approx. 5 - 10°.
- Place suitable heat-resistant containers under the lower end of the tube.
- The load can be charged.
- Set the desired through-put speed of the load with the inclination of the furnace and the rotational speed of the tube.

Trial / Mixed Operation

- To conduct various trials it is possible to seal the flange to the tube ends with lids fitted with gas seals (KF system).
- As necessary it is possible to connect, for example, vacuum pumps (with quartz tubes to maximum 950 °C) or gas panels to the working tube (available as options).
- We recommend leaving the load in the furnace until it is completely cooled off.



Warning - Danger of Electric Shock!

For the protection of the operator and the furnace the heating program must always be stopped before the furnace is charged. Ignoring this warning can result in electric shock.



Warning - General hazards! - Furnace opening temperature

Opening the furnace when hot (>180 °C / >356 °F) is prohibited. The resulting thermal shock can destroy the working tube and possibly the heating elements as well.



Caution - Damage to Components!

Ceramic tubes are extremely heat-resistant, but easily breakable – therefore handle with care.

	WARNING
	<ul style="list-style-type: none"> • Working tube • Danger of burning. • Do NOT touch working tube, load, flange. Wait until the furnace has naturally cooled down to room temperature.

6 Servicing, Cleaning, and Maintenance



Warning! General Hazards!

Cleaning, lubrication, and maintenance tasks may only be performed by authorized experts following the maintenance instructions and accident protection guidelines. We recommend that maintenance and repair be performed by Nabertherm GmbH Service. Failure to comply runs the risk of bodily injury, death, or significant property damage!



Warning - Danger due to Electrical Current!

Work on the electrical equipment may only be performed by qualified, authorized electricians!



During maintenance work, the voltage supply to the furnace and/or switching system must be switched off to prevent unintentional commissioning. Disconnect the mains power connector due to reasons of safety.

Operators may only correct malfunctions which are obviously due to operational error! Wait until the furnace chamber and attaching parts have cooled to room temperature.

The furnace must be visually inspected at regular intervals for damage. The interior of the furnace must also be cleaned as required (e.g. vacuuming out) **Attention:** Do not bang against the heating elements to avoid breaking them.

While work is being performed on the furnace, the furnace and work room must additionally be ventilated with fresh air.

Safety systems removed during maintenance tasks must be replaced after the work.

Warning of swinging loads in the workshop (e.g. crane systems). Work under a lifted load (e.g. a lifted furnace or switching system) is not permitted.

Safety switches and any limit switches present must be checked for function periodically (BGV A3) or according to the national guidelines of the country of operation.

To ensure proper temperature regulation of the furnace, the thermocouple must be checked for damage before every process.

If necessary, retighten the element holders (see chapter "Replacing the Heating Element"). Before carrying out this work, the voltage supply to the furnace and/or switching system must be switched off (disconnect mains power connector). The regulations (BGV A3) or corresponding national regulations in the relevant country of operation must be observed.

There are one or more contactors in the control system. The contacts of these circuit breakers are wearing parts and must therefore be serviced and/or replaced regularly (BGV A3) or according to the national guidelines of the country of operation.

The switching system cabinet (if available) contains vent grilles with integrated filter mats. These must be cleaned and/or replaced at regular intervals in order to ensure sufficient intake and outflow of air from the switching system. During melting operation, the switching cabinet door must always be firmly closed.



This Furnace contains Ceramic Fiber Material in the Insulation.

Active handling of these fibers (e.g., exchange of the insulation) in the Federal Republic of Germany is subject to the conditions of the Ordinance on Hazardous Substances, Annex V, No. 7 ("Artificial mineral fibers") of June 12, 1998. In the rest of the European Union, ceramic fibers are categorized as follows by Directive 97/69/EC of the Commission of December 5, 1997 CARC. Cat. 2; R 49; Xi R 38. Work with the fiber insulation must therefore be done in such a way that as little fiber dust as possible is released.

The Following Points must be Noted when Handling Ceramic Fiber:

- Dust development during processing should be minimized.
- Contact with skin and eyes should be avoided. The effects caused by fibers on the skin or in the eyes may cause mechanical irritation, as a result of which reddening and itching may occur.
- When processing large quantities of ceramic fibers, loose work clothing with long sleeves, gloves and safety glasses should be worn.
- When working with ceramic fiber insulation inside furnaces, a half/quarter mask with P2 filter should additionally be worn.

The furnace and its operating equipment must be regularly checked in accordance with the regulations of the employer's liability insurance association (BGV A3) or the corresponding national regulations in the relevant country of use!



6.1 Shutting the System Down for Maintenance



Warning! General Hazards!

Cleaning, lubrication, and maintenance tasks may only be performed by authorized experts following the maintenance instructions and accident protection guidelines. We recommend that maintenance and repair be performed by Nabertherm GmbH Service. Failure to comply runs the risk of bodily injury, death, or significant property damage!

Wait until the furnace chamber and attached parts have cooled to room temperature.

- The furnace must be completely emptied
- Inform operating personnel and name supervisors
- Switch off main switch and/or disconnect the power cord.
- Lock the main switch (if available) and secure against restoration of power using a padlock.
- Attach a warning sign on the main switch
- Clean up the maintenance area as far as possible.
- Check for disconnection of power.
- Ground and short-circuit the working area.
- Cover any nearby parts still under power.



Warning - Dangers During Normal Operation!

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



Warning - Danger of Electric Shock!

Work on the electrical equipment may be done only by qualified, authorized electricians. During work it must be ensured that the furnace and the switching equipment cannot be activated by mistake (pull out the power plug) and that all moving parts in the furnace are secured. Observe BGV A3 or the corresponding national regulations in the country where the furnace is installed. Wait until the furnace and the connected parts have cooled to room temperature.



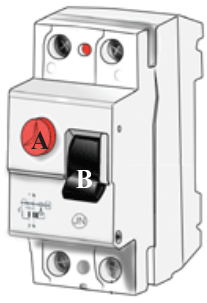
6.2 Regular Maintenance of the Furnace

Item/ maintenance point	Action	Maintenance Interval					Operati ng	Qualifi ed
		Day	Week	Month	Quarte r	Year	Personnel	
Safety test in accordance with BGV A3 or corresponding national regulations	According to regulations					●		X
EMERGENCY STOP device	Press the button or power switch	●					X	
Drives and 3rd-party subassemblies (if present)	Maintain according to manufacturers' instructions.							X

Item/ maintenance point	Action	Maintenance Interval					Operati ng	Qualifi ed
		Day	Week	Month	Quarte r	Year	Personnel	
	Visual inspection.							
Safety and limit switches (if present)	Perform functional test					●		X
Furnace chamber, exhaust holes and pipes	Clean and check for damage; vacuum out carefully	●					X	
Sealing surfaces: Door collar	Visual inspection	●					X	
Seals (if present)	Clean/replace		●				X	
Heating elements	Visual inspection		●					X
Working tube, fiber plugs and flanges	Visual inspection. E.g. check for cracks	● ■				●		X
Check for uniform power consumption by heating system	Functional test					●	X	
Thermocouple	Visual check of display at the controller				●		X	
Check setting values	Check according to work schedules	●					X	
Settings at the over-temperature limit controller (if present)	Each time the heat treatment program is changed	●					X	
Metal Working Tube (APM)	The earthing connection between the working tube and the guide bush must be checked before starting operation and each time the metal working tube is replaced						X	

Legend:	■ = clean	● = check, replace	x = performed by
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Fig. 26: Maintenance table

 <p>Example</p>	<p>Note</p> <p>Ground fault circuit interrupters (earth leakage circuit breakers) installed on the rear side (see section on "Overall View of the System") are equipped with a test button (A) for carrying out a simple function test. The test button should be operated for checking every 4 weeks. The test is successful if the switch (B) jumps to "0" when the test button is pressed. Following the successful test, set the switch back to "I". If the switch does not jump to "0", have the defective ground fault circuit interrupter replaced by a qualified electrician and checked by means of a measuring device. The system must not be put in operation without a functioning ground fault circuit interrupter. For performing the test the furnace system must be switched on.</p>
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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.



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.



Warning - Danger of Electric Shock!

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



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 Operating and Auxiliary Materials

6.4 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)

This list must be completed by the operator.	
Component and location	Detergent
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)
*) 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. 27: 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.

 	 DANGER	
	<ul style="list-style-type: none"> • Danger of electric shock. • Risk of fatal injury • Before cleaning, pull out the power plug. • Do NOT pour water or cleaning products over the inside or outside surfaces • Allow furnace to dry completely before operating it again 	



Carry out the procedure to switch off the furnace (see "Operation") Then pull the power plug out of the socket. Allow the furnace to cool naturally.

Cleaning the Feed Screw

The feed screw and the O-ring must be cleaned at regular intervals. Regular cleaning is a responsibility of the operator.

- For cleaning release the quick-release locking wheels ① and carefully remove the feed screw ② from the tube for cleaning. For the disassembly of the feed screw we recommend using a soft, clean surface to protect the individual parts. Make sure that you do not damage the cable of the drive motor.
- Make sure that all deposits, foreign particles, etc. in the tube are thoroughly cleaned out.
- Remove the O-ring ③ from the tube for cleaning. Check the seal for possible damage. A damaged seal must be immediately replaced with a seal of the same quality.
- Immediately report any damage to your supervisor or to the Nabertherm Service Department.
- The feed screw and the O-ring are re-assembled in the reverse sequence.

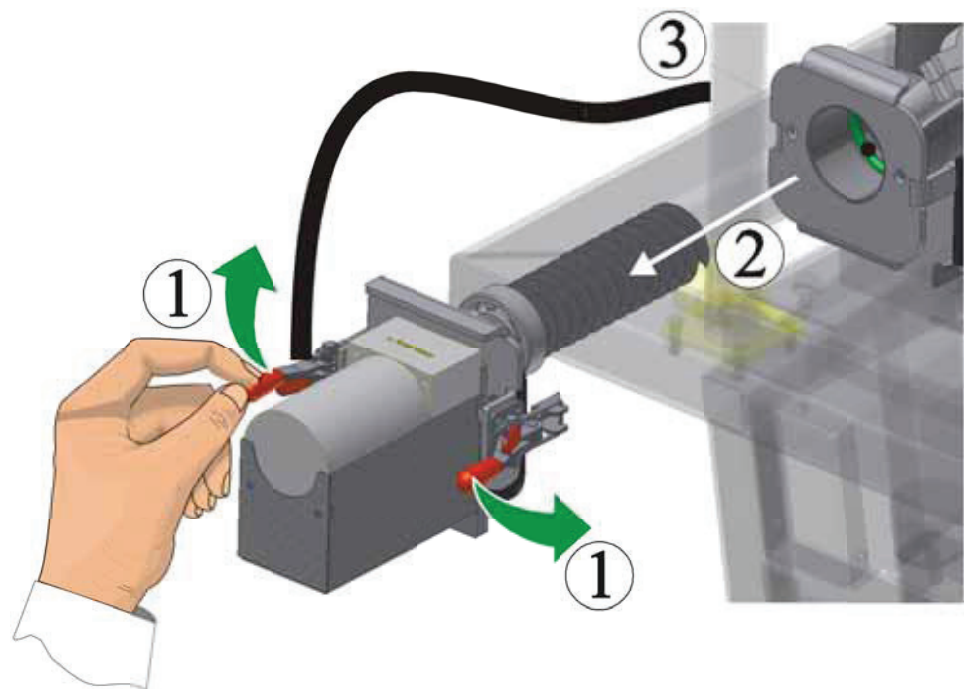


Fig. 28: Cleaning the feed screw.

7 Malfunctions

Work on the electrical system may be done only by qualified, authorized electricians. Operators may only rectify malfunctions that are obviously due to operating errors. Call the local electrician for malfunctions that you cannot localize.

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

Type of malfunction	Possible causes	Correcting the malfunction
Controller does not switch on.	-No voltage available. -Controller defective.	-Check connection fuse(s), renew if necessary. -Check controller fuses (if available), renew if necessary. -Check plug connector. -Have checking carried out by Nabertherm Service.
Controller indicates malfunction.	-See separate instructions for controller.	-See separate instructions for controller.
No heating chamber heating after starting program.	-Error in program input. -Connection fuse(s) defective. -Heating element defective	-Check heating program (see separate instructions for controller) -Check connection fuse(s), renew if necessary. Notify Nabertherm Service if the new fuse trips on screwing in. -Have checking carried out by Nabertherm Service.
Very slow heating of the heating chamber	-Connection fuse(s) defective.	-Check connection fuse(s), renew if necessary. Notify Nabertherm Service if the new fuse trips on screwing in.
Selected end temperature not reached.	-Lack of heater output due to undervoltage. -Heating element defective -Ends of the working tube not closed (fiber plugs, vacuum flanges)	-Have checking carried out by Nabertherm Service. -Close ends of the working tube (fiber plugs, vacuum flanges)
Heating system remains shut off/the heating chamber is not heated	Earthing brushes are not in contact with the guide bush.	Check earthing brushes and, if necessary, replace (see section "Spare/Wearing Parts")

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.

No.	Designation	Order Number		Quantity	Comment	▶
1	Furnace					
1.1	Half-dish module	1100 °C	1300 °C			○
	RSR 80-500/...	692200038	692200032	2		
	RSR 80-750/...	692200028	692200034	2		
	RSR 120-500/...	692200039	692200041	2		
	RSR 120-750/...	692200040	692200030	2		
	RSR 120-1000/...	692200031	692200029	2		
1.2	Fiber paper	1100 °C	1300 °C			○
	1 mm	691600929		*		
	2 mm	691600399		*		
	3 mm	691600414		*		
1.3	Fiber wool	1100 °C	1300 °C			○
		691600518		*		
2	Electrical/Controllers					
2.1	Thermocouple	1100 °C	1300 °C			
	Type K	540300060				○
	Type S		540300007			
2.2	Semi-conductor circuit breaker				1) 2)	
2.3	Earthing brushes	1100 °C	1300 °C			○
2.3.1	Brush holder	691405228	691405228			
2.3.2	Brushes	691405229	691405229			
2.3.3	Bolts	691405230	691405230			
3	Tool					
	Allen key	493000009		1		
1) = see circuit diagram, 2) = spare part supply depending on design, * = quantity as needed						



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

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.



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 Repairing the Insulation

The insulation of the furnace consists of a very high-quality refractory material. Heat expansion may cause tears in the insulation even after a few heating cycles. However, these have no affect on the function or quality of the furnace. However, if entire "sections" of the insulation come loose, Nabertherm Service must be notified.

9 Accessories (Options)

9.1 Laboratory Gas Supply Station



Gas panel (individual panel)
for simple protective gas applications.



Gas panel (double panel)
for operating with two non-combustible types of gas.

Fig. 29: Laboratory gassing stations


Gassing station are conceived for commercial applications in laboratories. Nabertherm furnaces can be upgraded with various equipment packages for operation with non-combustible gases. The various equipment packages can be delivered together with the furnace, but also at a later time as well. You can select from gas panels which function just manually or both manually and automatically. We provide gas supply systems for non-combustible protective gas (argon Ar, nitrogen N₂ and inert gas N₂H₂) with shut-off valve, flowmeter and control valve.









Note

See additional operating instructions for description and function

9.2 Available Working Tubes

 Dimensions Outer Ø x Inner Ø x Length in mm	Order-number (Part number)	Continuous rotary furnace RSR					Batch rotary furnace RSR-B					Universal rotary furnace RSR-U									
		1100 °C					1300 °C					1100 °C					1100 °C, 1300 °C				
		80-500	80-750	120-500	120-750	120-1000	80-500	80-750	120-500	120-750	120-1000	80-500	80-750	120-500	120-750	120-1000	80-500	80-750	120-500	120-750	120-1000
Ceramic tube C 530																					
80 x 65 x 1540	601404699	○				●										○					
Spare tube	691404536																				
80 x 65 x 1790	601404700		○		○		●		○								○		○		
Spare tube	691404537																				
80 x 65 x 2040	601404701									○										○	
Spare tube	691404538																				
110 x 95 x 1540	601404702			○				●										○			
Spare tube	691404539																				
110 x 95 x 1790	601404703				○				●										○		
Spare tube	691403376																				
110 x 95 x 2040	601404704									○										○	
Spare tube	691404540																				
Ceramic tube C 610																					
80 x 65 x 1540	601404705	○								○							○				
Spare tube	691404541																				
80 x 65 x 1790	601404706		○		○			○		○							○		○		
Spare tube	691404542																				
80 x 65 x 2040	601404707										○									○	
Spare tube	691404543																				
110 x 95 x 1540	601404708			○					○									○			
Spare tube	691404544																				
110 x 95 x 1790	601404709				○					○									○		
Spare tube	691404561																				
110 x 95 x 2040	601404710										○									○	
Spare tube	691403437																				
Quartz tube																					
76 x 70 x 1540	601404711	●								○		○					○				
Spare tube	691404545																				
76 x 70 x 1790	601404712		●		○				○		○						○		○		
Spare tube	691404546																				
76 x 70 x 2040	601404713										○									○	
Spare tube	691404547																				
106 x 100 x 1540	601404714			●							○							○			
Spare tube	691403519																				
106 x 100 x 1790	601404715				●							○							○		
Spare tube	691403305																				
106 x 100 x 2040	601404716													○						○	

 Dimensions Outer Ø x Inner Ø x Length in mm	Order-number (Part number)	Continuous rotary furnace RSR					Batch rotary furnace RSR-B					Universal rotary furnace RSR-U									
		1100 °C					1300 °C					1100 °C					1100 °C, 1300 °C				
		80-500	80-750	120-500	120-750	120-1000	80-500	80-750	120-500	120-750	120-1000	80-500	80-750	120-500	120-750	120-1000	80-500	80-750	120-500	120-750	120-1000
Spare tube	691404548																				
Quartz tube with nubs																					
76 x 70 x 1540	601404717	○					○										○				
Spare tube	691404549																				
76 x 70 x 1790	601404718		○		○			○		○							○		○		
Spare tube	691404550																				
76 x 70 x 2040	601404719					○					○										○
Spare tube	691404551																				
106 x 100 x 1540	601404720			○					○									○			
Spare tube	691404552																				
106 x 100 x 1790	601404721				○					○									○		
Spare tube	691403442																				
106 x 100 x 2040	601404722					○					○										○
Spare tube	691404553																				
Quartz reactors																					
76 x 70 x 1140	601402746											●		●							
Spare tube	691402548																				
76 x 70 x 1390	601402747												●		●						
Spare tube	691402272																				
106 x 100 x 1140	601402748													●							
Spare tube	691402629																				
106 x 100 x 1390	601402749														●						
Spare tube	691402638																				
Quartz reactors with nubs																					
76 x 70 x 1140	601404723											○		○							
Spare tube	691402804																				
76 x 70 x 1390	601404724												○		○						
Spare tube	691403429																				
106 x 100 x 1140	601404725													○							
Spare tube	691403355																				
106 x 100 x 1390	601404726														○						
Spare tube	691403295																				
Quartz mixing reactors																					
76 x 70 x 1140	601404727											○									
Spare tube	691403407																				
76 x 70 x 1390	601404728												○		○						
Spare tube	691404554																				
76 x 70 x 1540	601404729															○		○			
Spare tube	691404555																				
76 x 70 x 1790	601404730															○		○			
Spare tube	691404562																				
76 x 70 x 2040	601404731																				○
Spare tube	691404556																				
106 x 100 x 1140	601404732													○							
Spare tube	691404557																				
106 x 100 x 1390	601404733														○						

 Dimensions Outer Ø x Inner Ø x Length in mm	Order-number (Part number)	Continuous rotary furnace RSR					Batch rotary furnace RSR-B					Universal rotary furnace RSR-U									
		1100 °C					1300 °C					1100 °C					1100 °C, 1300 °C				
		80-500	80-750	120-500	120-750	120-1000	80-500	80-750	120-500	120-750	120-1000	80-500	80-750	120-500	120-750	120-1000	80-500	80-750	120-500	120-750	120-1000
Spare tube	691404558																				
106 x 100 x 1540	601404734																	○			
Spare tube	691404559																				
106 x 100 x 1790	601404735																		○		
Spare tube	691403451																				
106 x 100 x 2040	601404736																				○
Spare tube	691404560																				

*) Only working tubes with outside diameters as when the furnace was acquired may be used, since the insulation of the furnace was drilled to this dimension.



Key

- Standard working tube.
- Working tube optionally available.
 - 1) For use with water-cooled end flanges.
 - 2) With welded flanges for use with water-cooled flange covers.
 - 3) Tubes/rectors, incl. attached sleeves for the rotary drive. Replacement tubes without sleeves.

9.3 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.

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.

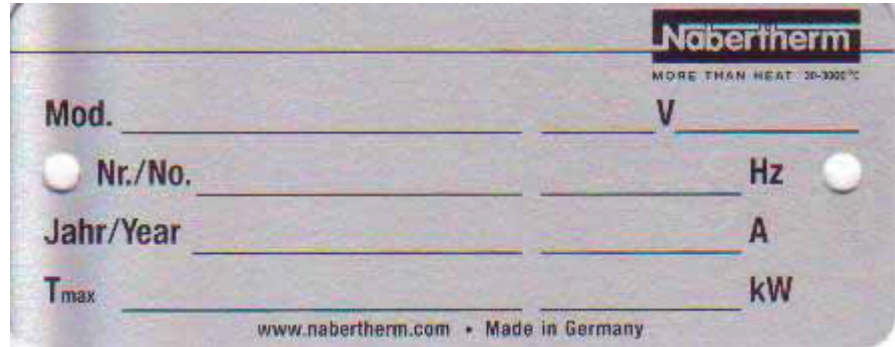


Fig. 30: Example: Type plate

11 Shut-Down, Dismantling, and Storage

To be Completed by the Operator

When the furnace is shut down, the following safety information must be observed to prevent serious injury, damage to property, and damage to the environment.

The furnace may only be shut down by authorized, trained personnel.



The following operating materials/parts are to be disposed of by:

Oils and other substances that are hazardous to water must be completely removed before the furnace is dismantled for reuse or scrap.

Ensure that operating materials, lubricants, and consumables are disposed of in an environmentally compliant manner. Regulations relating to proper waste recycling and disposal must be observed.

The furnace may be lifted only at the intended points.

Use only the stated lifting and securing equipment to lift the furnace/parts.

Consider a total weight of _____ kg when choosing suitable lifting equipment.

For transportation, consider a permitted floor weight of at least _____ kg/m².



Before transporting the furnace, attach the following securing equipment:



Note

Read the sections on "Safety" and "Transportation"

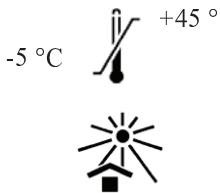
11.1 Transportation/Return Transportation



If you still have the original packaging, this is the safest way to send a furnace.

Otherwise:

Choose suitable, adequately sturdy packaging. During transportation, packages are often stacked, bumped, or dropped; the packaging acts as external protection for your furnace.



- Drain all piping and containers before transportation/return transportation (e.g. cooling water). Pump off operating materials and dispose of properly.

- Do not subject the furnace to extreme cold or hot temperatures (direct sunlight).

Storage temperature -5 °C to 45 ° (-23 °F to 113 °F)

Humidity 5 % to 80 %, non condensing

- Place the furnace on a level floor to prevent distortion.

- Packaging and transportation may be carried out only by qualified and authorized persons

If your furnace has transportation securing equipment (see "Transportation Securing Equipment"), use this.

Otherwise, in general:

"Fix" and "secure" (adhesive tape) all moving parts and cushion and protect any projecting parts against breakage.

Protect your electronic equipment against moisture and make sure that no loose packaging material can get inside it.

Fill gaps in your packaging with soft but adequately firm material (e.g. foam mats) and make sure that the equipment cannot slide around in the packaging.

If the goods are damaged during return transportation due to inadequate packaging or some other breach of duty, the costs will be borne by the customer.

As a rule:

The furnace is sent without accessories, unless the technician expressly requests them.

Enclose a detailed description of the malfunction along with the furnace – this saves the technician time and costs.

Don't forget to enclose the name and phone number of a contact in case there are any questions.



Note

Return transportation may only be carried out according to the information given on the packaging or in the transportation documents.



Note

Transportation and return transportation **not** covered by a warranty claim are paid for by the customer.

12 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 rotary tube furnace

Model	RSR ...-.../11	RSR ...-.../13
	RSR-B ...-.../11	

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 2006/95/EC for electrical equipment designed for use within certain voltage limits
- Directive 2004/108/EC 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 746-1 (02.2010)
- DIN EN 60204-1 (06.2007)
- DIN EN 61010-1 (07.2011)
- DIN EN 60519-1 (10.2011), DIN EN 60519-2 (05.2007)
- DIN EN 61000-6-2 (03.2006), DIN EN 61000-6-4 (09.2011)

Lilienthal, 29.05.2007

Thomas Adamek
Quality Management

Wolfgang Bartilla
Research and Development



MORE THAN HEAT 30-3000 °C

Headquarters:

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