Nabertherm
MORE THAN HEAT 30-3000 °C

Operating Instructions

Laboratory Furnaces (Muffle Furnaces)

L / LE / LT / LV / LVT -SKM -SW -HA

-> 10.2005

Original instructions

Made in Germany

www.nabertherm.com

Reg: M01.0032 ENGLISCH
Rev: 2011-01

1 Introduction

Dear Customer,

Thank you for choosing a quality product from Nabertherm GmbH.

You can be proud that you have chosen an oven 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)

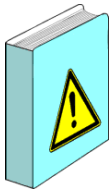
Protective Rights

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 oven.

1.1 Product Description



These laboratory 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.

Laboratory Furnaces are attractive thanks to their many advantages. These furnaces are all-rounders for research and laboratory applications. They are made from expertly finished, high-quality materials and are easy to operate. These furnaces are optimally designed for incinerating and heat treatment. The very best insulation materials permit energy-saving operation and fast heating times thanks to low heat storage and thermal conductivity. Laboratory furnaces attain furnace chamber temperatures of max. 1100 °C (2012 °F), 1200 °C (2192 °F) or 1300 °C (2372 °F).

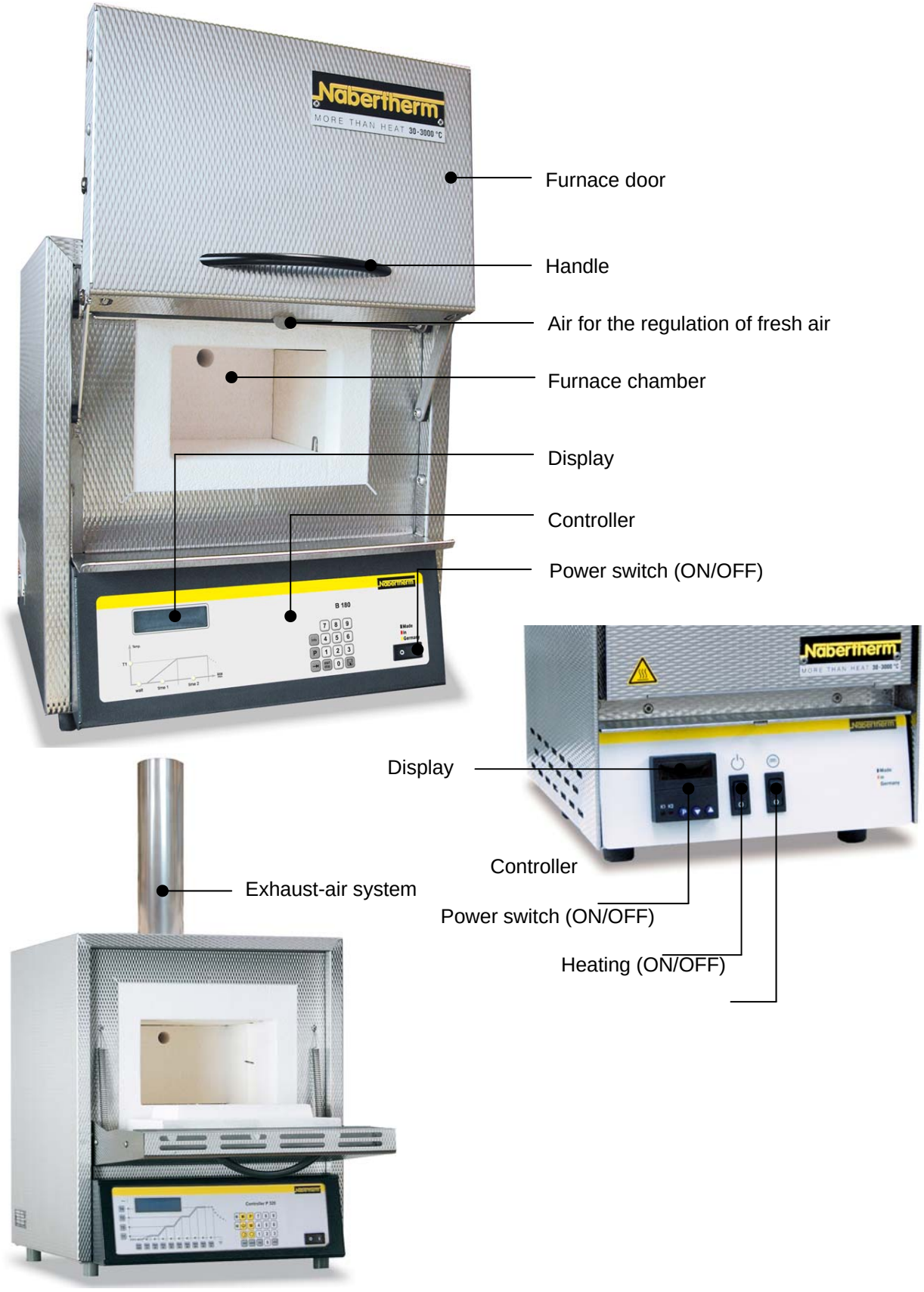
Other characteristics of this product are:

- All the models have a high-quality, multi-layered and energy-saving thermal insulation
- Double-wall housing means low outer temperatures and solid stability. All furnaces have housings made of textured stainless steel sheet.
- Good temperature uniformity provided by special air supply and exhaust system for models LV/LVT .../… and LT …/…HA. For models LV/LVT .../… the system delivers more than 6 air changes a minute. The incoming air is pre-heated, so that a good temperature uniformity is ensured.
- There are furnaces with drop-down doors or lift doors
- Ceramic heating plates with integrated heating wire, protected against splattering and exhaust-air for models L/LT …/… and LV/LVT .../…
- Model L/LT …/…/**SW** with scale and software (Controltherm MV) for annealing loss specifications
- All the models are equipped with a controller which provides considerable safety against operator mistakes. The furnace chamber temperature is measured and regulated by a long-life thermocouple (NiCr-Ni Tmax < 1100 °C or PtRh-Pt Tmax > 1100 °C).

Additional Equipment

- Vent, vent with fan or catalytic converter.
- Over-temperature limit controller with adjustable shut-down temperature for thermal protective class 2 as specified in EN 60519-2 to protect the furnace and the ware against overheating.
- Manual or automatic protective gas system Protective gas connection on the back side of the furnace
- Digital interface RS 422, for example, for process control and documentation provided by Controltherm MV software package.
- Base plates and catch basins to protect of the furnace and to enable easy charging
- Rectangular container, stackable for charging on several levels

1.2 Overview of the Complete Oven



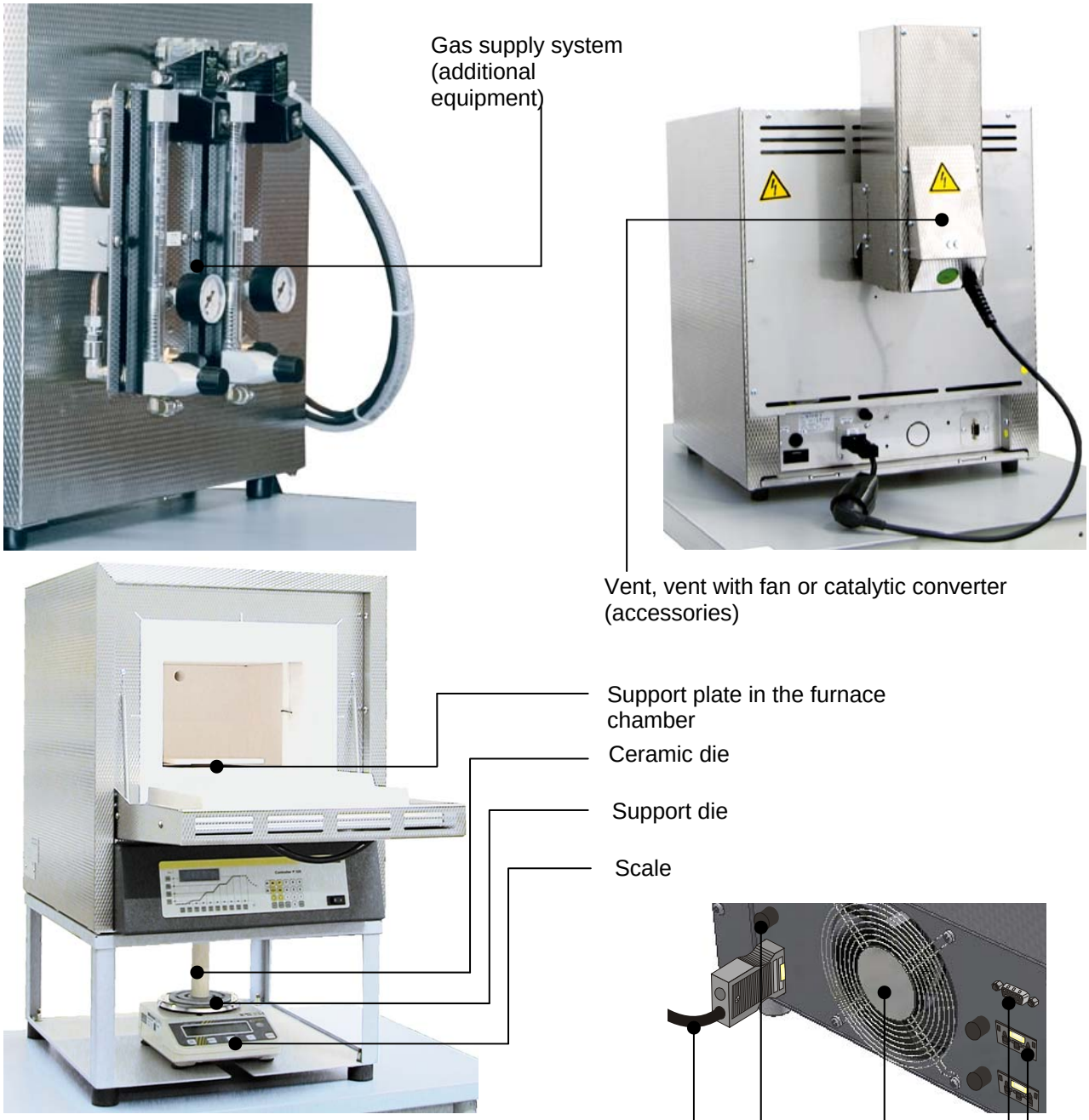


Fig. 1: Example: Complete overview of various laboratory furnaces

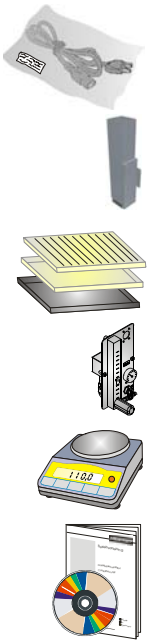
1.3 Key to the Model Names

Example	Explanation
LT 9/11SKM	**L** = Laboratory furnace with drop-down door **LE** = Laboratory furnace economy series **LT** = Laboratory furnace with lift door **LV** = Laboratory incinerator with drop-down door **LVT** = Laboratory incinerator with lift door
LT **9**/11SKM	**1** = 1-liter furnace chamber (volume in L) **2** = 2-liter furnace chamber (volume in L) **3** = 3-liter furnace chamber (volume in L) **4** = 4-liter furnace chamber (volume in L) **5** = 5-liter furnace chamber (volume in L) **6** = 6-liter furnace chamber (volume in L) **9** = 9-liter furnace chamber (volume in L) **14** = 14-liter furnace chamber (volume in L) **15** = 15-liter furnace chamber (volume in L) **24** = 24-liter furnace chamber (volume in L) **40** = 40-liter furnace chamber (volume in L)
LT 9/**11**SKM	**11** = Tmax 1100 °C (2012 °F) **12** = Tmax 1200 °C (2192 °F) **13** = Tmax 1300 °C (2372 °F)
LT 9/11**SKM**	**HA** = Laboratory furnace with recirculating air fan in the back wall **SKM** = Furnace chamber made of ceramic muffle **SW** = Scale furnace with support frame and scale

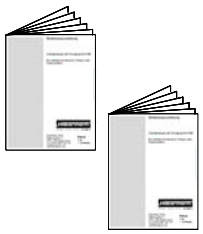
Fig. 2: Example: Model designation (type plate)

1.4 Scope of Delivery

The scope of delivery includes:



Furnace components	Quantity	Comment
Laboratory furnace 1)	1 x	Nabertherm GmbH
Power cable 1)	1 x	Nabertherm GmbH
Vent) 2) Vent with fan 1) 2) Catalytic converter 1) 2)	1 x	
Ceramic ribbed plate Ceramic ceramic catch basin Steel catch basin	4)	
Gas supply system 2)	1 x	Nabertherm GmbH
Scale 2)	1 x	Nabertherm GmbH
Process documentation Controltherm MV software package 1) 2)	1 x	Nabertherm GmbH
Other components, variable depending on the particular furnace	- - -	Consult the shipping papers



Document type	Quantity	Comment
Instruction Manual Laboratory Furnace 1)	1 x	Nabertherm GmbH
Operating Instructions for Controller 1)	1 x	Nabertherm GmbH
Operating Instructions gas supply system 1)	1 x	Nabertherm GmbH
Operating Instructions Controltherm MV software package 1)	1 x	Nabertherm GmbH
Other documents, variable depending on the particular furnace	- - -	

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

Caution

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

2 Specifications

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

Muffle Furnace

Model Drop-Down Door	Tmax °C	Dimensions Interior in mm w	d	h	Dimensions Outer in mm W	D	H	Volume in l	Capacity kW max.	Weight kg	Minutes to Tmax [1)]
L 3/11	1100	160	140	100	380	370	420	3	1.2	20	60
L 5/11	1100	200	170	130	440	470	520	5	2.4	35	60
L 9/11	1100	230	240	170	480	550	570	9	3.0	45	75
L 15/11	1100	230	340	170	480	650	570	15	3.6	55	90
L 24/11	1100	280	340	250	560	660	650	24	4.5	75	95
L 40/11	1100	320	490	250	600	790	650	40	6.0	95	95
L 1/12	1200	90	115	110	250	265	340	1	1.5	10	25
L 3/12	1200	160	140	100	380	370	420	3	1.2	20	75
L 5/12	1200	200	170	130	440	470	520	5	2.4	35	75
L 9/12	1200	230	240	170	480	550	570	9	3.0	45	90
L 15/12	1200	230	340	170	480	650	570	15	3.6	55	105
L 24/12	1200	280	340	250	560	660	650	24	4.5	75	110
L 40/12	1200	320	490	250	600	790	650	40	6.0	95	110

1) = for connection to 230 V 1/N/PE or 400 V 3/N/PE

Muffle Furnace

Model Lift Door	Tmax °C	Dimensions Interior in mm w	d	h	Dimensions Outer in mm W	D	H	Volume in l	Capacity kW max.	Weight kg	Minutes to Tmax [1)]
LT 3/11	1100	160	140	100	380	370	420+165	3	1.2	20	60
LT 5/11	1100	200	170	130	440	470	520+220	5	2.4	35	60
LT 9/11	1100	230	240	170	480	550	570+290	9	3.0	45	75
LT 15/11	1100	230	340	170	480	650	570+290	15	3.6	55	90
LT 24/11	1100	280	340	250	560	660	650+335	24	4.5	75	95
LT 40/11	1100	320	490	250	600	790	650+335	40	6.0	95	95
LT 3/12	1200	160	140	100	380	370	420+165	3	1.2	20	75
LT 5/12	1200	200	170	130	440	470	520+220	5	2.4	35	75
LT 9/12	1200	230	240	170	480	550	570+290	9	3.0	45	90
LT 15/12	1200	230	340	170	480	650	570+290	15	3.6	55	105
LT 24/12	1200	280	340	250	560	660	650+335	24	4.5	75	110
LT 40/12	1200	320	490	250	600	790	650+335	40	6.0	95	110

1) = for connection to 230 V 1/N/PE or 400 V 3/N/PE
2) = incl. opened lift door

Muffle Furnace

Model Drop-Down Door	Tmax °C	Dimensions Interior in mm w h	d		Dimensions Outer in mm W H	D		Volume in l	Capacity kW max.	Weight kg	Minutes to Tmax [1)]
L 5/13	1300	200	170	130	440	470	520	5	2.4	45	45
L 9/13	1300	230	240	170	480	550	570	9	3.0	50	50
L 15/13	1300	230	340	170	480	650	570	15	3.6	60	60
1) = for connection to 230 V 1/N/PE or 400 V 3/N/PE											

Muffle Furnace

Model Lift Door	Tmax °C	Dimensions Interior in mm w h	d		Dimensions Outer in mm W	D	H	Volume in l	Capacity kW max.	Weight kg	Minutes to Tmax [1)]
LT 5/13	1300	200	170	130	440	470	520+220	5	2.4	42	45
LT 9/13	1300	230	240	170	480	550	570+290	9	3.0	60	50
LT 15/13	1300	230	340	170	480	650	570+290	15	3.6	70	60
1) = for connection to 230 V 1/N/PE or 400 V 3/N/PE 2) = incl. opened lift door											

Compact Muffle Furnace

Model Drop-Down Door	Tmax °C	Dimensions Interior in mm w h	d		Dimensions Outer in mm W H	D		Volume in l	Capacity kW max.	Weight kg	Minutes to Tmax [1)]
LE 1/11	1100	90	115	110	250	265	340	1	1.5	10	10
LE 2/11	1100	110	180	110	275	380	350	2	1.8	10	25
LE 4/11	1100	170	200	170	335	400	410	4	1.8	15	35
LE 6/11	1100	170	200	170	510	400	320	6	1.8	18	35
LE 14/11	1100	220	300	220	555	500	370	14	2.9	25	40
1) = for connection to 230 V 1/N/PE or 400 V 3/N/PE											

Incinerator

Model Drop-Down Door	Tmax °C	Dimensions Interior in mm w h	d		Dimensions Outer in mm W Hb+[2)]	D		Volume in l	Capacity kW max.	Weight kg	Minutes to Tmax [1)]
LV 3/11	1100	160	140	100	380	370	750	3	1.2	20	120
LV 5/11	1100	200	170	130	440	470	850	5	2.4	35	120
LV 9/11	1100	230	240	170	480	550	900	9	3.0	45	120
LV 15/11	1100	230	340	170	480	650	900	15	3.6	55	120
1) = for connection to 230 V 1/N/PE or 400 V 3/N/PE 2) = incl. exhaust air pipe (Ø 80 mm)											

Incinerator

Model Lift Door	Tmax °C	Dimensions Interior in mm w	d	h	Dimensions Outer in mm W	D	Hb+[2)]	Volume in l	Capacity kW max.	Weight kg	Minutes to Tmax [1)]
LVT 3/11	1100	160	140	100	380	370	750	3	1.2	20	120
LVT 5/11	1100	200	170	130	440	470	850	5	2.4	35	120
LVT 9/11	1100	230	240	170	480	550	900	9	3.0	45	120
LVT 15/11	1100	230	340	170	480	650	900	15	3.6	55	120

1) = for connection to 230 V 1/N/PE or 400 V 3/N/PE
2) = incl. exhaust air pipe (Ø 80 mm)

Muffle Furnace

Model Drop-Down Door/ Lift Door	Tmax °C	Dimensions Interior in mm w	d	h	Dimensions Outer in mm W	D	H+Ha [2)]	Volume in l	Capacity kW max.	Weight kg	Minutes to Tmax [1)]
L 9/11/SKM	1100	230	240	170	480	550	570	9	3.0	50	90
LT 9/11/SKM	1100	230	240	170	480	550	570+290	9	3.0	50	90

1) = for connection to 230 V 1/N/PE or 400 V 3/N/PE
2) = incl. opened lift door

Muffle Furnace

Model Drop-Down Door	Tmax °C	Dimensions Interior in mm w	d	h	Dimensions Outer in mm W	D	H	Volume in l	Capacity kW max.	Weight kg	Minutes to Tmax [1)]
L 9/11/SW	1100	230	240	170	480	550	800	9	3.0	55	75
L 9/12/SW	1200	230	240	170	480	550	800	9	3.0	55	90

1) = for connection to 230 V 1/N/PE or 400 V 3/N/PE

Muffle Furnace

Model Drop-Down Door	Tmax °C	Dimensions Interior in mm w	d	h	Dimensions Outer in mm W	D	H	Volume in l	Capacity kW max.	Weight kg	Minutes to Tmax [1)]
LT 9/11/SW	1100	230	240	170	480	550	800+290	9	3.0	55	75
LT 9/12/SW	1200	230	240	170	480	550	800+290	9	3.0	55	90

1) = for connection to 230 V 1/N/PE or 400 V 3/N/PE
2) = incl. opened lift door

Scale

Type	Readability in g	Weight Range in g	Stamp Weight in g	Calibration Value in g	Minimum Load in g
EW-1500	0.01	1500 incl. stamp	850	0.1	0.5
EW-3000	0.01	1500 incl. stamp	850	0.1	0.5
EW-6000	0.10	1500 incl. stamp	850	1.0	5.0

Muffle Furnace

Model Lift Door	Tmax °C	Dimensions Interior in mm w	d	h	Dimensions Outer in mm W	D	H	Volume in l	Capacity kW max.	Weight kg	Minutes to Tmax [1)]
LT 5/11HA	1100	200	160	130	440	470	520+220	5	2.4	36	60
LT 9/11HA	1100	230	230	170	480	550	570+290	9	3.0	46	60
LT 15/11HA	1100	230	330	170	480	650	570+290	15	3.6	56	75
1) = for connection to 230 V 1/N/PE or 400 V 3/N/PE 2) = incl. opened lift door											

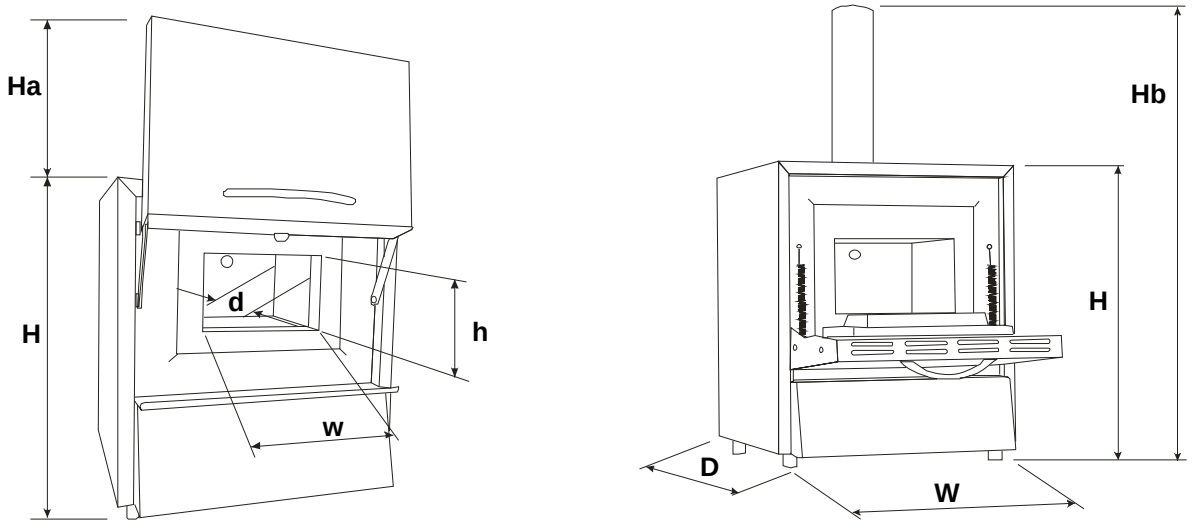


Fig. 3: Dimensions

Electrical connection		1-phase: (1 N/PE)	3-phase: (3 N/PE)
	Model:	to 3.6 kW	from 4.5 kW
	Power plug	Protective contact plug (with snap-in socket) 	CEE plug 
	Voltage:	110 V – 240 V 220 V – 240 V	380 V – 480 V
	Frequency:	50 or 60 Hz	

	Heating output in kW:	see section "Specifications" or type plate on the furnace
Thermal protection class	Furnaces:	**as specified in DIN EN 60519-2** without safety controller Class 0
Protective type	Furnaces:	IP20
Ambient conditions for electrical equipment	Temperature: Humidity:	+5 °C to + 40 °C max. 80 % not condensing

Emissions	Continuous sound pressure level:	< 80 dB(A)

2.1 Warranty and Liability

§

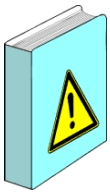
As regards warranty and liability, the normal Nabertherm warranty terms apply, unless individual terms and conditions have been agreed. However, the following conditions also apply:

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 oven 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 oven as intended,
- Improper installation, start-up, operation, or maintenance of the oven,
- Operation of the oven 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 oven,
- Making unauthorized changes to the oven,
- 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 ovens. 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 as well as 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.

Opening the furnace when hot (temperature greater than 200/392 °C/°F) can lead to accelerated wear of the following components: insulation, heating elements, and furnace housing.

Operating with power sources, products, operating equipment, additives, etc. that are subject to the Ordinance on Hazardous Substances or cause 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 heating food, animals, wood, grain, etc.
- 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 as a clothes dryer.

Note

See safety instructions in the individual sections.

Note

The oven must not be operated with explosive gases or mixtures and it must be ensured that explosive gases or mixtures do not form during the process.

This oven has **no** safety technology for processes in which ignitable mixtures could form, e.g. debinding.

If the oven is to be used for such processes, the concentration of organic gases must never exceed 3% of the lower explosive limit (LEL) in the oven. This requirement not only applies to normal operation, but also especially to exceptions, such as process faults (e.g. due to the failure of a unit, etc.).

Nabertherm offers a wide range of ovens and furnaces that were especially developed for processes with ignitable gases.

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 Oven Operator

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

This level of safety when operating the oven can be achieved only if all the necessary measures have been taken. It depends on the oven 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 oven 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 oven. These instructions must be available at all times for anyone working with or on the oven;
- all the safety and operating instruction signs on the oven can be read properly. Damaged or unreadable signs must be replaced immediately,
- oven 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 oven'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).
- operating personnel still in training initially perform their work at the oven under the supervision of an experienced person. Successful completion of the training period must be confirmed in writing.

▶ **Note**

In Germany, the VBG and BGZ accident prevention regulations must be followed. The accident prevention regulations applicable in the country where the oven is installed must be followed.

3.3 Requirements for the Operating Personnel

The oven may be operated only by persons who are trained, instructed, and authorized to do so. These persons must know the operating instructions and act accordingly. The authorizations of the operating personnel must be clearly defined.

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

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 oven may only be transported by _____
- The oven may only be installed by _____
- The oven may only be commissioned by_____
- Initial instructions may only be given by_____
- Faults may only be rectified by _____
- The oven may only be maintained by _____
- The oven may only be cleaned by _____
- The oven may only be serviced by _____
- The oven may only be repaired by _____
- The oven may only be shut down by _____

3.4 Protective Clothing

Wear protective clothing

Wear heat-resistant gloves to protect your hands.

Wear protective goggles.

3.5 Basic Measures During Normal Operation

Risks during Normal Operation!

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

Before starting production each time, check and ensure that all the safety equipment works properly.

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

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

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

- Check the oven for obvious external damage,
- Check that all safety equipment is working as intended (e.g. emergency stop button),
- Check all hydraulic or pneumatic hoses, make sure that they are not leaking and that they are connected properly (if applicable),
- Check all gas and oil lines, make sure that they are not leaking and that they are connected properly (if applicable),
- Check that the fan works properly,

3.6 Basic Measures in Case of Emergency

3.6.1 What to do in an Emergency

Note

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

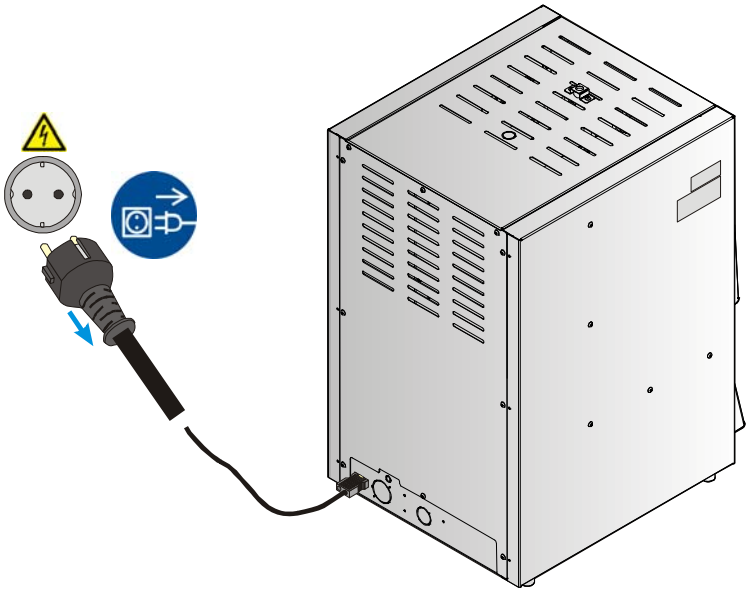


Fig. 4: Pulling the power plug

Risks during Normal Operation!

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

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

3.7 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 oven 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 oven 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 ovens, 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 oven,
- 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.

3.8 Environmental Regulations

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

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 oven contains no substances that make a hazardous waste classification necessary. However, residues of process materials may accumulate in the oven 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.

3.9 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 oven is operating. These residual risks include dangers for humans/products/ the oven, and the environment.

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

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

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

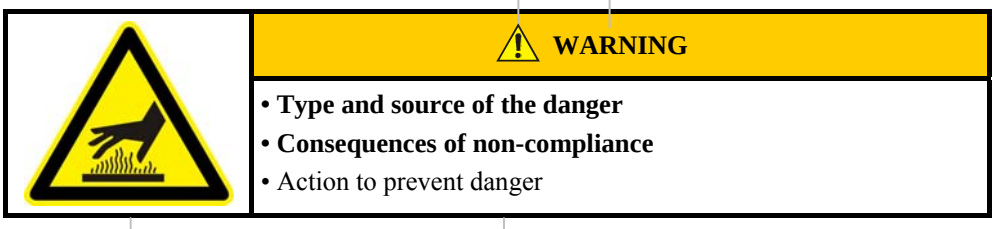
The general hazard symbol, in combination with the words **CAUTION**, **WARNING** and **DANGER** warns about the risk of serious injury. Observe the following information to prevent injury or death.

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

Structure of the warning: All warnings are structured as follows

Hazard symbol
Indicates the risk of injury

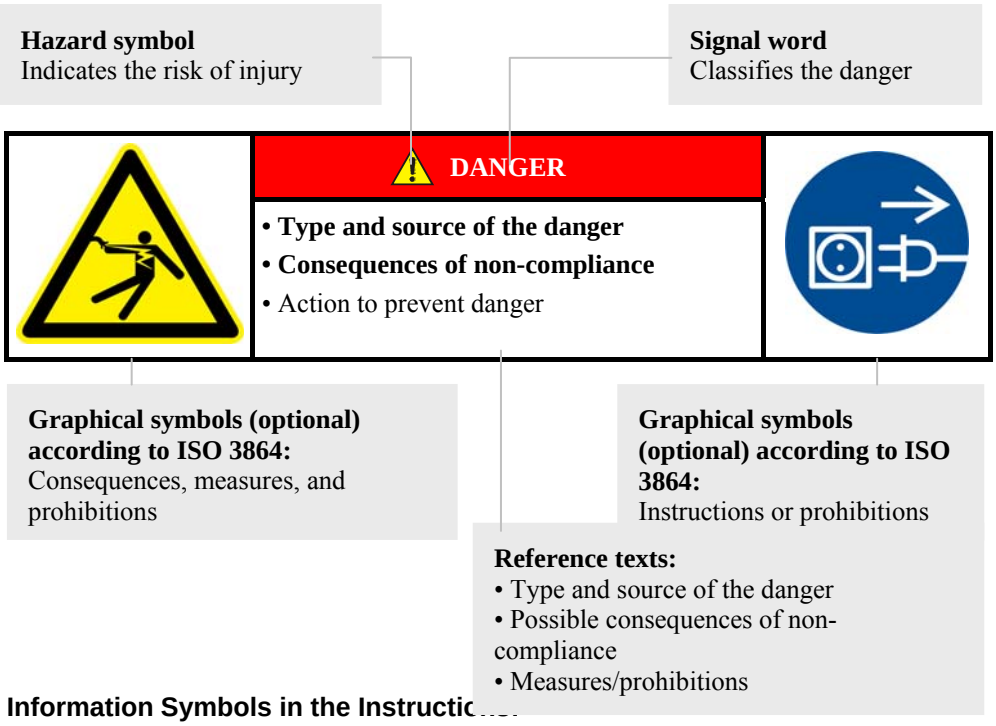
Signal word
Classifies the danger



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

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

or



Information Symbols in the Instructi…

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 – Risk of Device Toppling Over

This symbol tells the operator that there is a risk of the device toppling over 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 Oven:

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

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

Warning - Danger of Electric Shock!

Warning, dangerous electric voltage

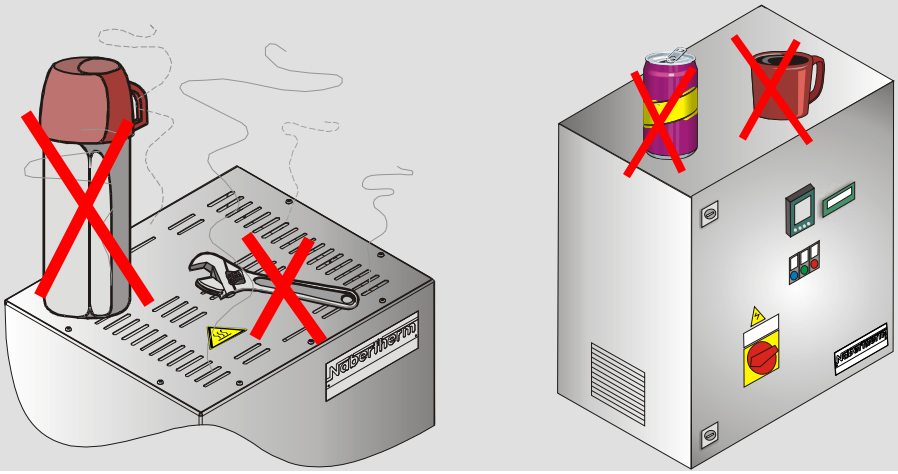
3.10 General Risks with the Oven

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.



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 oven is being lifted, parts of the oven or the oven itself could topple over, slip, or fall. Before the oven 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 oven 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 oven 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.

Transportation with a Pallet Truck

Observe the maximum permitted capacity of the pallet truck.

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

Fig. 5: Pallet truck is pushed **completely** beneath the transportation frame

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

⚠ CAUTION

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

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.

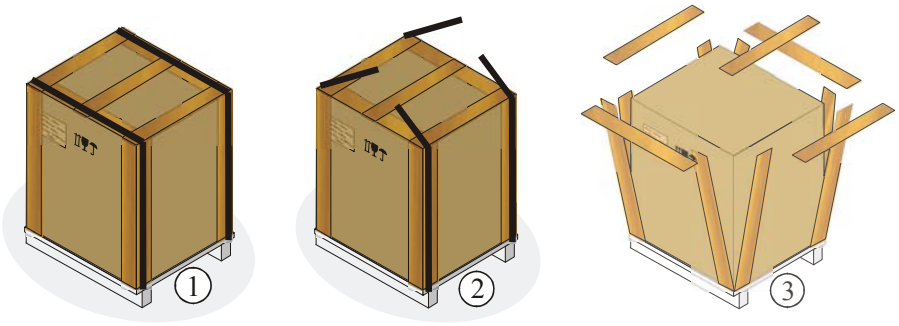
4.2 Unpacking

Note

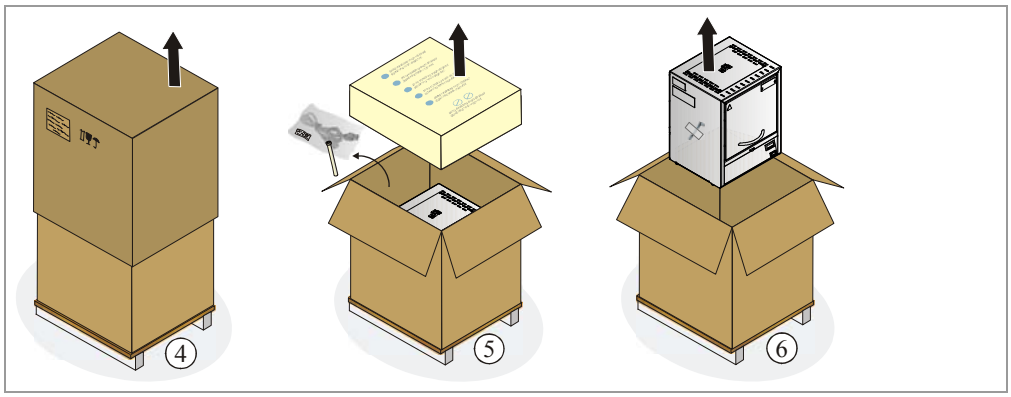
The oven packaging prevents damage during transportation. Make sure that you remove all packaging material (also inside the oven chamber). Keep the packaging and transportation securing equipment in case it is needed for future transportation or storage.

At least two people are needed to carry/transport the oven, more for larger ovens.

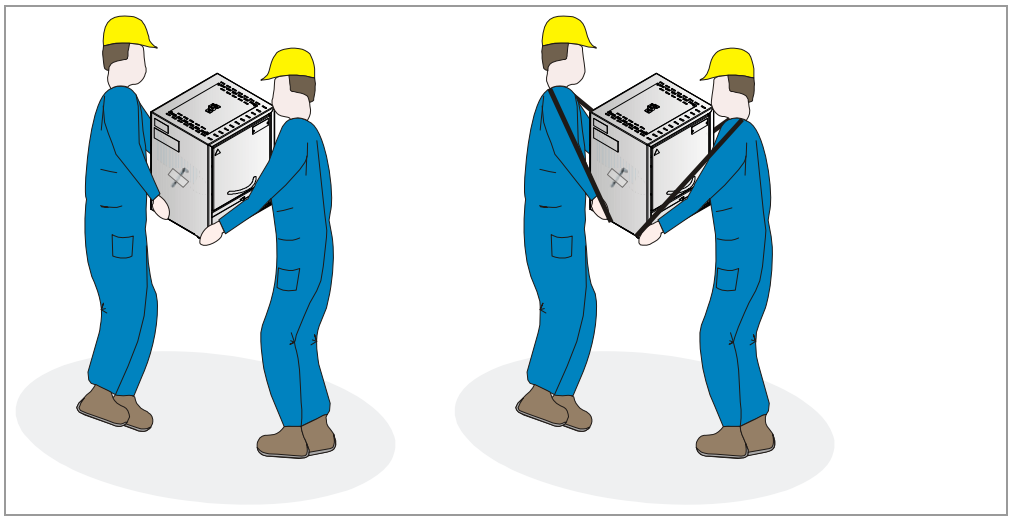
Wear protective gloves



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



4. Carefully lift the cardboard box and remove it from the pallet.
5. Remove the foam insert in the box. The box contains a packaging unit for accessories (Example: exhaust air tube, insert plate, power cable). Compare the delivered items with the delivery note and the order documents, see "Delivery".
6. Carefully lift the furnace out of the packaging unit.



7. To carry, grip furnace from below at the sides and make sure you have a firm grip.
8. 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 protection guidelines of VBG or BGZ must be observed. The national accident prevention regulations of the country of operation apply.

Note

Save the packaging for possible shipping or for storing the furnace.

4.3 Transportation Securing Equipment/Packaging

Note

No special transportation securing equipment is available for this oven

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

4.4 Constructional and Connection Requirements

4.4.1 Installation (Oven Location)

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 be made of nonflammable 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 a minimum safety distance (S) of 0.5 m on each side and 1 m at the top 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.

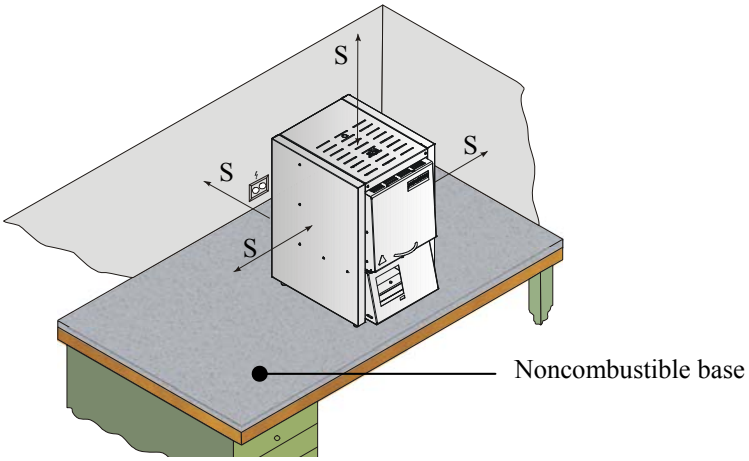


Fig. 6: Installation (Oven Location)

DANGER

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

Note

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

4.5 Assembly, Installation, and Connection

4.6 Assembly of a Vent

Which vents are supplied vary depending on the application/order (does not apply to protective gas connection):

Vent (not for LV models)

- Vent which exhausts the escaping gases and vapors through the exhaust air connecting piece (back wall) and releases them overhead. Exhaust air cross section: 40 x 30 mm
- Install by slipping the vent onto the connecting piece on the back wall of the furnace and fasten it with the screws included in the scope of delivery.

Fig. 7: Vent

Vent with fan (not for LV models)

- Supports the venting of gases and vapors from the furnace chamber. Exhaust air cross section: 85 x 60 mm
- Install by slipping the vent onto the connecting piece on the back wall of the furnace and fasten it with the screws included in the scope of delivery. Plug the connecting plug into the socket on the back of the switchgear (optional) or in an external socket.

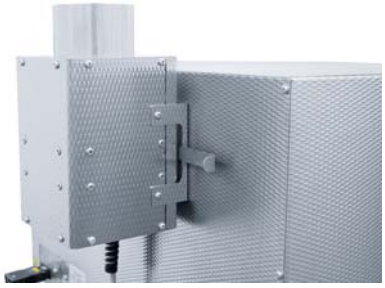


Fig. 8: Vent with fan

Vent with fan and catalytic converter (not for LV models)

- Heats the gases and vapors from the furnace chamber to approx. 600 °C and feeds it through the catalytic converter honeycomb. The converter incinerates most of

the organic substances, i.e. breaks them down into carbon dioxide and steam. This largely eliminates any annoying odors (for example, during dewaxing).

- Warning! Inorganic substances such as heavy metals halogens, silicons and particulates (even in small quantities) will destroy the catalytic converter!
- The temperature of the catalytic converter must be checked; from the start of the program the converter must be operating at approx. 600 °C. A statement cannot be made regarding residues which may be released into the environment. This is largely dependent on the individual materials/embedding masses used and their compositions. Exhaust air cross section: 120 x 120 mm
- Installation: Fasten the U-shaped brackets to the back wall of the furnace using the screws included in the scope of delivery, slide the included section of pipe onto the connecting piece of the furnace and screw the vent (with CAT) firmly to the bracket. Plug the power plug into the socket on the back side (optional) of the switchgear or into an external socket.

Fig. 9: Catalytic converter

Installation of a Exhaust Gas Pipe on LV(T) …/… Models

- These models come with a special exhaust gas pipe.
- Begin the installation by fastening the rectangular pipe to the inner housing of the furnace with the screws included in the scope of delivery, then by fastening the rounds section to the outer housing. The screws included in the scope of delivery are for this purpose.
- Operating the furnace without this pipe results in a reduced air flow which is insufficient for an incinerating process.

Caution

The installation of a catalytic converter or vent with fan is not possible on these models.

4.6.1 Waste Gas System

We recommend connecting an exhaust air pipe to the furnace to remove the exhaust gases.
For this purpose you can use a commercially available, metal exhaust gas pipe with NW80 to NW120. It must be installed continuously rising and fastened to the wall or ceiling. Center the pipe over the furnace vent (for models with vent fan or catalytic converter, NW 120 is necessary.
The exhaust gas pipe must not be installed with a tight fit to the furnace vent pipe since this would prevent any bypass effect. This is necessary so that not too much fresh air is sucked in by the furnace. (An exception are the LV furnaces: Here the exhaust gas pipe NW80 can be slid directly onto the furnace vent pipe.)

Vent Ⓐ: Position the exhaust air piping approx. 50 mm over the vent.

Exhaust air (model LV/LVT) or vent with fan Ⓑ: Exhaust air piping can be slid directly onto the exhaust air pipe or vent.

Furnaces without exhaust air pipe or with catalytic converter Ⓒ: We recommend feeding the exhaust air through a flue.

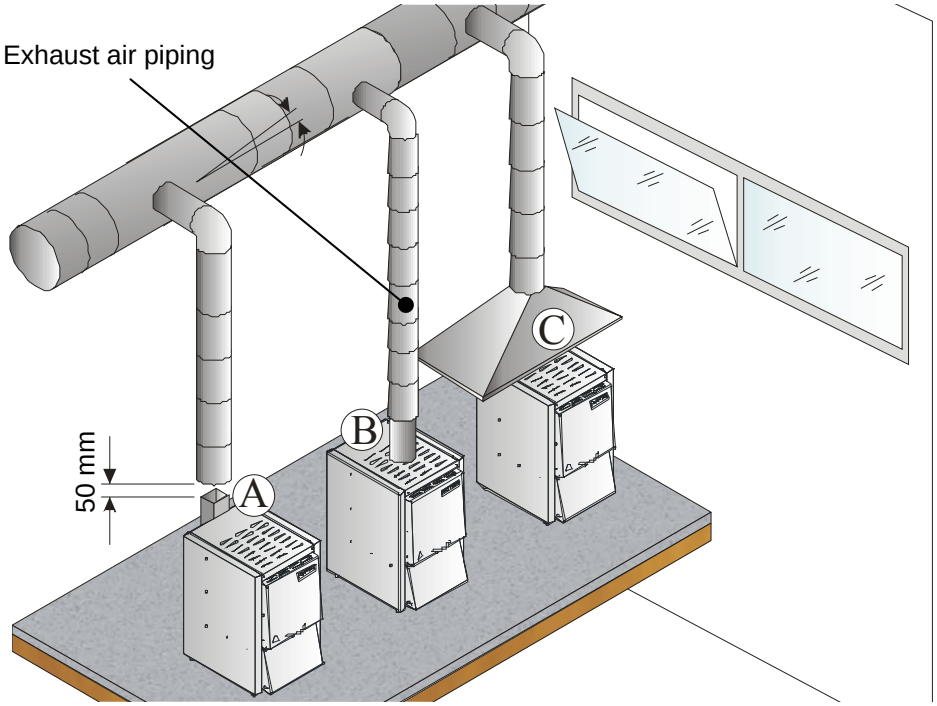


Fig. 10: Example: Various ways of removing the exhaust air

Caution
The exhaust gases can only be vented if the workspace is ventilated with an adequate fresh-air opening.

Caution
The customer is responsible for providing the masonry and roofing work necessary for venting the exhaust. The size and design of the exhaust air system must be decided by a ventilation expert. The accident prevention regulations applicable in the country where the furnace is installed must be followed.

4.6.2 Connecting the Oven to the Power Supply

On the building side, the required services must be provided, i.e. the carrying capacity of the installation surface, provision of power (electricity), etc.

- The furnace must be installed in accordance with its intended use. The power connection values must correspond to the values on the furnace type plate.
- The power socket must be located close to the furnace and must be easily accessible. The safety requirements are not met if the furnace is not connected to a socket with grounding contact.
- On use of an extension cable or a multipoint socket, the maximum electrical rating must not be exceeded. Do not use the furnace with an extension cable if you are uncertain whether grounding is guaranteed.
- The power cable must not be damaged. Do not place any objects on the power cable. Route the cable so that nobody can tread on or stumble over it.
- A damaged power cable must be replaced immediately.
- Ensure that the furnace's connection cable is routed so that it is protected.

Note

Before connecting the voltage supply, make sure that the power switch is in the "**Off**" or "**0**" position.

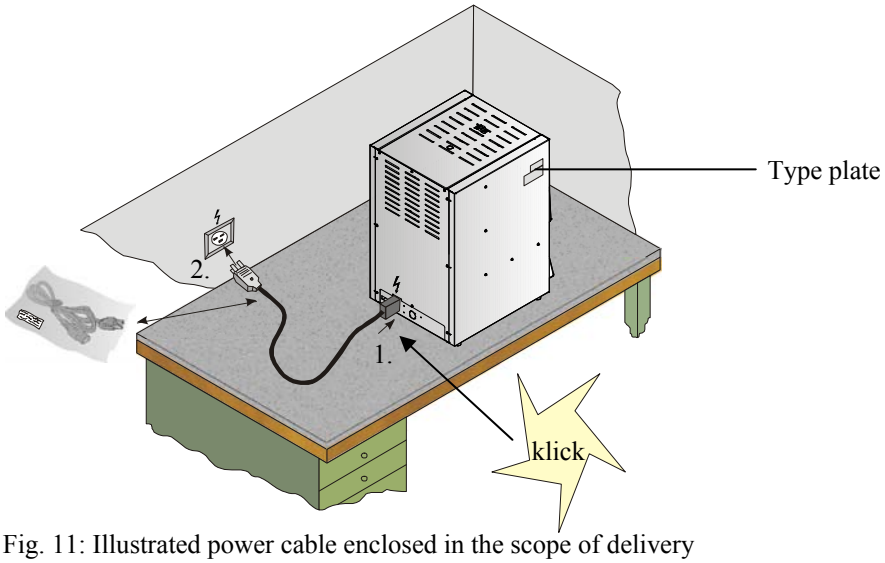


Fig. 11: Illustrated power cable enclosed in the scope of delivery

1. First connect the enclosed power cable to the intended mains power connector on the furnace.
2. Now connect the enclosed power cable to the power connection. Only use a socket with grounding contact to supply power.

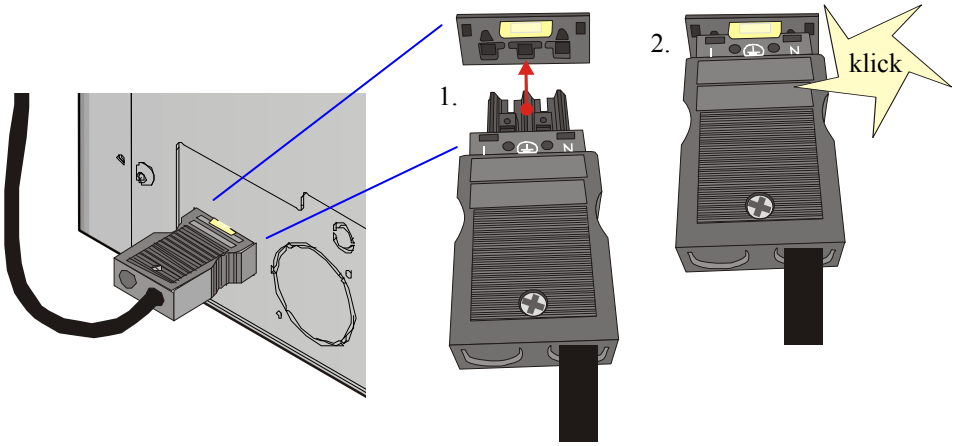


Abb. 12: Reconnect the power cable

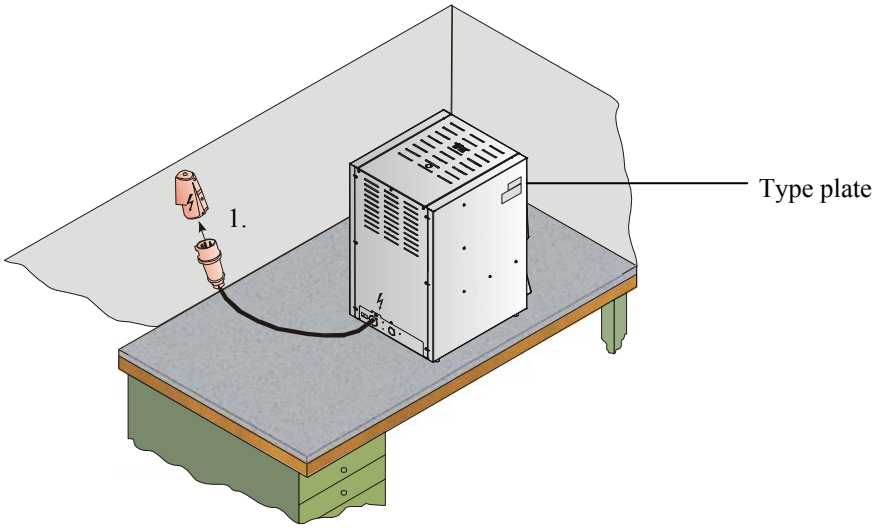


Fig. 13: Power connection with power line

1. Connect the power cable to the power connection. Only use a socket with grounding contact to supply power.

Grounding of the furnace and switching system (compliant with VDE 0100, part 410) is a prerequisite for the current-operated e.l.c.b. system of the heater.

Test the ground resistance (compliant with VDE 0100); see also accident prevention guidelines.

Electrical systems and equipment compliant with BGV A3.

Note

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

Note

The national regulations of the country of operation apply.

Warning - danger due to electrical current!

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

Note

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

NOTICE

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

DANGER

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

4.6.3 Insertion of the Base Plate

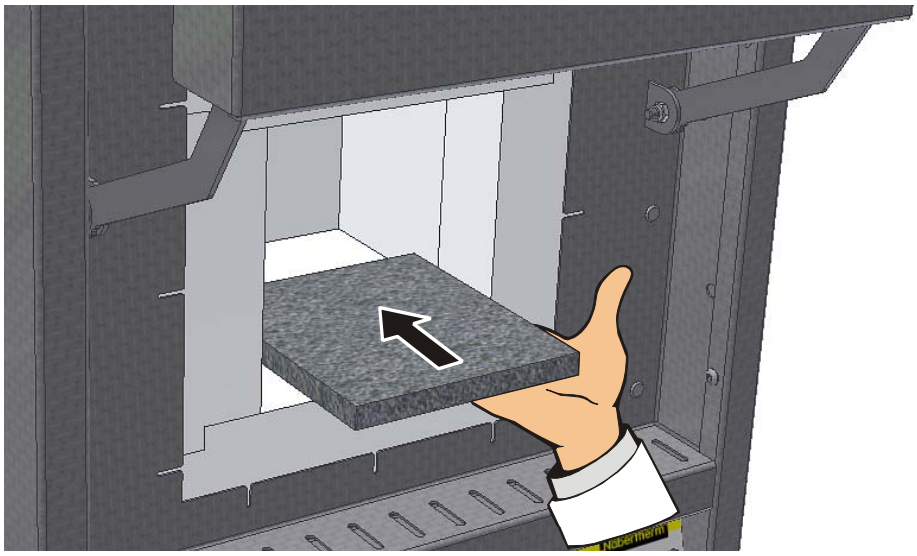


Fig. 14: Inserting the ceramic insert plate

Swivel the furnace lift-door carefully away upwards. Carefully place the ceramic insert plate/s (quantity of insert plates dependent on furnace model) centrally on the base of the furnace. When inserting the ceramic insert plate/s, ensure that the door collar and the heating elements are not damaged. Under all circumstances, avoid coming into contact with the heating elements when inserting the insert plate/s; this may lead to the immediate destruction of the heating elements.

The base of the furnace is manufactured from high-quality, fireproof material which is extremely sensitive to impact. The ceramic insert plate has the task of protecting the base of the furnace. Damaged insert plate/s must be immediately replaced with new ones (see chapter entitled "Replacement/Wearing Parts").

The furnace must not be commissioned without the insert plate.

If possible, the load must be positioned centrally in the working chamber on the ceramic insert plate. This guarantees even heating.

After loading, the furnace lift-door must be closed carefully.

▶ **Note**

It must be ensured that the load on the furnace base does not exceed 2 kg.

Installing the Scale on the L(T).../.../SW Model

- Insert the ceramic stamp ① included in the scope of delivery from below into the hole in the floor of the furnace.
- Place the scale ② in the frame under the furnace. At the same time raise the pipe carefully and place it on the supporting surface of the scale.
- To hold the pipe in place the support die ③ must be slide into the space between the pipe and the supporting surface of the scale. This is done by carefully raising the pipe.
- In the furnace chamber, slide the ceramic plate ④ with its guide onto the pipe and orient it precisely. The pipe must be free-standing on the scale and must not have any contact with the furnace insulation to avoid falsifying the measurement results.
- Connect the scale with the power plug.
- The function of the scale: This information can be found in the instructions enclosed with the scale.
- Separate instruction manual for MV software (optional)

Fig. 15: Scale

4.7 Commissioning

The oven may be put into operation only by qualified persons and in compliance with the safety instructions.

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

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

The oven may be used only for its intended purpose.

Ensure that only authorized persons remain in the working area of the oven and that no other persons are put at risk when the oven is put into operation.

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

Activate all safety equipment (power switch, emergency stop button if applicable) before putting the oven into operation.

Incorrectly wired connections may destroy electric/electronic components.

Observe the special protective measures (e.g. grounding, …) for components that are at risk.

Faulty connections can cause the oven to start unexpectedly.

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

Before starting the oven for the first time, check the electrical connections and control displays.

Before placing materials in the oven, check whether they could harm or destroy the insulation or the heating elements. Materials that could damage the insulation include: alkalis, alkaline earths, metal vapors, metal oxides, chlorine compounds, phosphorous compounds, and halogens.

Note

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

4.8 Recommendations for Heating the Oven for the First Time

The furnace **must first be heated up** to dry out the masonry and generate a protective oxidated layer on the heating elements.

During the heating up the furnace may give off unpleasant odors, which is due to the release of binding agents from the insulation material. We recommend that the furnace location be well ventilated during the first warm-up phase.

- Warm up the empty furnace over a period of roughly **6 hours**[1] **to 1050 °C (1922 °F)**. Hold this temperature for roughly 1 hour.
- Warm up LE …/… models to 1000 °C (1832 °F) (without the warm-up ramp).
- After the first warm-up phase, let the furnace cool down naturally to room temperature.
- The furnace is now ready to operate

1) Warm-up ramp

Caution

This procedure must be performed at the time the furnace is commissioned, following the replacement of heating elements or to regenerate the oxidated layer.

4.9 Loading/charging

Charging the Furnace

The insulation is made of high-quality refractory material but is highly sensitive to impact. Avoid contact when charging to prevent any damage.

To obtain a temperature distribution which is as uniform as possible it is advantageous to leave space between the pieces and between the pieces and the side walls. Nabertherm supplies insert plates (base plate) and the like to help you make use of the furnace chamber.

Loading a very large quantity of ware into the furnace chamber can substantially lengthen the heating-up time.

The furnace heating system is interrupted if the door is opened. After the door is reclosed, it is automatically switched on again (not applicable to LE …/… models).

If it can be at all avoided, do not open the furnace when it is hot. When it is necessary to open the furnace at a high temperature, the time should be kept to an absolute minimum. Make sure that operators wear the appropriate protective clothing and that the workspace is adequately ventilated.

Always make sure that the door is completely closed.

Stainless steel sheet can discolor (especially if the furnace is opened while hot). This does not impair functionality in any way. This is no reason for a complaint.

Caution LE …/… Models:
Continuous operation at maximum temperature can lead to increased wear of the heating elements and the door seal. We recommend operating at approx. **50 °C below the maximum temperature**.

Caution for LT …/…HA Models:
The recirculating air motor starts when the program begins and cuts out again automatically when the program ends and the furnace chamber temperature has dropped to **below** 80 °C (176 °F). Above this temperature the furnace must not be switched off or disconnected from its power source. If this caution is not observed the recirculating air motor may be damaged.

Warning - Danger of Electric Shock!

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

Cracks in the insulation

The insulation of the furnace and/or the side heating plates in the furnace (depending on the furnace model) are made of very high-quality refractory material. Thermal expansion causes cracks in the insulation even after only a few warm-up cycles and, in some circumstances, in the side heating plates as well. But these have no impact on the function or quality of the furnace. This is no reason for a complaint.

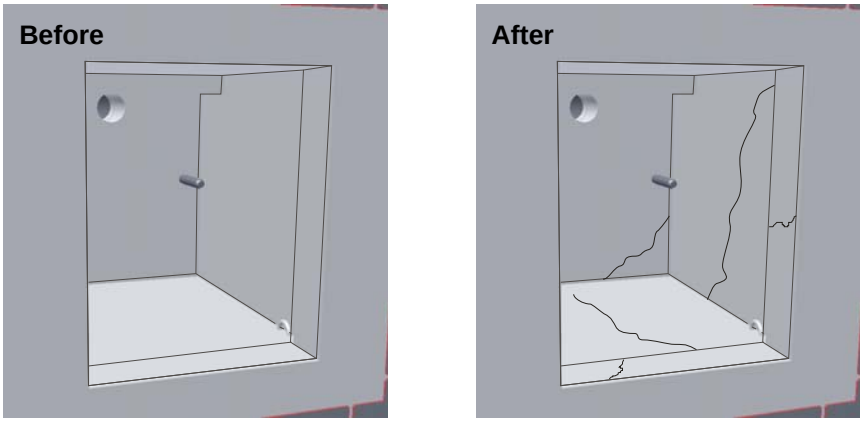


Fig. 16: Example: Cracks in the insulation after a few warm-up cycles.

Notice for the Use of Catalytic Converters and Exhaust Vent Fan:

The air feed lever must always be set to ● because the exhaust gases cannot be adequately vented from the furnace chamber.

Information for LV/LVT …/… Models:

These models have an independent, air feed system which cannot be regulated. The fresh air is fed through holes in the back wall into the upper heating plate where it is pre-heated and comes back out in front, above the furnace chamber. In the ● setting of the air feed lever fresh air is also fed in which is not pre-heated. For complete feed air pre-heating select the ○ setting. During protective gas connection/operation the lever must be set to ○ .

5 Operation

5.1 Operating Controller B 180/P 330

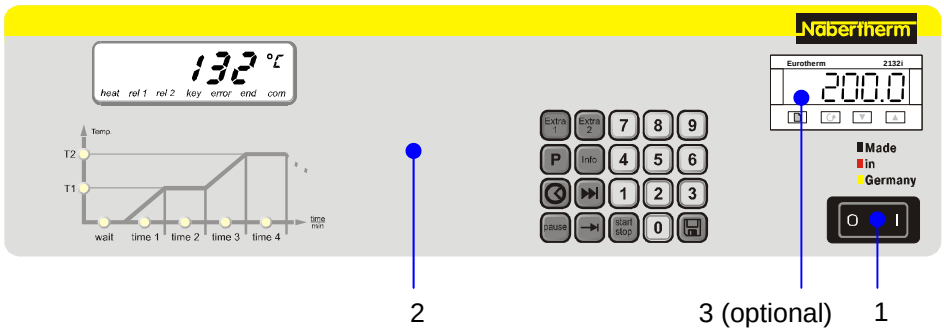


Fig. 17: Example: Controller

OFF/ON

1. The control power is switched on and off with the power switch (1). When the control voltage is switched on the heating space temperature is displayed by the controller (2) in the LED.
2. The desired heating and cooling program is set at the controller (2). The description of the controller is in a separate instruction manual.
3. Temperature value of the over-temperature limit controller (3) (optional) must be set 30 °C higher than the setting on the controller. Description of the over-temperature limit controller (OTLC) is contained in the instruction manual of the controller B 180/P 330.

Caution

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

Caution

Description of the controller B 180/P 330 is contained in a separate instruction manual.

5.2 Operating Controller R 6

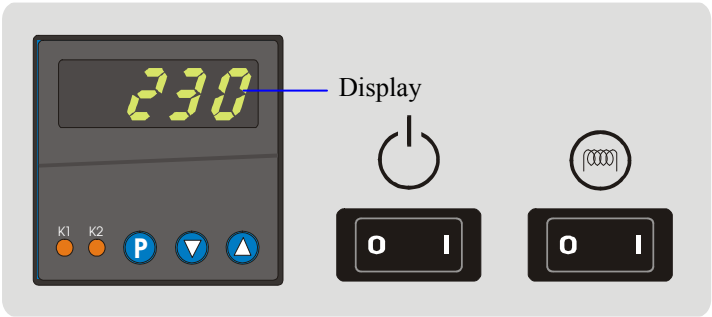


Fig. 18: Controller R 6

Key	Description	Display
O I OFF/ON	Switch on oven **I** The oven is switched on and off with the power switch "⏻". When the power is switched on, the current oven temperature (actual temperature) is shown on the controller display (Example: 20 °C). When the **K1** lamp "✹" remains on, this means that the controller is ready.	20
Press P	To adjust the required oven temperature (temperature set point), press the "P" button once. The display alternates between "SP" and the last temperature set point in the entry level (Example: 0 °C)	SP ↔ 0
Press ▼ ▲	Use the "▼ ▲" buttons to set the required oven temperature (temperature set point) between 0 °C and 300 °C (Example: 230 °C) Increase the value with ▲ (225 … 229, 230) Reduce the value with ▼ (230 … 226, 225) Wait 2 seconds until the new temperature set point is integrated automatically (display flashes 1x) (For the required temperature set point you can choose a temperature range from 5°C above room temperature to 300°C).	230 230
Press P (or the display changes automatically after 15 seconds)	The display changes automatically after 15 seconds or if you press the "P" button again (The current oven temperature is displayed. Example 20 °C).	20
O I OFF/ON	Switch on heating **I** → The heating process is started. Use the "≋" switch to switch the heating on and off. When the **K2** lamp "✹●✹" flashes, this means that the heating is ready.	230 23 22 21 20
Press P	You can check the temperature set point at any time with the "P" button.	230

SP = Set point

5.3 Over-Temperature Limit Controller with Manual Reset and Adjustable Cut-Off Temperature

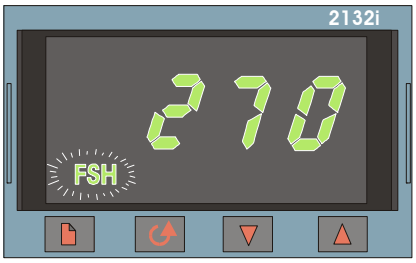
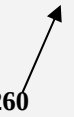
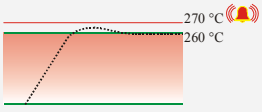


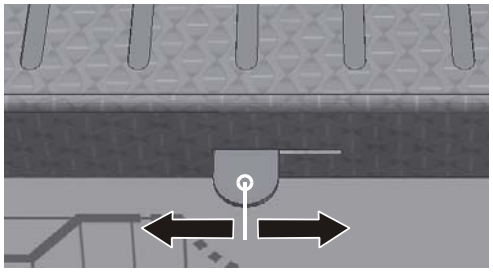
Fig. 19: Over-temperature limit controller with manual reset 2132i

Key	Description	Display
	The over-temperature limit controller with manual reset monitors the temperature in the oven chamber. The display shows the last trigger temperature that was set. If the temperature in the oven chamber exceeds the set trigger temperature, the heating is switched off to protect the oven and the load. "FSH" alarm flashes on the over-temperature limit controller.	**260 °C** **FSH**
	When the temperature in the oven 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 oven can continue to operate:	
	Release heating:	
	Press  and  simultaneously. The alarm on the over-temperature limit controller is reset and this releases the heating.	
	Adjust the trigger temperature:	
	Set the required trigger temperature with the   button (Example 270 °C) Increase the value with  (260 … 269, 270) Reduce the value with  (270 … 261, 260) To change the value quickly: hold the   button depressed for longer. Wait 2 seconds until the new trigger temperature is integrated automatically (display flashes 1x).	**270**  **260**
	**Note:** Premature triggering of the over-temperature limit controller can be avoided if the difference between the adjustable temperature in the oven chamber and the trigger temperature is not below 10°C.	
	The display jumps back to the start screen showing the trigger temperature. The current trigger temperature is displayed.	**270 °C**
	Entry finished.	
	For more information about operation, see the separate instructions for the Eurotherm 2132i	

	NOTICE
	• **Overheating** • **Damage to the batch** • If, as a result of excessive heat, a batch is likely to be damaged by the pre-set response temperature of the over-temperature limit controller with manual/automatic reset or if the batch itself becomes a source of danger for the oven or its surroundings, the temperature setting on the over-temperature limit controller with manual/automatic reset must be reduced to the maximum permissible value.

5.4 Air Inflow Lever

The volume of air fed to the furnace can be adjusted with the fresh air lever. The fresh air lever is located at the side of the door at the bottom. The position is explained by the symbols beside and on the lever.



Fres Fig. 1: Fresh air lever

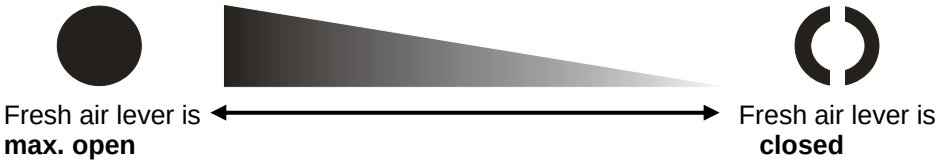


Fig. 21: Regulating the feed of fresh air (symbols)

▶ **Notice for the Use of Catalytic Converters and Exhaust Vent Fan:**

The air feed lever must always be set to ● because the exhaust gases cannot be adequately vented from the furnace chamber.

▶ **Information for LV/LVT …/… Models:**

These models have an independent, air feed system which cannot be regulated. The fresh air is fed through holes in the back wall into the upper heating plate where it is pre-heated and comes back out in front, above the furnace chamber. In the ● setting of the air feed lever fresh air is also fed in which is not pre-heated. For complete feed air pre-heating select the ○ setting. During protective gas connection/operation the lever must be set to ○ .

▶ **Note**

If the fresh air lever is open, under certain circumstances this may affect temperature uniformity in the furnace chamber.

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.
- Notify operating personnel and specify a supervisor.
- Switch off the main switch and disconnect the mains power connector.
- Lock the main switch and secure against restoration of power using a padlock.
- Attach a warning sign on the main switch.
- Seal off a large area around the servicing area.
- Check for disconnection of power.
- Ground and short-circuit the working area.
- Cover any nearby parts still under power.

Warning! General hazards!

Do not touch any object without first checking its temperature.

Warning - Danger of Electric Shock!

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

6.2 Regular Maintenance of the Oven

Position/ Maintenance Point	Measure	Maintenance Interval					Operating	Qualified
		Day	Week	Month	Quarter	Year	Personnel	
Safety test in accordance with BGV A3 or corresponding national regulations	According to regulations	According to regulations						x
Safety and limit switches (if available)	Function test					●		x
Furnace chamber, flue outlets and flue	Clean and check for damage, vacuum out carefully			■			x	
Seal surfaces: door lining/furnace lining	Visual check	●					x	
Heating elements	Visual check (visible part of the heating element in the furnace chamber)	●					x	
Check for even power consumption of heating	Function test					●		x
Thermocouple	Visual check (visible part of the thermocouple in the furnace chamber)	●					x	
Set setpoint	Test according to work schedules	●					x	
Key:	■ = clean ● = check, replace x = performance by							

Fig. 22: Maintenance table

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.

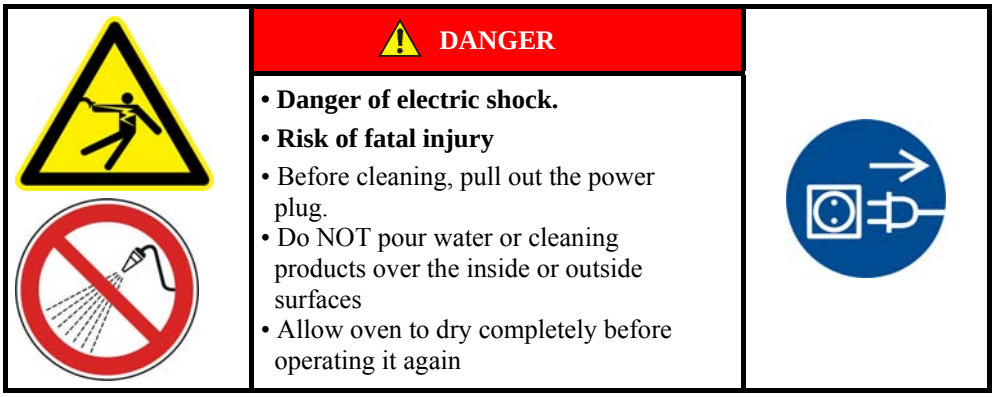
Follow the labeling and the instructions on the packaging of the detergent.
Wipe the surface with a damp, lint-free cloth. The following detergents can also be used:

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)
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. 23: Detergent

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

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



7 Faults

Work on the electrical system may be done only by qualified, authorized electricians.
Operators may only rectify faults that are obviously due to operating errors.
Call the local electrician for faults that you cannot localize.
If you have any questions, problems, or requirements, contact Nabertherm GmbH. By mail, phone, or e-mail → See "Nabertherm Service".

Type of fault	Possible causes	Fault rectification
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.
Controller indicates fault.	-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 chamber heating.	-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 is not reached.	-Lack of heater output due to undervoltage. -Heating element defective	-Have checking carried out by Nabertherm Service.

7.1 Replacing a Fuse

A fuse is located on the back of the oven beside the power cable connection. The fuse is an important component of the power supply system and protects the oven and its components against damage and fire. When you insert a new fuse, make sure that the fuse rating is suitable for the voltage used by your oven.

	NOTICE
	• **Damage to the oven and its components** • **Use of a fuse that is NOT suitable for the respective voltage may damage the oven and its components and is a fire hazard.** • Use only a suitable fuse type. Check that the fuse type has the correct nominal current value.

Carry out the procedure to switch off the oven (see "Operation"). Then pull the power plug out of the socket.

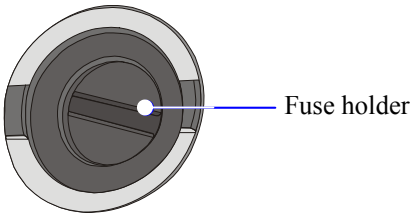


Fig. 24: The fuse is located in the back wall of the oven.

- Insert a suitable flat blade screwdriver into the slot of the fuse holder. To remove the fuse holder, press it in and turn it anti-clockwise. After a few turns, pull the fuse holder out carefully with your fingertips.

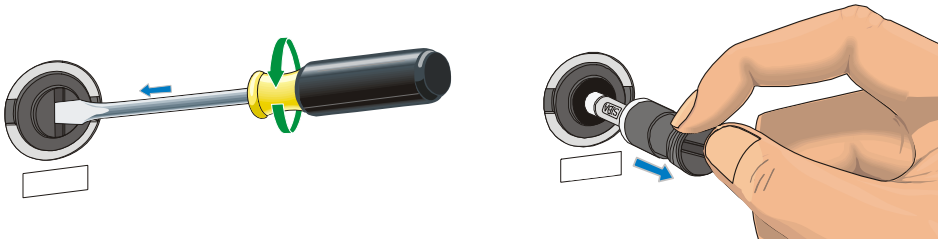


Fig. 25: Release and pull out the fuse holder

- Remove the fuse from the fuse holder.
- Replace the defective fuse with a similar fuse.
- Before you replace the fuse, make sure that it has the correct nominal current. For the correct fuse (fuse link), see "Spare/Wearing Parts".

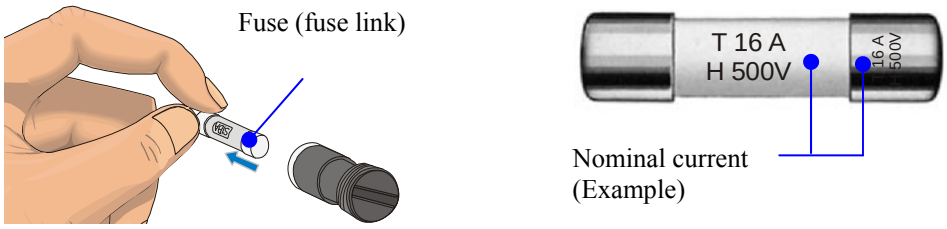


Fig. 26: Remove fuse

Note

The nominal current is engraved into the metal cap of the fuse or can be found imprinted directly on the fuse.

- Insert the new fuse into the fuse holder. Make sure that the fuse is pushed fully into the holder.
- Replace the fuse holder slowly and carefully. To fix the fuse holder, insert the flat blade screwdriver into the slot and turn it in a clockwise direction with some pressure.

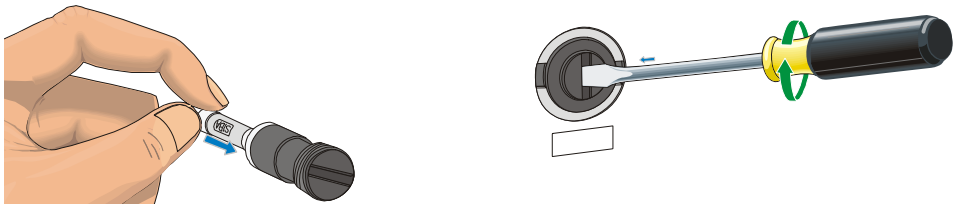


Fig. 27: Insert fuse

- Check that the power cable is not damaged. The power cable must not be damaged. Power cables may be replaced only with similar, approved cables.
- Reconnect the power cable (see "Connecting the Oven to the Power Supply")
- Switch on the oven's power switch (see "Operation")

7.2 Separate the Snap-In Coupling (Plug) from the Furnace Housing

With a small flat blade screwdriver carefully push the locking latch ① upward while pulling the plug ② out of the coupling ③.

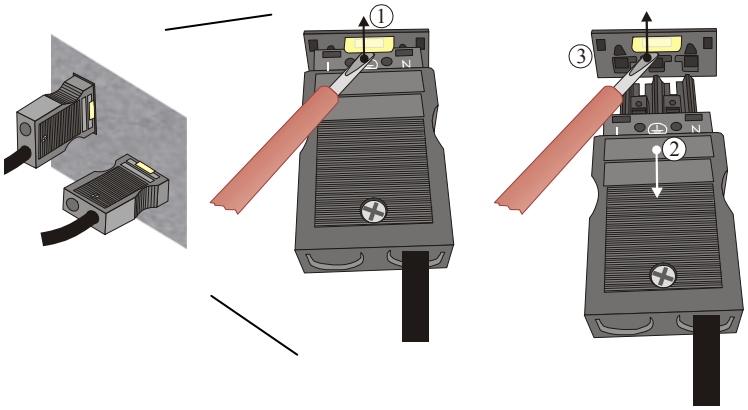


Fig. 28: Separate the snap-in coupling (plug) from the furnace housing

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 cannot find the spare part you want we will be glad 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.

Model						
No.	**Designation**	**Part number**				▶
1	**Furnace**					
1.3	Fiber wool	691600518 *)				●
1.2						
2	**Electrical/controllers**					
2.1	Controller P 330	520100258				❍
2.2	Controller P 180	520100257				❍
2.3	Controller R 6	635001141				❍
2.4	Rocker switch	541700200				❍
2.5	G back-up set 2 A	541500182				●
2.6	G back-up set 10 A	541500215				●
2.7	G back-up set 16 A	541500303				●
2.8	Power cable (xx = country code required)	V0013xx				●
3	**Tools**					

*) = Quantity depending on need

▶ **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 ovens. 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.

9 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.

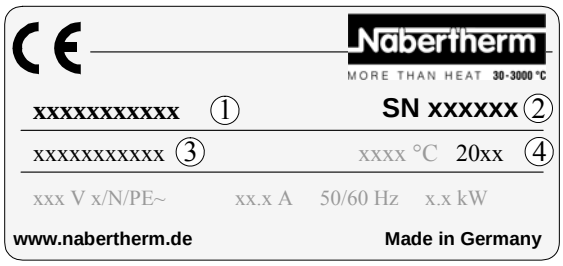
Mail
Nabertherm GmbH
Bahnhofstrasse 20
28865 Lilienthal/Germany

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

Web or e-mail
www.nabertherm.com
contact@nabertherm.com

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

Provide the following details from the type plate:



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

Fig. 29: Example (type plate)

10 Electrical Connections (Circuit Diagram)

Note
See the Appendix for the wiring diagram for this system.

11 Shut-Down, Dismantling, and Storage

11.1 Environmental Regulations

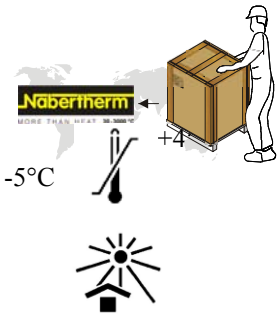
When it is delivered, this oven contains no substances that make a hazardous waste classification necessary. However, residues of process materials may accumulate in the oven insulation during operation. These may be hazardous to health and/or the environment.

- 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.

Note

Observe the national regulations of the country in which the kiln will be used.

11.2 Transportation/Return Transportation



If you still have the original packaging, this is the safest way to send an oven.

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

- **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 oven 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 oven on a level floor to prevent distortion.**
- **Packaging and transportation may be carried out only by qualified and authorized persons**

If your oven 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 oven is sent without accessories, unless the technician expressly requests them.

Enclose a detailed description of the fault along with the oven – 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:

Product	Laboratory Furnaces (Muffle Furnaces)
Model	L / LE / LT / LV / LVT -SKM -SW -HA

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.

- DIN EN 746-1 (02.2010)
- DIN EN 60204-1 (06.2007)
- DIN EN 60519-1 (05.2004), DIN EN 60519-2 (05.2007)
- DIN EN 61000-6-2 (03.2006), DIN EN 61000-6-4 (09.2007)

The following harmonized standards were applied:

Lilienthal, 12.01.2011

Thomas Adamek
Quality Management

Wolfgang Bartilla
Research and Development

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