

Original operating manual HT sintering furnace HT-Speed sintering furnace

English



Content

General information	4
Limitation of liability	4
<i>Responsibilities of the operating company.....</i>	<i>4</i>
Documentation	5
<i>Contents and structure</i>	<i>5</i>
<i>Labelling scheme for integrated texts and references.....</i>	<i>5</i>
Formatting and signs	6
Service address.....	6
Safety	7
Requirements on the personnel	7
Transport, packing and storage.....	9
Transport	9
Packaging.....	10
Storage	10
Technical description.....	11
Function	11
Conformity	12
Intended use.....	13
Potential misuse	13
Technical data.....	14
General specifications	14
HT connected electrical load	14
HT-Speed connected electrical load.....	14
Operating conditions.....	14
Installation.....	15
Installing	15
<i>Installation conditions.....</i>	<i>15</i>
Electrical connection.....	16
<i>Building installation.....</i>	<i>16</i>
Operation.....	17
Operating elements and displays	17
Switches and key functions	18
Standby screen.....	19
Switching on the Sintering furnace	19
Initial commissioning.....	20
Installing the door insulation	20
Speed-internal operating mode	21
<i>Feeding the Sintering furnace</i>	<i>21</i>
<i>Selecting and loading the heating program.....</i>	<i>22</i>
<i>Starting/stopping the heating program</i>	<i>22</i>
<i>Removing the sinter bowl from the heating furnace</i>	<i>23</i>
<i>Programming the heating stages</i>	<i>24</i>
<i>Programming of stages S2 to S4</i>	<i>25</i>

<i>Storing the heating program</i>	25
<i>Speed-internal programming</i>	26
<i>Saving program values with name</i>	27
<i>Renaming a heating program</i>	27
<i>Automatically starting a heating program</i>	28
Preparation of the sintering aid.....	29
<i>Recommended filling of the Speed sinter bowl</i>	29
Standard-internal operating mode	30
<i>Feeding the Sintering furnace</i>	30
<i>Selecting and loading the heating program</i>	31
<i>Starting/stopping the heating program</i>	31
<i>Removing the sinter bowl from the heating furnace</i>	32
<i>Programming the heating stages</i>	33
<i>Programming of stages S2 to S4</i>	34
<i>Storing the heating program</i>	34
<i>Saving program values with name</i>	35
<i>Renaming a heating program</i>	35
<i>Automatically starting a heating program</i>	36
Preparation of the sintering aid.....	37
<i>Recommended filling of the Standard sinter bowl</i>	37
<i>Sintering with sintered disc</i>	37
Special functions	38
Sintering with ventilation.....	38
Pre-drying without sintering	38
Pre-drying with sintering.....	38
Fast cooling by setting values	38
Basic settings	39
Service settings	39
<i>Parameter settings</i>	39
Switching off the Sintering furnace.....	42
Care and maintenance	43
Cleaning/Regeneration firing.....	43
Changing the battery	43
Faults and error messages	44
Safety	44
Faults	45
Electronic system error messages	46
Decommissioning	47
Disposal	47
Safety	47
Disposal	47

General information

Limitation of liability

The contents of this operating manual have been generated taking the applicable laws and standards into account.

The equipment has been developed according to state-of-the-art engineering.



NOTICE

The manufacturer assumes no liability for damage resulting from:

- Disregarding/non-observance of the operating manual
- Intentional misuse
- Non-designated use
- Use of untrained personnel
- Use of non-specialists (for maintenance work, etc.)
- Technical modifications to the equipment that have not been agreed with the manufacturer
- Use of spare parts that have not been approved by the manufacturer

Responsibilities of the operating company

The equipment is used for commercial purposes. The operating company of the equipment is therefore subject to the statutory obligations for work safety.

In addition to the safety instructions in this operating manual, the applicable safety, accident prevention and environmental regulations must be complied with for the field of use.

In particular, the following applies:

- The operating company must be aware of the applicable work protection provisions.
- The operating company must ensure that all employees involved with the equipment have read and understood this operating manual.
- The operating company must also train the personnel at regular intervals and inform them of the dangers involved in using the equipment.
- The operating company must provide the personnel with the necessary protective equipment.
- The operating company must have all safety devices checked regularly for functionality and completeness.

Documentation

Contents and structure

This operating manual is an integral part of this equipment. It contains instructions and information for the safe handling of the equipment and must be available to each user throughout the entire operating life of the equipment. This operating manual is intended for trained operating personnel.

Labelling scheme for integrated texts and references

The following safety indications are used:



DANGER

Indicates an immediate threat of danger that can cause serious physical injury or death.



WARNING

Indicates a potentially dangerous situation that can cause serious physical injury or death.



CAUTION

Indicates a potentially dangerous situation that can cause minor physical injury.




NOTICE

Indicates a potentially harmful situation in which the product or an asset in its vicinity can be damaged.

NOTICE

Note/Tip for easier operation.

Formatting and signs

- ⚠ *refers to a general safety instruction*
- ☑ indicates that a prerequisite must be fulfilled
- 1. refers to handling steps
- ➡ refers to a handling outcome
- refers to a list
-  refers to a key

Service address



Friedrich-List-Straße 8
D-76297 Stutensee-Blankenloch
Tel.: +49 (0) 7244 70871-0
www.mihm-vogt.de

Safety

The **sintering furnace** is a high temperature furnace for commercial use in dental laboratories and must only be used for sintering sinterable ceramics.

Requirements on the personnel

Trained specialist who is familiar in handling the equipment and is able to carry out the assigned tasks due to specialised training, knowledge, experience, and knowledge of the relevant provisions, and is also able to independently recognise and avoid potential hazards.



DANGER

Electrical power!

Danger of fatal injury from electric shock.

- Do not touch live cables and components with wet hands.
- Heed the accident prevention instructions when handling electric current.
- Before any installation, maintenance, cleaning and repair work, disconnect the power supply of the **sintering furnace** and secure it from being switched back on.



DANGER

Danger of ignition!

Use of inflammable and explosive materials in the furnace area.

- Do not operate the **sintering furnace** in the vicinity of highly inflammable sources.
- Do not install the **sintering furnace** on highly inflammable installation surfaces.



WARNING

Danger of burns from hot surfaces!

Operation of the *sintering furnace* causes surfaces to become hot where burns are possible if touched.

- Do not touch the housing or the furnace door during operation.
- Do not reach into the heating chamber. It can still have high residual heat from a previous heating process.
- Ensure the *sintering furnace* has cooled down before maintenance, cleaning and repair work.
- Wear heat-resistant safety gloves when working on hot components.
- Use suitable removal tongs that are long enough for putting in and removing sintered goods.



CAUTION

Incorrect operation!

No liability is assumed for any damage due to misuse, incorrect operation, incorrect connected or improper maintenance/repair by untrained personnel. All warranty services are also excluded in such cases.

If there is any damage to the equipment or mains cable and it is no longer functioning properly, the equipment must no longer be used.

In this event, contact the manufacturer immediately.

Only original spare parts must be used for your own safety and the longevity of your equipment.

For safe operation of the *sintering furnace*, regional regulations (e.g. accident prevention regulations) also apply in addition to the instructions in this operating manual which must be provided by the operating company of the equipment. The safety signs on the *sintering furnace* must be kept in a legible condition.



NOTICE

This operating manual must be read and understood by each operator before working on and with the equipment.

The operating manual must be safeguarded for the specified lifetime of the *sintering furnace*.

Transport, packing and storage

Transport



CAUTION

Risk of injury due to furnace weight!

Physical strain/back complaints due to high inherent weight.

- Carry/move the *sintering furnace* using at least two persons.




NOTICE

Transport damage!

To avoid injury to personnel and material damage:

- Only transport the equipment in a upright position.
- Do not stack equipment on top of each other.
- Do not place any other objects on the equipment.
- The transport must be as free of shaking and vibration as possible to prevent damage to the equipment.
- Make sure that the equipment is secured against slipping and falling over during transport.
- Immediately upon receipt, the goods must be inspected for any damage and losses, which must be documented by the freight carrier on the letter of consignment in order to lodge claims.

 assumes no liability for any damage and losses only determined subsequently.

Packaging



NOTICE

The packaging protects the **sintering furnace** against transport damage, corrosion and other forms of damage. Only remove it shortly before the initial commissioning and store it under dry conditions for later reuse.

Storage



NOTICE

Temperature damage!

To prevent temperature damage:

- Only store the equipment at temperatures from +5 °C to +40 °C.
- Always store the equipment in dry and dust-free conditions.
- Avoid any direct sunlight.
- Avoid mechanical vibrations.

Technical description

Function

The **sintering furnace** is used for processing sinterable ceramics.

The product to be sintered is placed in the sintering bowl and set on the support pins. After entering the heating parameters and pressing the start button, the electrically-operated furnace door closes and the heating process begins.

After the heating program has run and the **sintering furnace** has cooled down, the furnace door opens and the finished product can be removed.

Heating chamber

The product is sintered in the heating chamber. It consists of two different, ceramic insulation layers and is operated with four heating elements connected in series. The outer insulating layer is designed for temperatures up to 1200 °C, the inner layer for temperatures up to 1700 °C.

Furnace door

The furnace door consists of a two-part ceramic door panel. A safety switch disconnects the heating current as soon as the furnace door is opened.

A slip coupling used in the drive mechanism prevents excessive contact pressure between the furnace door and heating chamber.

Furnace housing

The furnace housing consists of steel plate coated on the inside and outside with plastic and is cooled by an emergency cooling system.

An integrated battery assures the emergency cooling, even upon failure of the voltage supply.

Program controller

The program controller is equipped with a finished time setting according to weekday and time. The switch-on time is calculated automatically so that the heating process is stopped at the required time and the sintered goods can be removed.

Operating parameters and heating programs are stored in a non-volatile memory and are retained even if the current supply fails.

The set target temperature is maintained with an accuracy of ± 1 °C. A temperature sensor integrated in the heating chamber records the chamber temperature close to the product.

Overheating of the **sintering furnace** due to a defective temperature sensor is prevented by means of a thermocouple fail-safe mechanism.

Conformity



EC Declaration of conformity for machinery

MIHM-VOGT GmbH & Co. KG
 Friedrich-List-Str. 8
 76297 Stutensee – Blankenloch
 Germany

We herewith declare that the sintering furnace models

HT, HT-S, HT Speed, and HT-S Speed

are in conformity with all the relevant provisions of the following European directives:

1. Directive 2011/65/EU on the restriction of the use of certain hazardous substances in electrical and electronic equipment (RoHS)
2. Directive 2002/96/EC on waste electrical and electronic equipment (WEEE)
3. Directive 2006/42/EC on machinery
4. Low voltage directive 2006/95/EC
5. EMC directive 2004/108/EC

And furthermore, we declare that the following European harmonised standards have been used:

DIN EN 61010-1: 2002-08
 DIN EN 61010-2-010: 2004-06
 DIN EN 61326-1: 2006-10

Stutensee, 17 July 2013



MIHM-VOGT GmbH & Co. KG
 Dietmar Gräbe
 (Managing Director)

MIHM-VOGT GmbH & Co.KG
 Friedrich-List-Straße 8
 76297 StutenseeBlankenloch
 AG Mannheim HRA 101782

Persönlich haftende Gesellschafterin:
 Mihm-Vogt Verwaltungs GmbH
 AG Mannheim HRB 101361

Geschäftsführer: Dietmar Gräbe
 Hermann Gräbe

Intended use

The **sintering furnace** is a high temperature furnace for commercial use in dental laboratories and must only be used for sintering sinterable ceramics.



NOTICE

No liability is assumed for any damage due to misuse, incorrect operation, incorrect connected or improper maintenance/repair by untrained personnel. All warranty services are also excluded in such cases.

Potential misuse

- Use of non-instructed and insufficiently qualified personnel.
- Use of products not approved by the manufacturer.
- Use of spare parts not approved by the manufacturer.
- Any use not in accordance with the declaration of conformity.
- Technical modifications and conversions to/of the equipment not approved by the manufacturer.

Technical data

General specifications

Dimensions (W x H x D)	500 x 770 x 600 mm
Combustion chamber volume	2 bowls Ø 120 x 35 mm
Max. temperature	1650 °C
Weight	80 kg
Minimum distance around the Sintering furnace	50 mm

HT connected electrical load

Voltage supply	200 - 240 V (±10 % deviation)
Frequency	50 - 60 Hz
Max. power consumption	3.1 kW
Energy consumption/cycle	approx. 5.8 kWh
Fusing (on site)	Connect to a separate power circuit with a 16 A fuse, type K,Z (other fuse types according to the country of use)
Protection class	IP 20 (protection against penetration of foreign bodies, but not against the penetration of water)

HT-Speed connected electrical load

Voltage supply	220 - 240 V (± 10 % deviation)
Frequency	50 - 60 Hz
Max. power consumption	3.8 kW
Energy consumption/Cycle	approx. 5.8 kWh
Fusing (on site)	Connect to a separate power circuit with a 16 A fuse, type K,Z (other fuse types according to the country of use)
Protection class	IP 20 (protection against penetration of foreign bodies, but not against the penetration of water)

Operating conditions

Installation area:	Indoor area only (in dry rooms)
Temperature range	+5 - +40 °C
Relative air humidity	Up to 31 °C: 80 %
Maximum air humidity	Up to 40 °C: 50 %
	No condensation
Height	Max. 2000 m
Degree of soiling	2

Installation

Installing

The **sintering furnace** is designed as a table-top unit. A level surface of at least 50 cm x 60 cm that supports a load up to 80 kg is recommended for stability.

Installation conditions

- ▶ Always install the **sintering furnace** in dry rooms that are as dust-free as possible and make sure liquids cannot get into the equipment.
- ▶ No highly inflammable and combustible gases and liquids must be stored in the installation rooms.
- ▶ Do not place any combustible and inflammable objects in the vicinity of the **sintering furnace**.



CAUTION

Tilting loads!

Insufficient load-bearing capacity of the supporting surface.

When installing the **sintering furnace**, ensure sufficient load-bearing capacity of the supporting surface.



CAUTION

Risk of injury due to furnace weight!

Physical strain/back complaints due to high inherent weight.

- ▶ Carry/move the **sintering furnace** using at least two persons.



CAUTION

Danger of overheating!

The electronics system shuts down in case of overheating.

- ▶ Make sure that the air vents remain clear on all sides.

1. Align the supporting surface horizontally.
2. Place the **sintering furnace** on the supporting surface.

⚠ *Make sure the surface is non-slip.*

Electrical connection

Building installation

- ☑ The **sintering furnace** requires its own power circuit.
- ☑ The power circuit must be installed on the building side via an automatic circuit-breaker of at least 16 A type K,Z (other circuit-breaker types according to the country of use).
- ☑ If an additional residual-current circuit-breaker is used, it must be designed for a maximum triggering current of 30 mA.
- ☑ For electrically-safe operation, the **sintering furnace** requires a protective earth connected to the power socket.
- ☑ When selecting the installation location, ensure that the accompanying mains cable has a length of 2.5 m and note that cable extensions are not permitted. The voltage supply must lie in the nominal voltage range of 200 - 240 V.



DANGER

Electrical power!

Danger of fatal injury from electric shock.

- Do not touch live cables and components with wet hands.
- Heed the accident prevention instructions when handling electric current.
- Only connect the equipment to a voltage supply that conforms with the specifications on the rating plate.

Mihm-Vogt GmbH & Co. KG
Friedrich-List-Str.8
D-76297 Stutensee-Blankloch 1

Sinterofen

Type: 2 HT S / N: 49686 3

4 200-240V 5 50/60Hz 6 3100W

Manufactured in Germany 2013 7 8

EN 50419

Fig. 1: Rating plate (example illustration)

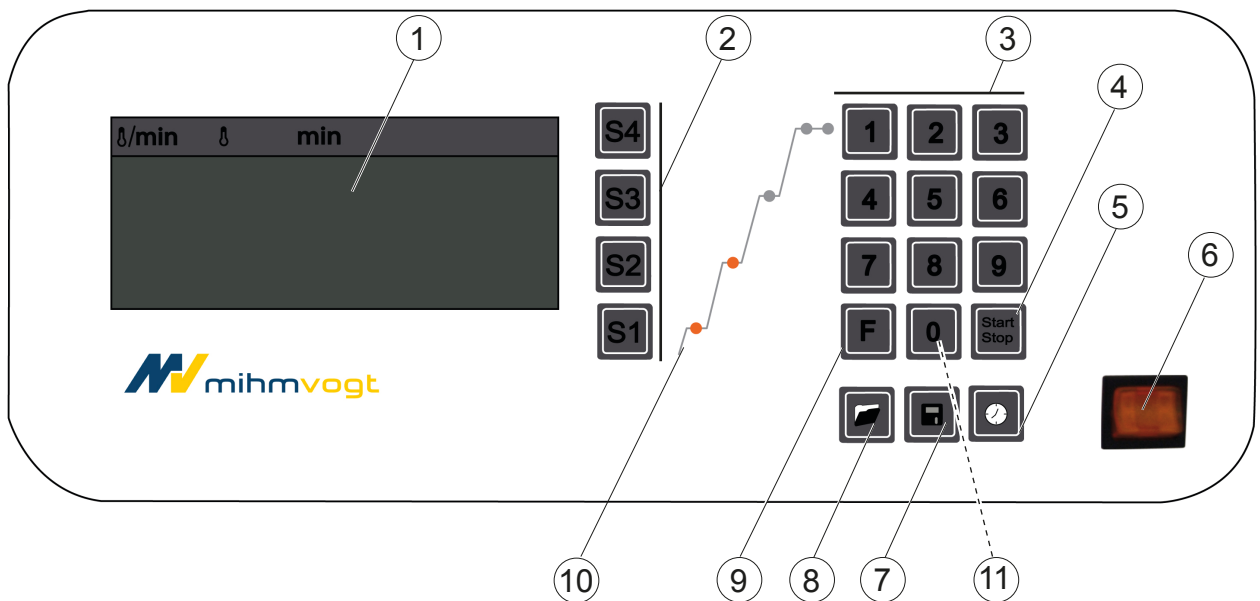
- | | |
|------------------------------|-----------------------|
| 1 Manufacturer's information | 5 Mains frequency |
| 2 Machine type/designation | 6 Capacity |
| 3 Serial number | 7 Year of manufacture |
| 4 Operating voltage | 8 CE label |

Operation

Operating elements and displays

The microprocessor-controlled program controller enables a wide range of heating curves to be run through with high precision. The operation is menu-controlled which is realised using a membrane keyboard and displayed on an LCD display.

The program controller contains the following operating elements:



- | | |
|---|-----------------------|
| 1 Display | 6 Mains switch |
| 2 Heating stages | 7 Save key |
| 3 Numeric keypad | 8 Load key |
| 4 Start/Stop key | 9 Function key |
| 5 Finished time key | 10 Heating phase LEDs |
| 11 Additional function: Open furnace door | |

Switches and key functions

Function



Mains switch, lights when switched on (at bottom switch position)



Starts/stops the current heating program



Loads an existing program from the memory



Stores a created program in the memory



Setting of the finished time



Function key for setting the parameters (see graphic "Parameter settings" on page 34)



Additional function: Open furnace door
This additional function is only active if the current furnace temperature is lower than the temperature set in stage 4.

Parameter

Function



Language

Change system language (DE, EN, FR, IT, ES, DA, CZ, NL)



Tone signal

Switch on/off tone signal



Date

Set weekday and time



Continue

Jump to next parameter menu level 2:



Adjustable lift opening temperature

Serves as double safety. The lift opening temperature is set by S4.



Timing scheme

Time display 12/24 h mode



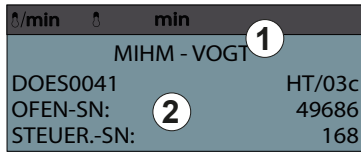
Temperature scale

Temperature unit °C/°F



Continue

Exit parameter menu



Standby screen

- 1 Manufacturer
- 2 Details of hardware and software level

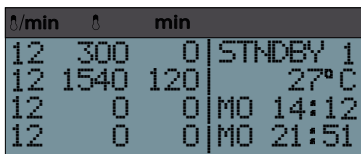


Function

- 1 Heating rate in °C/min. (°F/min.)
- 2 Set final temperature of the stage
- 3 Set holding time of the stage

Switching on the Sintering furnace

1. Connect the voltage supply.
 2. Switch on the **sintering furnace** at the mains switch.
- ➔ The mains switch pilot lamp lights.
 - ➔ The current furnace temperature is displayed after approx. 3 s.
 - ➔ The furnace door opens automatically.



Initial commissioning

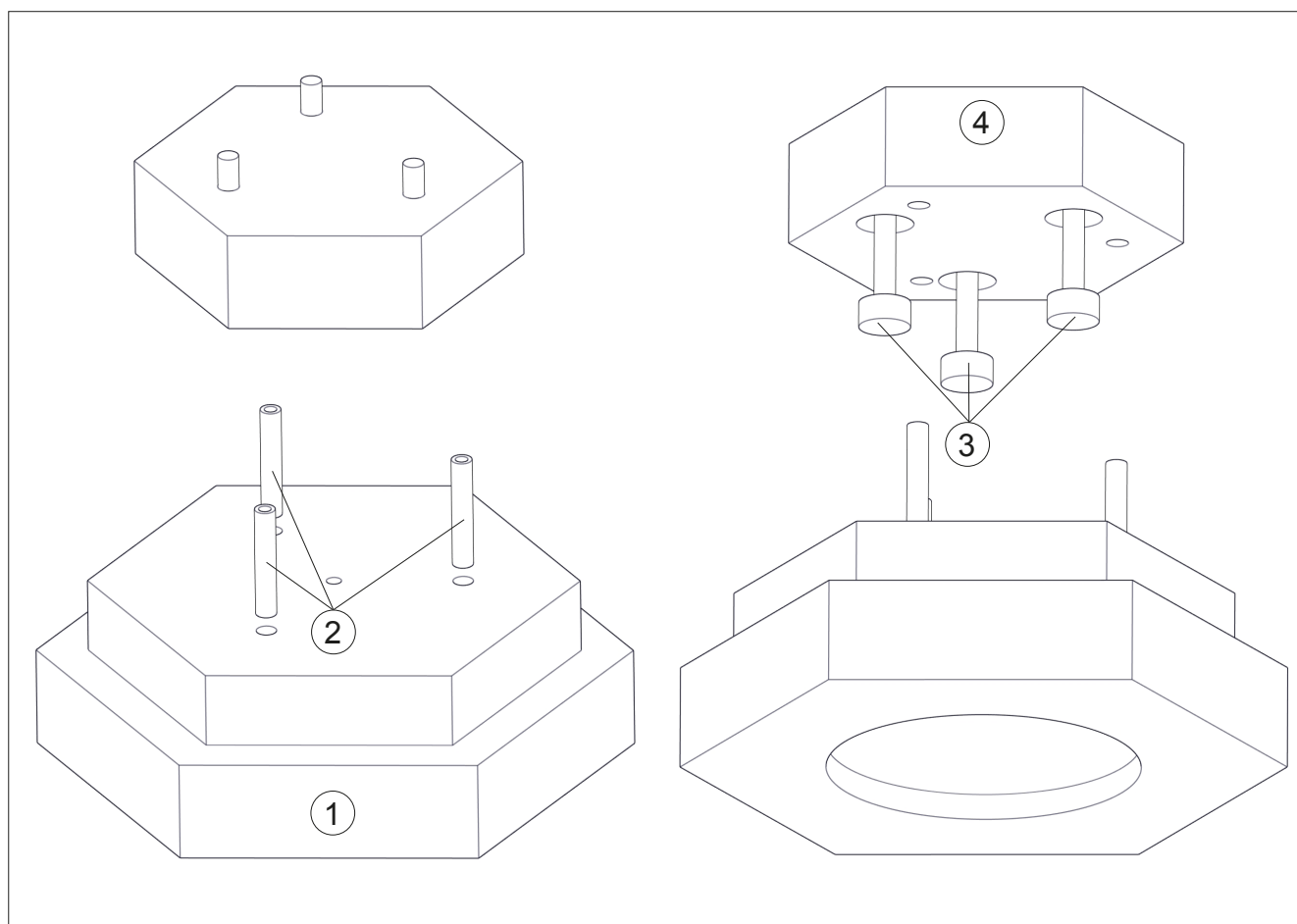


NOTICE

Check the basic settings of the *sintering furnace* (see “Basic settings” on page 34).

Installing the door insulation

1. Insert the connecting pins (pos. 2) in the base support (pos. 1).
2. Set the support pins (pos. 3) into the support (pos. 4).
3. Set the support (pos. 4) onto the connecting pins (pos. 2).
4. Install the complete door panel in the furnace door.



Speed sintering operating mode

Feeding the Sintering furnace

⚠ *The ceramic door panel is highly porous and sensitive to scratches and impacts.*

⚠ *Do not grasp the door panel with removal tongs.*

1. Switch on the **sintering furnace**.

➡ The furnace door opens automatically.

2. Fill the Speed sinter bowl included in the scope of delivery with sinter beads (see "Preparation of the sintering aid" on page 24).

3. Lay the sinter goods in the Speed sinter bowl.

4. Place the fitted Speed sinter bowl on the support pins with the aid of suitable removal tongs.



5. Start a firing program using the **START/STOP** key.

➡ The furnace door closes automatically.



CAUTION

Danger of crushed limbs!

The furnace door closes automatically.

- Press the **START/STOP** key only after the sinter goods have been positioned.
- Make sure that no one reaches between the furnace door and the heating chamber while the furnace door closes.

Selecting and loading the heating program



1. Press the **LOAD** key.



- ➔ The **LOAD PROGRAM** menu opens.



2. Press the **S4** key as often as necessary until the required heating program is reached or enter the heating program using the numeric keypad.



3. Press the **S2** key (for "YES") to confirm loading.

- ➔ The loaded heating program is displayed.



4. Press the **S1** key (for "NO") to cancel loading.

- ➔ The last loaded heating program is displayed.

Starting/stopping the heating program

Requirements

- Sintering furnace** is fed
- Heating program is loaded



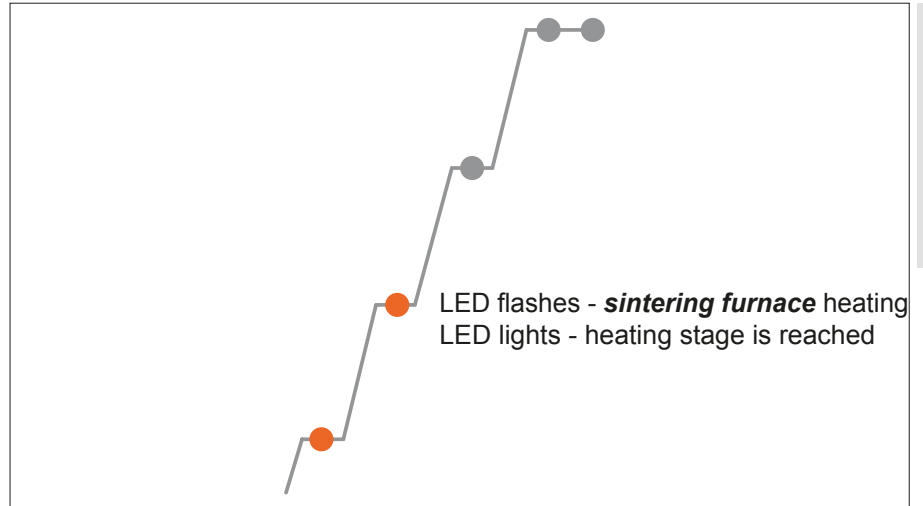
1. Press the **START/STOP** key.

- ➔ The heating program starts.

- ➔ The furnace door closes automatically.

- ➔ The status display switches from **READY** to **PROCESS**.

- ➔ The process status is also shown on a bar chart:



2. Press the **START/STOP** key again.

➡ The heating program is halted.

➡ The status display switches from **PROCESS** to **READY**.



3. Press the **START/STOP** key again to continue the heating program.

Removing the sinter bowl from the heating furnace

Requirements

The furnace door is open

1. Guide suitable removal tongs under the Speed sinter bowl and lift it from the support.

2. Set the Speed sinter bowl on a suitable, heat-resistant support surface.

Programming the heating stages

The control unit provides the possibility of specifying the heating of the **sintering furnace** in 1 - 4 heating stages as a heating program. A heating program can be used for heating and cooling.

If no setting is made within one minute during the programming process, the program automatically jumps back to the overview of the last called-up heating program.



1. Press the **S1** key.
 - ➔ The cursor for the entry flashes in the **0/min** field.
2. Enter the heating speed using the numerals 0-9.
The minimum heating speed is 1 °C/min (2 °F/min),
the maximum heating speed is 99 °C/min (178 °F/min).
 - ➔ If the entry lies below a two-digit value, the cursor must be moved to the next input field using the respective stage key.
 - ➔ After entering the heating speed, the cursor jumps to the next input field.
3. Enter the four-digit holding temperature to be reached in heating stage **S1** using the numerals 0-9.

NOTICE

The maximum programmable temperature of the **sintering furnace** is 1650 °C.

If a higher temperature is entered, the display jumps back to the previous value.

- ➔ After entering the temperature value, the cursor jumps to the next input field.
- ➔ If the entry lies below a four-digit value, the cursor must be moved to the next input field using the respective stage key.

4. Enter the holding value of the selected temperature in minutes using the numerals 0-9.

NOTICE
The maximum programmable holding time is 999 minutes (holding time in S1-S3 , entry in S4 controls the audible alarm for "End of program").

- After all three values have been entered, programming of heating stage 1 is complete.

Programming of stages S2 to S4

To program further heating stages, follow the handling steps of the first heating stage with the corresponding heating stage key (e.g. **S2** for the second heating stage, **S3** for the third heating stage, etc.).

If not all 4 heating stages are needed, the temperature must be set to zero in the unused stage.

Stages **S1** to **S3** can be set to zero.

The **S4** stage controls the door opening temperature and must be entered.

Storing the heating program

The *sintering furnace* can store up to 30 different heating programs.

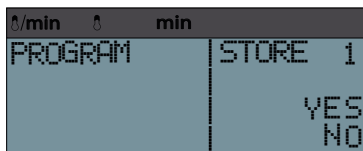
Stored heating programs are also retained after switching off the *sintering furnace*.

A heating program is always stored under the program number under which it was loaded beforehand.



1. Press the **SAVE** key.

- The **SAVE** menu is displayed.



2. Press the **S2** key (for "YES") to save the heating program.



3. Press the **S1** key (for "NO") to cancel the saving process.

Speed sintering programming

It is possible to carry out a fast sintering process with the *sintering furnace*. To do this, the cooling speed must be set to above 30 °C (54 °F/min) in stage **S3**. To reach the higher speed, the furnace door opens in steps.

Programming example

	Heating speed (°C/min)	Temperature (°C)	Holding time (min)
S4	99	750	0
S3	99	1100	0
S2	99	1540	30
S1	12	0	0

Heating at 99 °C/min. up to 1540 °C. This temperature is maintained for 30 min. The *sintering furnace* then cools down at 99 °C/min. The furnace door remains closed up to 1100 °C. From 1100 °C, the furnace door opens in steps up to max. half of the opening path. At 750 °C, the furnace door opens completely.

NOTICE

For an unused stage, it is enough to set the temperature to "0".

If the temperature of **S3** is higher than the temperature of **S4** and the cooling rate of **S4** is greater than 30 °C/min (86 °F/min), cooling is generated from 1100 °C (2012 °F) by stepped opening of the furnace door.

The furnace door is fully open only at 750 °C (1382 °F).

Saving program values with name

Requirements

- The program values are entered for all stages.



1. Press the **SAVE** key.
- ➔ The **SAVE** menu is displayed.



A save name with up to four lines can now be stored by means of key entry in the left field.



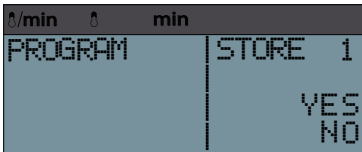
- ➔ The cursor can be moved to the right in steps using the **S4** key.

Renaming a heating program

In order to uniquely identify a specific heating program, it can be saved under a freely-selectable name.



1. Press the **SAVE** key.
- ➔ The **SAVE** menu is displayed.



2. Press the **FUNCTION** key to change the first letter. Pressing this key repeatedly runs through the alphabet from A to Z.



3. Press the **S4** key to jump to the next letter.



4. After entering the required name, press the **S2** key to save the changes.

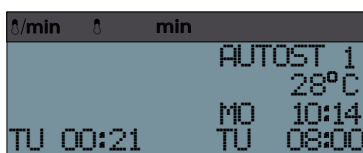
Automatically starting a heating program

The Sintering furnace can be programmed via an integrated timer so that it ends the currently loaded heating program at a specified finishing point. The finishing point is specified by weekday and time using the integrated timer.

1. Select a heating program.



2. Press the **FINISH TIME** key.



3. The **AUTOSTART** program opens.



3. Press the **S1** key to enter the weekday. Set the weekdays using the 1-7 keys (1 = Mon, 2 = Tues, 3 = Wed, etc.).



4. Press the **S1** key again to jump to the time entry.

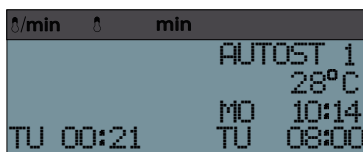
5. Set the hours using the 0-9 keys.



6. Press the **S1** key to switch to the minutes display.

7. Set the minutes using the 0-9 keys.

8. The timer is activated.



9. The finishing time and the calculated switching-on time appear on the display.

Preparation of the sintering aid

Recommended filling of the Speed sinter bowl

1. Fill the Speed sinter bowl with a layer of sinter beads.
 2. Place the parts to be sintered in the Speed sinter bowl.
- ⚠ *Make sure that the bottom of the bowl is covered by a layer of sinter beads and the sinter beads can move freely.*
 - ⚠ *Manufacturer's information of the material manufacturer can vary and must be heeded.*



Standard sintering operating mode

Feeding the Sintering furnace

⚠ *The ceramic door panel is highly porous and sensitive to scratches and impacts.*

⚠ *Do not grasp the door panel with removal tongs.*

1. Switch on the **sintering furnace**.

➡ The furnace door opens automatically.

2. Fill the Standard sinter bowl included in the scope of delivery with sinter beads (see "Preparation of the sintering aid" on page 32).

3. Lay the sinter goods in the Standard sinter bowl.

4. Place the fitted Standard sinter bowl on the support pins with the aid of suitable removal tongs.



5. Start a firing program using the **START/STOP** key.

➡ The furnace door closes automatically.



CAUTION

Danger of crushed limbs!

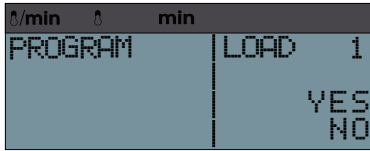
The furnace door closes automatically.

- Press the **START/STOP** key only after the sinter goods have been positioned.
- Make sure that no one reaches between the furnace door and the heating chamber while the furnace door closes.

Selecting and loading the heating program



1. Press the **LOAD** key.



- ➔ The **LOAD PROGRAM** menu opens.
- ➔ The **sintering furnace** loads the last-used heating program.



2. Press the **S4** key as often as necessary until the required heating program is reached or enter the heating program using the numeric keypad.



3. Press the **S2** key (for "YES") to confirm loading.

- ➔ The loaded heating program is displayed.



4. Press the **S1** key (for "NO") to cancel loading.

- ➔ The last loaded heating program is displayed.

Starting/stopping the heating program

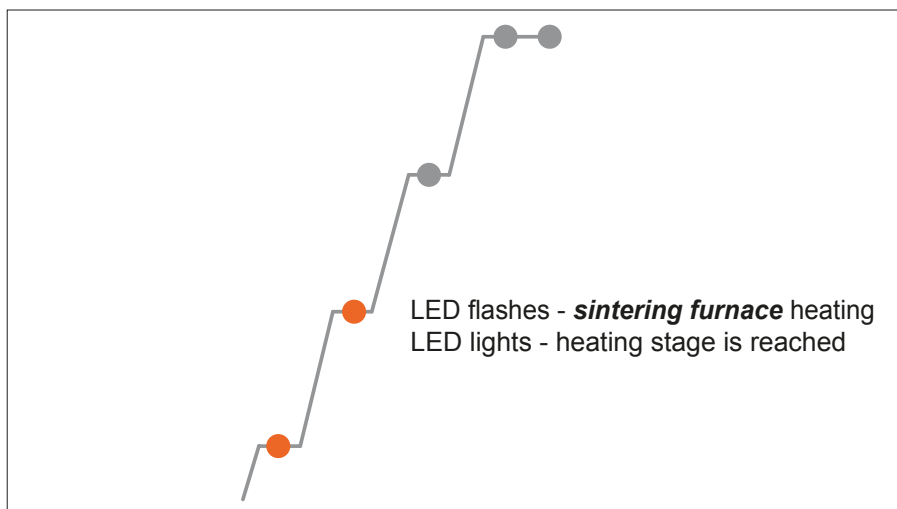
Requirements

- Sintering furnace** is fed
- Heating program is loaded



1. Press the **START/STOP** key.

- ➔ The heating program starts.
- ➔ The furnace door closes automatically.
- ➔ The status display switches from **READY** to **PROCESS**.
- ➔ The process status is also shown on a bar chart:



2. Press the **START/STOP** key again.

⇒ The heating program is halted.

⇒ The status display switches from **PROCESS** to **READY**.



3. Press the **START/STOP** key again to continue the heating program.

Removing the sinter bowl from the heating furnace

Requirements

The furnace door is open

1. Guide suitable removal tongs under the Standard sinter bowl and lift it from the support.
2. Set the Standard sinter bowl on a suitable, heat-resistant support surface.

Programming the heating stages

The control unit provides the possibility of specifying the heating of the *sintering furnace* in 1 - 4 heating stages as a heating program. A heating program can be used for heating and cooling.

If no setting is made within one minute during the programming process, the program automatically jumps back to the overview of the last called-up heating program.



1. Press the **S1** key.
 - ➔ The cursor for the entry flashes in the \emptyset/min field.
2. Enter the heating speed using the numerals 0-9. The minimum heating speed is 1 °C/min (2 °F/min), the maximum heating speed is 30 °C/min (54 °F/min).
 - ➔ If the entry lies below a two-digit value, the cursor must be moved to the next input field using the respective stage key.
 - ➔ After entering the heating speed, the cursor jumps to the next input field.
3. Enter the four-digit holding temperature to be reached in heating stage **S1** using the numerals 0-9.

NOTICE

The maximum programmable temperature of the *sintering furnace* is 1650 °C.

If a higher temperature is entered, the display jumps back to the previous value.

- ➔ After entering the temperature value, the cursor jumps to the next input field.
- ➔ If the entry lies below a four-digit value, the cursor must be moved to the next input field using the respective stage key.

- 4. Enter the holding value of the selected temperature in minutes using the numerals 0-9.

NOTICE

The maximum programmable holding time is 999 minutes (holding time in **S1-S3**, entry in **S4** controls the audible alarm for "End of program").

- ➔ After all three values have been entered, programming of heating stage 1 is complete.

Programming of stages S2 to S4

To program further heating stages, follow the handling steps of the first heating stage with the corresponding heating stage key (e.g. **S2** for the second heating stage, **S3** for the third heating stage, etc.).

If not all 4 heating stages are needed, the temperature must be set to zero in the unused stage.

Stages **S1** to **S3** can be set to zero.

The **S4** stage controls the door opening temperature and must be entered.

Storing the heating program

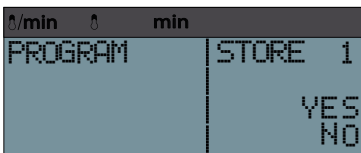
The *sintering furnace* can store up to 30 different heating programs.

Stored heating programs are also retained after switching off the *sintering furnace*.

A heating program is always stored under the program number under which it was loaded beforehand.



- 1. Press the **SAVE** key.



- ➔ The **SAVE** menu is displayed.



- 2. Press the **S2** key (for "YES") to save the heating program.



- 3. Press the **S1** key (for "NO") to cancel the saving process.

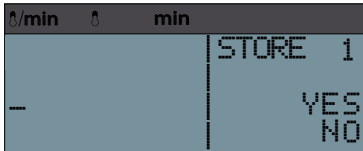
Saving program values with name

Requirements

- The program values are entered for all stages.



1. Press the **SAVE** key



- The **SAVE** menu is displayed.

A save name with up to four lines can now be stored by means of key entry in the left field.



- The cursor can be moved to the right in steps using the **S4** key.

Renaming a heating program

In order to uniquely identify a specific heating program, it can be saved under a freely-selectable name.



1. Press the **SAVE** key.



- The **SAVE** menu is displayed.



2. Press the **FUNCTION** key to change the first letter. Pressing this key repeatedly runs through the alphabet from A to Z.



3. Press the **S4** key to jump to the next letter.



4. After entering the required name, press the **S2** key to save the changes.

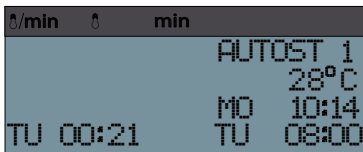
Automatically starting a heating program

The *sintering furnace* can be programmed via an integrated timer so that it ends the currently loaded heating program at a specified finishing point. The finishing point is specified by weekday and time using the integrated timer.

1. Select a heating program.



2. Press the **FINISH TIME** key.



➔ The **AUTOSTART** program opens.



3. Press the **S1** key to enter the weekday. Set the weekdays using the 1-7 keys (1 = Mon, 2 = Tues, 3 = Wed, etc.).



4. Press the **S1** key again to jump to the time entry.

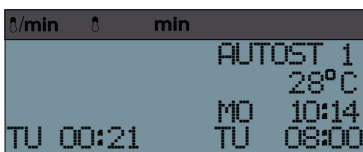
5. Set the hours using the 0-9 keys.



6. Press the **S1** key to switch to the minutes display.

7. Set the minutes using the 0-9 keys.

➔ The timer is activated.



➔ The finishing time and the calculated switching-on time appear on the display.

Preparation of the sintering aid

Recommended filling of the Standard sinter bowl

1. Fill the Standard sinter bowl with a layer of sinter beads.
2. Place the parts to be sintered in the Standard sinter bowl.

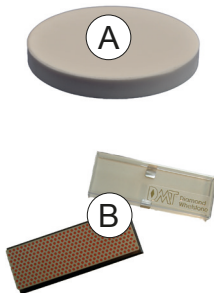


⚠ *Make sure that the bottom of the bowl is covered by a layer of sinter beads and the sinter beads can move freely.*

⚠ *Manufacturer's information of the material manufacturer can vary and must be heeded.*

Sintering with sintered disc

1. Check the sintered disc (pos. A) for roughness.
2. If necessary, rub the sintered disc (pos. A) using a suitable diamond grinding stone (pos. B).



Special functions

Sintering with ventilation

°/min	°	min	
12	300	0	STNDBY23
12	1470	120	27°C
12	0	0	MO 14:12
12	1300	0	MO 21:51

With this additional function, the combustion chamber is also ventilated during the sintering process, which has a positive effect on the oxidation process.

This function is only possible on program channels 23 - 24.

- Stage 1 Heating to ventilation temperature. When ventilating, the furnace door remains open a crack. After completing the first stage (max. 999 min), the furnace door closes.
- Stage 2 Heating to an intermediate temperature with holding time.
- Stage 3 Heating up to sinter temperature with holding time.
- Stage 4 Cooling down to door opening temperature.

Pre-drying without sintering

°/min	°	min	
12	100	0	STNDBY27
12	0	0	27°C
12	0	0	MO 14:12
12	300	30	MO 21:51

During pre-drying, the furnace door is left widely ajar in the first program stage **S1**. Factory-preset program channels are present for the pre-drying. This function can therefore only be carried out on these channels. The special function is only active on channels 25 - 30.

For pre-drying without sintering, values must only be specified in stage **S1**. No values for stages **S2-S3** are specified for the holding temperature and holding time. If values have been set for stages **S2-S3**, however, these must reset to "0".

Pre-drying with sintering

°/min	°	min	
12	300	0	STNDBY27
12	1540	30	27°C
12	0	0	MO 14:12
12	300	00	MO 21:51

Pre-drying with sintering basically uses the same function as for pre-drying without sintering. That means, during pre-drying, the furnace door is left widely ajar in the first program stage **S1**. For this reason, this special function is also stored on program channels 25 - 30. To add this function to the sintering, the required values are also set in stages **S2-S4**.

Fast cooling by setting values

This special function is active on all selectable program channels. Fast cooling is set by specifying lower holding temperatures on stages **S3** and **S4**.

NOTICE

If the temperature of **S3** is higher than the temperature of **S4** and the cooling rate of **S4** is greater than 30 °C/min (86 °F/min), cooling is generated from 1100 °C (2012 °F) by stepped opening of the furnace door.

The furnace door is fully open only at 750 °C (1382 °F).

Basic settings

Service settings

Parameter settings

The *sintering furnace* is supplied with preset time and pre-programmed heating programs ex-works.

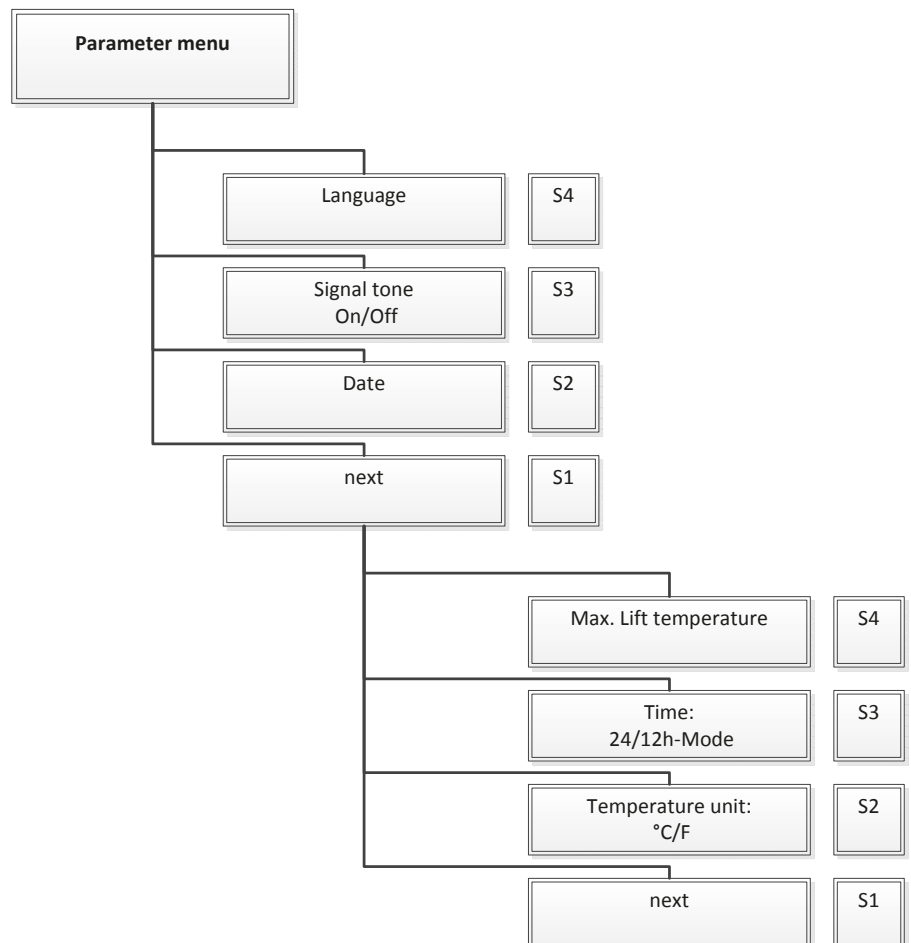
The *sintering furnace* does not carry out automatic summer/winter time changeover.

1. Switch on the *sintering furnace* at the mains switch.











2. Press the **FUNCTION** key.

➔ The parameter menu opens.



3. Press a key (**S1-S4**) to select a parameter.
4. Press the corresponding parameter key until the required change is reached.

Parameter	But-ton	Function
Language		Change system language (DE, EN, FR, IT, ES, DA, CZ, NL)
Tone signal		Switch on/off tone signal
Date		Set weekday and time
Continue		Jumps to the next parameter menu level 2:
Max. adjustable lift opening temperature		Serves as double safety. The lift opening temperature is set by S4.
Timing scheme		Time display 12/24 h mode
Temperature scale		Temperature unit °C/°F
Continue		Exit parameter menu

Set weekday and time



1. Press the **FUNCTION** key.



2. Press the **S2** key.
- ➔ The **DATE** menu opens.

3. Set the weekdays using the 1-7 keys (1 = Mon, 2 = Tues, 3 = Wed, etc.).



4. Press the **S2** key to switch to the hours display.

5. Set the hours using the 0-9 keys.



6. Press the **S2** key to switch to the minutes display.

7. Set the minutes using the 0-9 keys.



NOTICE

Any change is only accepted when the cursor is no longer visible.

Setting the lift temperature



1. Press the **FINISH TIME** key.



2. Press the **S1** key.

➔ The second parameter menu opens.



3. Press the **S4** key.

➔ The **LIFT TEMPERATURE** menu opens.

4. Set the lift temperature using the 0-9 keys.

Switching off the Sintering furnace

1. Switch off the *sintering furnace* at the mains switch.
- ⇒ The mains pilot lamp in the main switch goes out.



CAUTION

Danger of burns from residual heat of the high-temperature furnace!

Even with the *sintering furnace* switched off, the heating chamber can still have considerable residual heat. There is a danger of burns on the heating chamber walls and the furnace door.

Therefore:

- Before working on the *sintering furnace*, make sure it has cooled down sufficiently. The *sintering furnace* needs at least 4 h to cool down from maximum temperature to roughly room temperature.

Care and maintenance

Clean the housing of the *sintering furnace* now and again with a mild cleaning agent.



NOTICE

Damage to the heater!

- Make sure the heating chamber does not become contaminated. The heater can be damaged.



NOTICE

Impairment of service life from colouring liquids!

During the sintering process, colouring liquids can significantly shorten the service life of the heating elements.

Cleaning/Regeneration firing

h/min	h	min	
20	300	0	STNDBY 1
15	1550	480	27°C
	0		MO 14:12
	0		MO 21:51

Depending on the frequency of use, a cleaning firing process should be carried out. This is used to regenerate the heating elements and to remove residues from the porous insulation.

Changing the battery

h/min	h	min	
			RPL. STR. BATT.
			CALL CUSTOM. SERVICE

The battery has a limited service life and must be replaced after 4 years at the latest. The prompt to replace the battery is indicated by a system message on the LCD display.

Faults and error messages

Safety



DANGER

Electrical power!

Danger of fatal injury from electric shock.

- Work on electrical power systems must only be performed by electricians.
- Before any installation, maintenance, cleaning and repair work, disconnect the power supply of the **sintering furnace** and secure it from being switched back on.
- Do not touch live cables and components with wet hands.
- Heed the accident prevention instructions when handling electric current.



WARNING

Hot surfaces!

Serious burns to the limbs.

- Do not touch the housing or the furnace door during operation.
- Ensure the **sintering furnace** has fully cooled down before maintenance, cleaning and repair work.
- Wear heat-resistant, thermally-insulated safety gloves when working on hot components.





NOTICE

Material damage due to improper repairs of electrical cables!







Malfunctions and defective components possible.

- Never repair any defective cables and connectors.

Faults

Fault	Possible cause	Troubleshooting	Responsibility
Incorrect time	Time in controller stored incorrectly	Set the time correctly	Operator
Sintering furnace does not start automatically	Power failure/Loss of power feed	Check the voltage supply is correctly connected, notify an electrician if necessary	
No indication on the display, mains pilot lamp lights, the stage LEDs do not light when switching on	Defective protective fusing	Switch off the Sintering furnace, wait for 10 s, switch back on If the malfunction reoccurs, notify Service	
No indication on the display, mains pilot lamp does not light	No voltage supply present	Check fuses on the building side Check connection cable, notify an electrician if necessary	
Pieces broken off the door panel, other damage to the door panel	Improper treatment of the door panel	Replace door panel	
"Mains failure" display	Mains failure during the sintering process for longer than 10 s	Acknowledge with Start/Stop button	
No display, mains pilot lamp lights, the stage LEDs light briefly when switching on	Defective display	Replace controller	 service department
Stage LED flashes, but furnace does not heat	Defective heater	Check heater for continuity	 service department

Electronic system error messages

Fault	Possible cause	Troubleshooting	Responsibility
Display: "Defective sensor"	Defective thermocouple	Replace thermocouple	 service department
	Loose thermocouple connections	Retighten thermocouple connections	
Display: "Sensor + <-> -"	Furnace interior is significantly colder than ambient temperature	Open furnace door to let the chamber interior come to ambient temperature.	Operator
	Thermocouple incorrectly connected/wired	Replace thermocouple connections	 service department
Display: "Safety shutdown"	Furnace temperature is above 1650 °C	Switch off furnace and let cool. If the fault reoccurs, notify Service.	Operator
Display: "Replace battery"	Battery is older than 4 years	Call Customer Service	 service department
Display: "Sensor short-circuit"	Defective temperature sensor	Call Customer Service	 service department
Display: "Defective thyristor"	Defect in the electronics	Call Customer Service	 service department
Long signal tone without LCD display, furnace door does not close, program does not start	Door switch not adjusted correctly	Call Customer Service	 service department

Decommissioning

Decommissioning can be carried out for two reasons:

- For the purpose of reinstalling at another location.
- For the purpose of final disposal.

If the **sintering furnace** is to be reinstalled at another location, decommissioning must be well prepared. All mounting and attachment parts must be carefully dismantled, labelled and packed for transport if necessary. This ensures that all parts are assigned correctly and can be fitted again at the right position when reinstalling.

1. Switch off the **sintering furnace**.
2. Disconnect the **sintering furnace** from the voltage supply.
3. Disconnect all connections (e.g. PC interface cable, etc.) from the **sintering furnace**.

Disposal

Safety



WARNING

Contamination of the environment and groundwater from improper disposal!

- The regulations and guidelines of the legislator in the country of operation must be adhered to when disposing of system parts and operating materials.

Disposal

1. Sort the component parts of the **sintering furnace** according to recyclable materials, hazardous substances and operating materials.
2. Dispose of the component parts of the **sintering furnace** or take them for recycling.