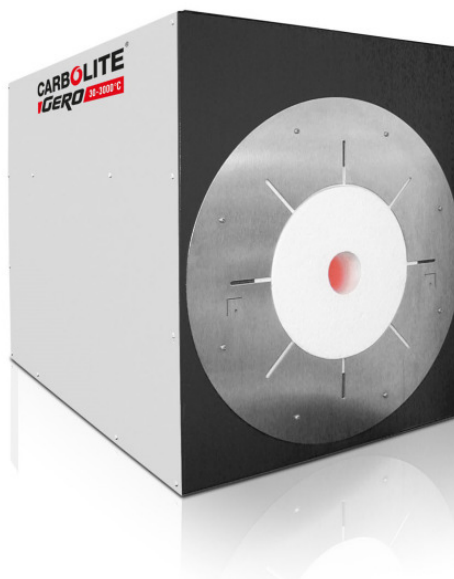


OPERATING INSTRUCTIONS

STANDARD FURNACE „HTRH/HTRV“

Furnace:



CARBOLITE-GERO
GmbH & Co.KG

Hesselbachstr. 15
D-75242 Neuhausen

Tel.: +49/7234/9522-0

FAX.: +49/7234/9522-99

URL: www.carbolite-gero.com

mail: info@carbolite-gero.com

Controller:
(Option)



These documents are meant only for the customers of our machines / plants and must not be copied, nor forwarded or made available to a third party without prior written permission.

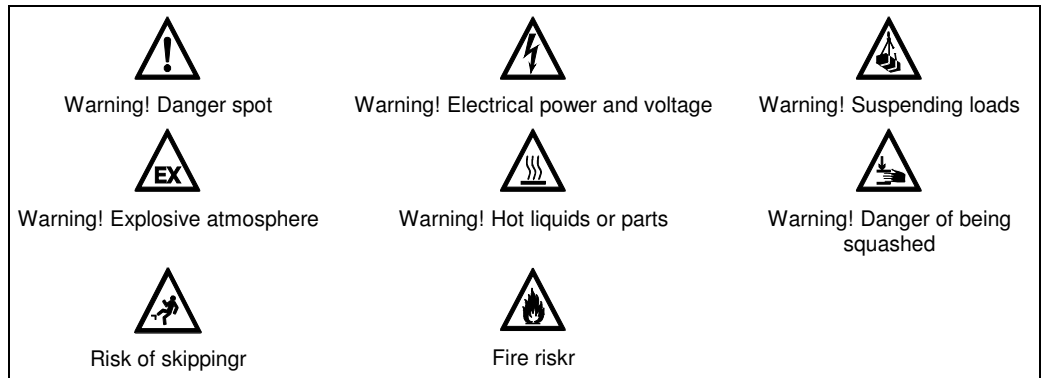
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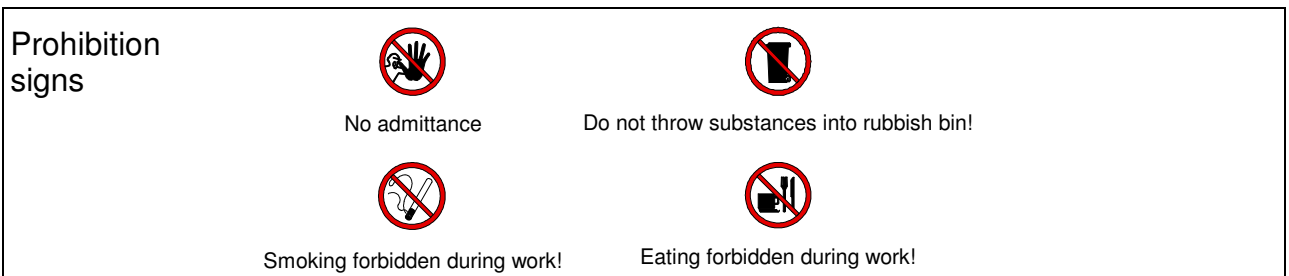
Used Symbols

Warning symbols

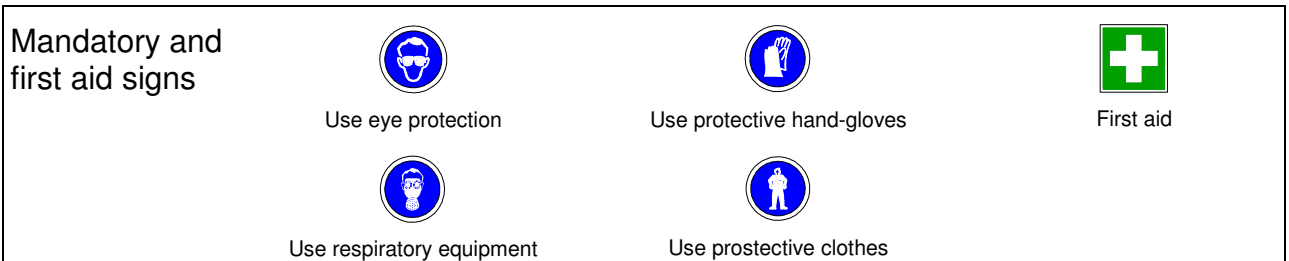
The following warning symbols serve as work-safety instructions in these operating instructions. They are also fixed to the exterior of the plant if the respective operations could jeopardise the safety of the operating personnel.
Please, pay attention to these instructions and act with particular care under the specified circumstances.



Prohibition signs





Mandatory and first aid signs



Information symbols



-  Used for additional information
-  Refers to other facts, causes, or consequences
- Fordert sie zum handeln auf
- Used for enumerations

Safety precautions

Protective measures and rules of conduct

When working When working on the furnace, wear protective glasses, protective clothes, and protective hand-gloves.



Health risk Eating, drinking, and smoking are prohibited when working.



What to do in the case of emergency Remove spilt liquid or absorb with binder. Dispose of these substances as per the proper procedure.

Proper disposal Please, pay attention to the manufacturer's instructions.
Remaining substances and waste materials must be disposed with other hazardous materials.



First aid If your eyes get in contact with irritants, rinse eyes immediately with sufficient water. Consult a doctor.



Operation as per destination

Operation modes

Permissible
operation
modes

Operation of the furnace is permitted

- after thoroughly reading and fully understanding the operating instructions. Furthermore, the procedures described in the operating instructions must be observed.

This furnace is designed for:

- a furnace temperature of max. 1600°C (HTR.....-.../16), of max. 1700°C (HTR.....-.../17), von max. 1800°C (HTR.....-.../18).

The use of the furnace for other purposes than those referred to in this document such as processing products other than those fulfilling the furnace's purpose of design in addition to handling hazardous materials or harmful substances, is considered as an improper application.

The operator is fully liable for damages resulting there from.

➔ For nominal values of the plant, please refer to the technical data.

Proper application of the plant includes observation of the procedures described in these operating instructions during installation, commissioning, and maintenance.



The furnace corresponds to „protective degree 0“, i. e. it must be operated under supervision. (Please, refer to EN 60519-2:1993).

Only furnaces with a separate over temperature sensor can be operated without supervision. (Please, refer to EN 60519-2:1993).

Prohibited
operation modes

Operation of the furnace is not permitted

- using sources of power, products, operating material, aids, etc. which are subject to an ordinance on hazardous materials or which affect the operating personnel's health in any way.
- using plant equipment which was modified by the plant operator

Manipulations

When operating the furnace protective facilities are not allowed to be removed, by-passed, or shut off.

Otherwise, the plant operator acts on his own responsibility!



Operation as per destination

Operation modes

Requirements for the operating personnel Persons operating powered working equipment must make sure that they do not put their own or other person's health at risk as a result of dangerous vehicle manoeuvres.

The plant operator may only assign works with powered working equipment and entailing dangerous vehicle manoeuvres to persons who are appropriately authorised and who

- can carry out works independently and safely or who
- after prior instruction, are supervised by a person familiar with these types of works.

This furnace can be highly dangerous if put to improper use by unskilled personnel.



Danger of accident!

Works on and with this furnace may only be carried out by persons who are appropriately authorised with the appropriate training or qualifications.

Moreover, these persons require prior instructions from the operator.

Remaining risk

Danger Warning The furnace has been built according to the latest state of the art. Therefore, a high degree of operational reliability is guaranteed. Nonetheless, improper use may result in dangers to the user and third parties in addition to impairments of the plant and other material assets.

Safety facilities

For protection of the operating personnel and the environment, the furnace is equipped with the following safety facilities:

No.	Protective equipment
1	Main switch
2	Casing of parts under voltage
3	Galvanised isolation of the heater
4	Over temperature controller (Option)

Protective equipment for the operating personnel

The following protective equipment must be worn when working at the furnace:

No.	Protective equipment
1	Protective hand-gloves
2	Protective glasses

Operator's obligations



Accident danger!

The operator is obliged to operate the furnace in a perfect condition. Danger spots resulting from connected plants must be secured appropriately by the operator.

Assign and instruct responsible persons

- Only skilled and instructed personnel may be assigned to these works. Clearly determine the personnel's areas of responsibility for operating, setting-up, and maintaining the plant.
 - Check if personnel are aware of safety requirements and dangers and observes the relevant operating instructions.
-

Obligation to inform

- Store operating instructions and applicable regulations in a place where they are quickly available for the maintenance personnel.
-



Note!

Observe operating instructions in all life phases of the furnace. The operator must take care that the operating personnel always wears the mandatory protective equipment.

Operating and working instructions

Instructions for the furnace operation

Basic safety instructions

Please observe these instructions. Non-observance may result in danger to life and limb!

Instructions	
1	Do not de-mount or amend protective clothing.
2	Immediately inform the senior employee responsible about any defects or damages to the furnace. Interrupt production until damage is repaired.
3	Observe all safety and danger information on the furnace and make sure it is at all times legible.
4	Prior to the work to be carried out on the furnace: <ul style="list-style-type: none"> ○ Cordon off a wide area around the working space (barrier chains, warning plates). ○ Inform operating personnel and assign a supervisor. ○ Observe instructions concerning remaining risk.
5	Do not modify or re-construct the furnace. This applies also for the installation or the adjusting of safety facilities in addition to welding structural parts.
6	Spare parts must correspond to the technical requirements specified by the manufacturer. The installation of non-genuine parts may result in danger to man and furnace. In this case, the manufacturer will not assume liability.
7	See to proper disposal of non-usable hazardous waste material such as lubrication oils and cleaning agents.

Operating and working instructions

Instructions for electrical / electronic equipment



Note!

Works with electrical components / component may only be affected by skilled electricians in accordance with the appropriate electro-technical regulations.

The five safety rules

1	Switch off main switch.
2	Lock main switch and secure against re-activation.
3	Verify safe isolation from supply.
4	Ground work place and shunt out.
5	Cover adjoining parts which are under voltage.
Alternative => unplug power supply	



Danger!

Defective electrical components may be under voltage and could be fatal.

Detected deficiencies of electrical furnaces / component / operating equipment must be repaired immediately. If exist an acute danger the furnace, component and / or operating equipment must no longer be used until the repair of the deficiency.

Only work according to circuit diagram!

Operating and working instructions

Cleaning instructions



Caution!

For cleaning works other than those described above, switch off the furnace thus avoiding unintentional activation of the furnace.

Wet cleaning of the furnace is not permitted!

Cleaning agents

For **medium amount of dirt**

- Use customary non-flammable cleaning agent and vacuum air.

For **stubborn dirt**

- Use non-flammable solvent.
-

Safety instructions

Please pay attention to the labels and instructions on the packing of the cleaning agents.

After cleaning, examine all supply lines and connections for leakage, loosened connections, chafe marks, and damages; If possible, repair detected deficiencies on your own or after consulting the manufacturer!

Maintenance instructions



Caution!

Maintenance work entails risks of crushing, impact and electric shocks etc..

This is why it is important that maintenance work is only performed by adequately trained professional personnel!!

Delivery

Check completeness	Compare scope of delivery with delivery note and ordering documents. Missing parts or damages resulting from inadequate packing or transport must be reported immediately to the forwarder or supplier.
Packing	The type of packing used depends on the transport route. If necessary, the furnace is delivered in transport units.

Installation and connection to the mains

Installation	It is recommended to have the furnace installed by CARBOLITE-GERO-Service. Position the furnace components with a fork-lifter or in accordance with the layout plan and adjust all units to their exact height, angle, and position.
Securing of the plant	Re-fix all de-mounted parts and check their proper function. Check firm position of complete furnace.
Connection to the mains	Only skilled personnel are allowed to carry out the installation of the mains connection while observing the relevant local regulations and legal provisions. Check if mains voltage and frequency are identical with the values stated on the rating plate.
Cooling system	The furnace is provided with housing with convection cooling. The flow of fresh and waste air must not be restricted to avoid overheating.

Liability information

Storage of furnace The manufacturer / supplier will not assume liability or warranty for damages resulting from corrosion which can be put down to improper storage, e.g. in a damp location or similar.
Store furnace on an even ground and secure it from tilting, rolling, and unauthorised use.

Protective rights All rights for drawings and other documents in addition to any kind of distribution rights are reserved by Firma CARBOLITE-GERO GmbH&Co.KG. This also applies to the case of patent applications.

Installation structure

Complete
furnace

The furnace consists of the following sub-assemblies:

Sub-assemblies:
Standard pipe furnace
Control system Option

Furnace case

The furnace consists of an enamelled case with covered power supply points in the interior of the case.

Heating
elements

The heating elements are from a metal ceramic material (MoSi₂).

☞ Power requirement see Label.

Furnace
Housing Cooling
System

The furnace housing is cooled by means of convection.

Automatic
control system
(Option)

The automatic control system consists of an enamelled housing.

☞ Power requirement see label.

Process control
(Option)

Please refer to automatic controller operating instructions.

Notes on the MoSi heating elements

General

- ☞ The air supply of the heating elements should be ensured, as the heating elements need this oxygen supply for creating a quartz protective layer. This protective layer has got the function to protect the basic material from extreme oxidation and pollution.
- ☞ The air supply should be realized by small openings at the furnace inlet and outlet, so that there gets not too much power lost.
- ☞ The heating elements should be able to radiate heat without limitation.

Continuous operation

- ☞ The furnace is operated at its maximum temperature for a rather long time (>10 h). To increase the life time of the heating elements it is recommended for this kind of operation to cool down the furnace not completely ($T > 650^{\circ}\text{C}$). If possible, never cool down to ambient temperature.
- ☞ Running times of up to 2,000-5,000 hours at high temperatures can be realized.
- ☞ Variable parameters must be chosen so that during continuous operation there is no change of the correcting variables of more than $\pm 10\%$.

Discontinuous operation

- ☞ Enables the cooling down to ambient temperature.
 - ☞ Daily heating ramps up to maximum temperature are possible. However, the rest period should not be longer than 5 hours.
 - ☞ The life expectancy is about 100-300 heating cycles.
-

Functional description

Step	Procedure
Processing instructions	
1.	When heating the furnace for the first time, small amounts of water can flow from the insulation (fibre insulation, hygroscopic).
2.	The heating element is designed to stand a maximum furnace temperature of 1600°C (HTR.....-.../16), of 1700°C (HTR.....-.../17) or of 1800°C (HTR.....-.../18). Temperatures exceeding this limit by only 20° may shorten the service life of the furnace considerably.
3.	<p>The maximum heating-up rate of the furnace depends on the size of the ceramic working pipe (accessories). Below, you will find the recommended heating-up rates for pipes of:</p> <ul style="list-style-type: none"> • an external diameter of up to 100mm, heating-up rate of 300K/h • an external diameter of up to 150mm, heating-up rate of 120K/h • an external diameter of up to 200mm, heating-up rate of 80K/h • an external diameter of more than 200mm, heating-up rate of 50K/h <p>When cooling down and using APM working pipes it is possible to double the value.</p> <p>If you use a quartz glass tube: The tube must not operate higher as 1050°C. For a short time you can operate with 1100°C.</p>
4.	If the furnace is installed in an outlet, check if the chemical vapours can generate in the outlet. Even only slight chemical loads can strongly decrease the working temperature.
5.	Regulators, which are configured with the thermocouple type B, will show a temperature of -2°C on the display after switching on, without the furnace having been heated. Small thermoelectric voltages of the thermocouple at room temperature are responsible for this erroneous indication. From about 150°C on the display should be correct. The linearization accuracy is achieved at approx. 400°C. To be able to check the thermocouple with the first commissioning, a nominal value has to be set in any case, which lies above the current actual value.

Functional description

Step	Procedure
Processing instructions	
6.	After the first commissioning or after the first hours of operation at higher temperatures, the contacts of the Kanthal Super heating elements have to be checked. If the elements are operated with loose contacts, the power connections of the MoSi heaters can burn off.



For the working tube and the plug, please note:
Push the working tube very carefully through the furnace. It must not touch the heater not the thermo couple.

Commissioning

Switching on the furnace

Requirements The furnace must be connected as per the required technical procedure as long as it shows no signs of technical deficiencies. No disturbances may occur during operation of the system.

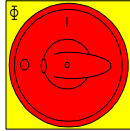


For operation of the furnace, please observe the safety precautions in chapter 1.

Step	Procedure	Graphic/Operating element
1	<ul style="list-style-type: none"> Switch on main switch 	
	Enter charge/sample piece	
2	☞ Charge furnace, close ends of the tube.	
	Furnace control via control system	
3	☞ Switch power on by button.	
4	☞ Temperature setpoint, output power or programmer (see user manual controller).	

Shut-down

Switching off the furnace

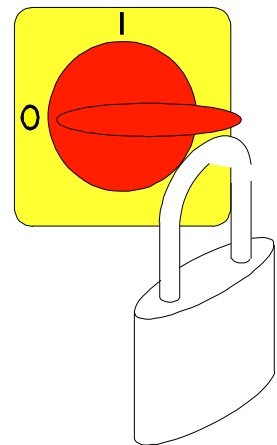
Step	Procedure	Graphics / Operating element
Terminating the process		
1.	Switch the controller to OFF: Standby (see user manual controller). Necessary because the controller starts after switch on poss. unintentional.	
2.	Switch power off by button	
3.	Main switch OFF	
4.	Remove charge/sample piece	

Securing against unintentional activation of the system

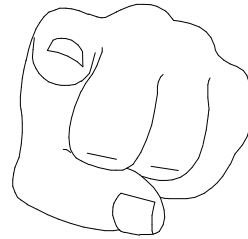


By means of the following measures unintentional activation of the furnace can be avoided:

- Turn the main switch on the control cabinet to the OFF-position and secure with a padlock.



For your safety



You are responsible!
“Observe safety precautions!”

Personal requirements

Who is allowed to operate the furnace?

- Persons with appropriate training and the appropriate qualifications who have been authorised and assigned to operate the furnace and who are familiar with its operation.
- The persons are required to be familiar with the operation of the furnace, to be aware of the possible dangers of the furnace and confirm their knowledge with their signature.



Avoid any procedure which might endanger safety at work!
Take appropriate measures so that it is only possible to operate the furnace in a safe and operative condition.
Operate furnace only after installation and activation of all protective facilities and safety-related facilities such as detachable protective facilities, emergency devices, sound insulations, and suction implements!

-
- ☞ Before switching on the furnace make sure that nobody can endanger the safe operation of the furnace.

Liability

The furnace may only be used for its intended purpose. Any application deviating from the intended use is not permitted. Operation by unauthorised personnel must be prohibited by the operator. Modification must not be effected on the furnace with prior consent by CARBOLITE-GERO GmbH&Co.KG.
Attach these regulations on a place near the furnace where they are always access able.

Maintenance Schedule



Observe the safety instructions in the operating manual!

Position / Maintenance position	Size / Value Remark	Maintenance interval after ... hours					Operating	Specialist	INFO Page
		8	40	160	500	2000			
1 Switchgear, measuring and control system									
1.1	Control housing								
	• Check regular power consumption of heating							○	–
1.2	Measuring and control system								
	• Replace thermocouple if faulty							○	–
2 Furnace System									
2.1	• Safety measuring	Whole plant					●	○	
	•								
	•								
	•								
	•								
clean = ■ controll / change = ● grease = X									

EG Declaration of Conformity

The manufacturer: Carbolite Gero GmbH & Co KG
Hesselbachstraße 15
75242 Neuhausen
Tel.: 0049 7234 95522-0



Hereby declares, that the following product:

Product description: HTRH/HTRV/(A)/RETTH
Type: tube furnace
Year of manufacturing: rating (machine) label
Serial number: rating (machine) label
Project number: rating (machine) label

is designed to comply with **Machinery Directive (2006/42/EG)**.

The furnace complied with the essential protection requirements of the **EMC Directive (2014/30/EU)** and **Low Voltage Directive (2014/35/EU)** and amendment of these directives.

The following directives are applied:

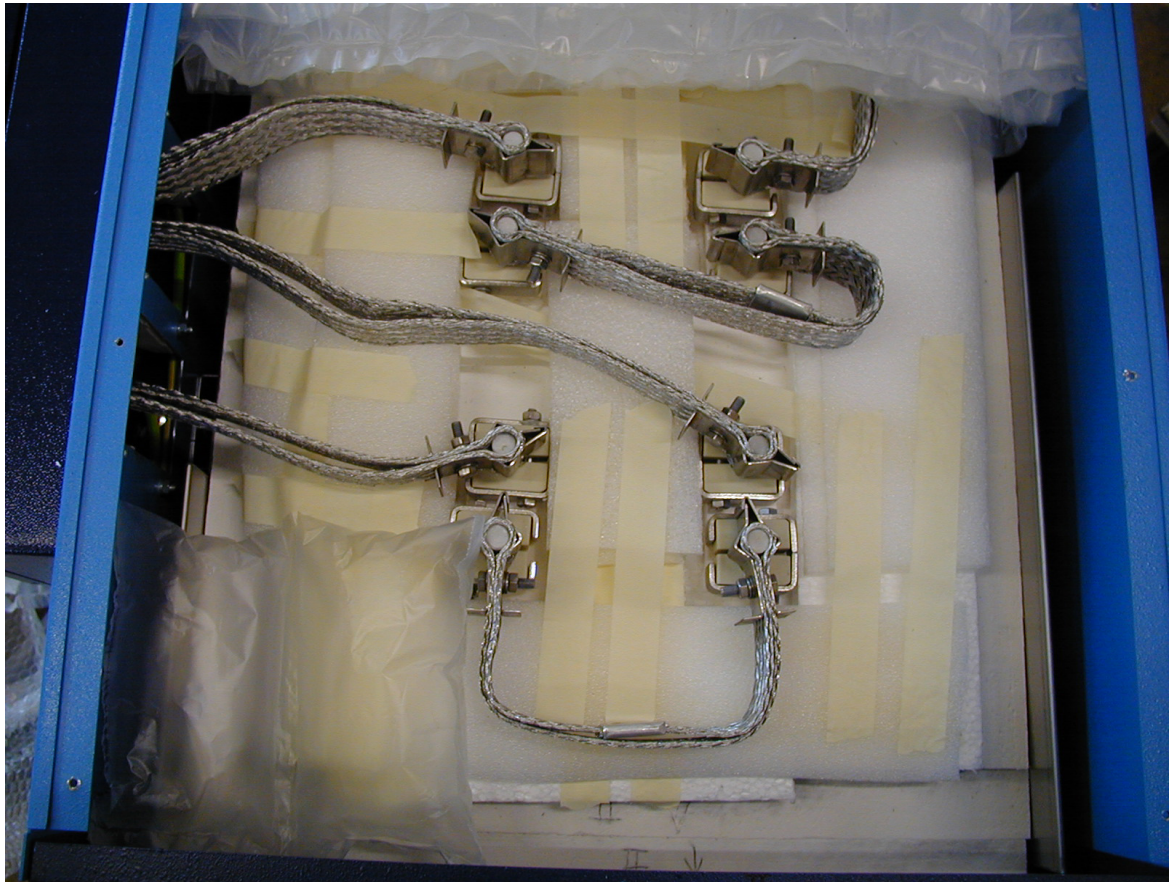
DIN EN ISO 12100/2010	Security of machines – General principles for design – risk evaluation and risk minimization
DIN EN ISO 60204-1/2007-06	Security of machines – Electrical equipment of machines, part 1: General requirements
DIN EN ISO 13849-1/2015	Security of machines – security related parts of controls, part 1: General requirements for design
DIN EN ISO 13850/2015	Security of machines - emergency stopping function – Principles of design

Responsible for the documentation: Dr. Tobias Lehmann.
Address as of manufacturer.

Neuhausen, 14.November 2016

.....
ppa. Dr. Timm Ohnweiler
Technical Director

Attention!



Please remove transport support before put into operation. Concerning this you have to take off the above metal sheet

Remove all parts from foam and plastic.