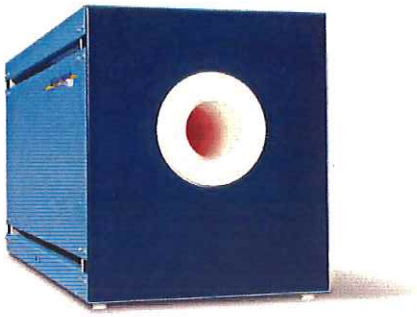
OPERATING INSTRUCTIONS
STANDARD FURNACE „ F(A) “

Furnace:

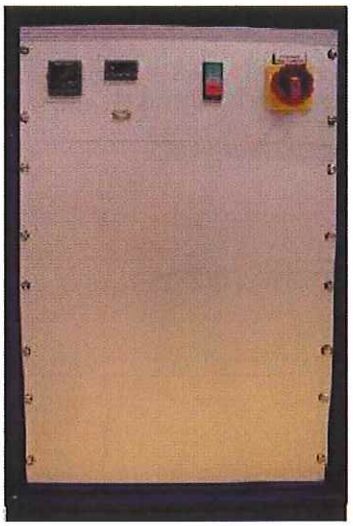


CARBOLITE-GERO
GmbH & Co.KG

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)



Directory

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.


Warning! Danger spot


Warning! Electrical power and voltage


Warning! Suspending loads

Warning! Explosive atmosphere


Warning! Hot liquids or parts


Warning! Danger of being squashed


Risk of skippingr


Fire riskr

Prohibition signs


No admittance


Do not throw substances into rubbish bin!


Smoking forbidden during work!


Eating forbidden during work!

Mandatory and first aid signs


Use eye protection


Use protective hand-gloves


First aid


Use respiratory equipment


Use prostective clothes

Information symbols

☞ Used for additional information
➔ Refers to other facts, causes, or consequences
• Asks you to actf
o 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. 1300/1350°C

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

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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 type 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	Galvanic isolation of the heater
4	Overtemperature controller (Option)
5	Safety switch (Option only for F-A)

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 is 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: o cordon off a wide area around the working space (barrier chains, warning plates). o inform operating personnel and assign a supervisor. o 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 effected 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 an acute danger exists the furnace, component and / or operating equipment must no longer be used until the repair of the deficiency.

Only work according to circuit diagram!

Danger for life!

The furnace must not used without working tube.

(Danger through touch at power terminal)

Working without working tube is not allowed at DIN-EN 60204-1

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 form 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 is 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 a 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

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 element (s) consist(s) of a alloy and are directly integrated into the insulation.

☞ 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.

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 1300/1350°C. Temperatures exceeding this limit by only 20° may shorten the service life of the furnace considerably.
3.	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: • 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 When cooling down and using APM working pipes it is possible to double the value. If you use a quartz glass tube: The tube must not operate higher as 1050°C. 1. For a short time you can operate with 1100°C.
4.	There is a positive effect on the heating element if the pipe ends are closed as far as possible during operation. During completely open operation with the operating temperature rising up to maximum, the heat conductor is subject to the maximum load. This applies particularly for the vertical operation. Generally, attention should be paid to the fact that the heating conductor temperature (which is not to be mistaken with the furnace temperature) of 1200°C is not exceeded during continuous operation.
5.	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.

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	• 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 set point, output power or programmer (see user manual controller).	

Shut-down

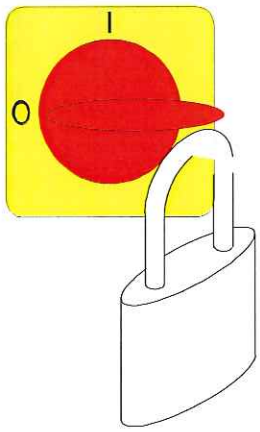
Switching off the furnace

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	

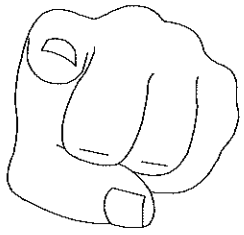
Securing against unintentional activation of the system

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**			

Manufacturer's Declaration of Conformity

according to the CE machinery directive 2006/42/CE, annex II A

Hereby, **CARBOLITE-GERO GmbH & Co.KG**
Hesselbachstr. 15
75242 Neuhausen / GERMANY

declares that the machine designated in the following corresponds, due to its design and version put on the market by us, to the relevant basic safety and health requirements of the CE directives.
In case of any substantial modification of the designated machine this declaration becomes null and void.

Designation of the machine: **Standard Tube Furnace**
Type: **F(A)-Furnace**
Year of construction: **See type plate**

Relevant CE directives:

- CE Machinery directive (2006/42 CE)
- CE Electromagnetic compatibility directive (2004/108 CE)
- Low voltage directive 2006/95 CE

Responsible person for documentation: Mr Tobias Lehmann

Applied harmonized standards, particularly:

- DIN-EN ISO 12100 (General principles for design, risk assessment and risk reduction)
- DIN-EN ISO 13849 (Safety-related parts of control systems)
- DIN-EN ISO 13850 (Safety of machinery - Emergency stop function)
- DIN EN 60204 (Electrical equipment of machines)

Neuhausen, October 31, 2014

R. Geiger
General Manager

Inspection sheet for the acceptance of electrical machinery

VDE 0113/ EN 60204, BGV A2

CARBOLITE GERO 30-3000°C

Order no.: 20140943 [√]
Appliance no.: 201503035
Company: Verder Scientific Inc.

Visual inspection

Identification of equipment, connectors and modules	[√]	PE wiring, connection points	[√]
Insulation or shielding of all active parts	[-]	Clockwise phase sequence	[√]
Connection of PE, N, and phase conductors	[√]		

Measurement

Measurement was taken without cooling water

Measured current 10 A / 50 Hz, Measuring duration 10 sec

Continuous connection of the protective circuit

If more than one measurement is taken in a measuring range, only the worst measurement is given.

Conductor cross section	max. voltage drop	Measured value	
1.0 mm	3.3 V	-	V
1.5 mm	2.6 V	-	V
2.5 mm	1.9 V	-	V
4.0 mm	1.4 V	-	V
> 6 mm	1.0 V	0,61	V

Insulation resistance Primär

Caution! Disconnect test piece from the mains

Measuring-circuit voltage 500 VDC, limit value: 1 MΩ — [>1] MΩ

High-voltage test

Measuring-circuit voltage 1,000/1,500 V / 50 Hz with 500 VA
Measuring duration >= 1 sec [√]

Residual voltage

Limit value: < 60 VDC after 1 sec — [9] V

Trial

Safety device functionning [√]

Rotational direction drives [-]

Furnace temperature: [800] ° C

Measuring apparatus used:

UNITEST 0113 High-voltage tester Nr.:U21 0122 96, CH.BEHA GmbH
UNITEST 0113-Multitest No.: U18 0222 96, CH.BEHA GmbH
UNITEST Digital leakage current clamp-on ammeter 93440 Nr.:72655, CH.BEHA GmbH

Date	Place	Inspector	Signature
18.02.15	**Neuhausen**	**Wohlgemuth**	O. Wohl