Installation, Operation and Maintenance Instructions
1200°C Tube Furnace - CTF Model: 700mm
No Controller

CTF 12/75/700 + No Controller
Contents

This manual is for guidance on the use of the Carbolite Gero product specified on the front cover. This manual should be read thoroughly before unpacking and using the furnace or oven. The model details and serial number are shown on the back of this manual. Use the product for the purpose for which it is intended.

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1.0 Symbols and Warnings

1.1 Switches and Lights

Instrument switch: when the instrument switch is operated the temperature control circuit is energised.

Heat light: the adjacent light glows or flashes to indicate that power is being supplied to the elements.

Heat switch: the switch disconnects power to the heating elements; unless this switch is OFF there is a danger of electric shock when inserting objects into the product.

1.2 General Warnings

DANGER – Electric shock. Read any warning printed next to this symbol.
WARNING: Risk of fatal injury.

DANGER – Hot surface. Read any warning printed next to this symbol.
WARNING: All surfaces of a product may be hot.

DANGER – Read any warning printed next to this symbol.
Caution – Double Pole/Neutral Fusing
2.0 Installation

2.1 Unpacking and Handling

When unpacking or moving the product always lift it by its base or by both ends of the main body. Never lift it by its work tube or the surrounding insulation. Use two or more people to carry the product and control box. Remove any packing material from inside the product before use.

If an optional or special stand is separately supplied, assemble the product on to it. Some models may be supplied for customer mounting and may require customer preparation of mounting components before installation.

NOTE: This product contains Refractory Ceramic Fibre (also known as Alumino Silicate Wool - ASW). For precautions and advice on handling this material see section 7.2.

2.2 Siting and Setting Up

Place the product on a level surface in a well ventilated area.

Site away from other sources of heat and on a non-flammable surface that is resistant to accidental spillage or hot materials.

The surface on which the equipment is mounted should be stable and not subject to movement or vibrations.

The height of the mounting surface is important to avoid operator strain when loading and unloading samples.

Unless otherwise stated elsewhere in this manual, ensure that there is at least 150 mm of free space around the back and sides of the product. Clear space is required above the product to dissipate heat.

Work tubes:

It is recommended that the work tube has either insulation plugs or radiation shields fitted to minimise heat loss from both ends of the work tube. If the work tube has open ends, a significant amount of energy could be radiated from the ends of the work tube. Adjacent surfaces should always be made from a non-flammable material.

Ensure that the ends of the work tube are positioned at least 500 mm away from any adjacent surface so that any energy radiated cannot heat an adjacent surface to a dangerous temperature.
Ensure that the product is placed in such a way that it can be quickly switched off or disconnected from the electrical supply.

A product ordered for vertical use has a small clip or plate at one end to prevent a wound tube element or a work tube from slipping downwards.

Mount the product so that this clip is at the bottom. In models with one thermocouple the thermocouple should be near the top rather than the bottom.

If the product is supplied with a separate work tube or any accessories fit these into position.

Under no circumstances should any objects be placed on top of the product. Always ensure that any vents on the top of the product are clear of any obstruction. Always ensure all cooling vents and cooling fans (if fitted) are clear of any obstruction.
2.3 Tube Fittings

For optimum temperature uniformity, insulating plugs should be placed in the tube ends as shown in fig.1. With a long work tube, the stem of the plug assembly should line up with the end of the tube as in fig.2. Alignment of radiation shields is similar to that of plugs.

If stainless steel seals with gas inlets are supplied, they are to be fitted as shown in fig.3; the stem of any insulating plug should touch the seal.

For vertical models with stainless steel seals, a hook and eye arrangement holds the upper insulating plug assembly.

Horizontal models: if heavy fittings are to be clamped to the end of an extended work tube they can increase the bending stress at the centre of the tube. Support such fittings in such a way that expansion of the tube is allowed.

---

**Fig 1 - Insulating Plug**
(standard length tube)

**Fig 2 - Insulating Plug**
(long work tube)

**Key**
- A Tube
- B Insulating Plug
- C Stem
### 2.0 Installation

#### Key

<table>
<thead>
<tr>
<th></th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Clamp</td>
</tr>
<tr>
<td>B</td>
<td>Seal plate</td>
</tr>
<tr>
<td>C</td>
<td>‘O’ Ring seal</td>
</tr>
<tr>
<td>D</td>
<td>Seal sleeve</td>
</tr>
<tr>
<td>E</td>
<td>Clamp seal</td>
</tr>
<tr>
<td>F</td>
<td>End plate</td>
</tr>
</tbody>
</table>

#### Key

<table>
<thead>
<tr>
<th></th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Clamp</td>
</tr>
<tr>
<td>B</td>
<td>End plate</td>
</tr>
<tr>
<td>C</td>
<td>Clamp seal (between Seal sleeve and Clamp)</td>
</tr>
<tr>
<td>D</td>
<td>Seal sleeve</td>
</tr>
<tr>
<td>E</td>
<td>Seal plate &amp; ‘O’ Ring seal (underneath clamp)</td>
</tr>
<tr>
<td>F</td>
<td>Tube</td>
</tr>
</tbody>
</table>

**Fig 3 ‘Twin Clamp’ End Seal**

For assembly details refer to the separate work tube end seal manual.

### 2.4 Electrical Connections

Connection by a qualified electrician is recommended.

The product covered by this manual may be ordered for single phase A.C. supply, which may be Live to Neutral non-reversible, Live to Neutral reversible or Live to Live. This model can be supplied for use on two phases of a three phase with neutral supply (one phase unused).
Check the product rating label before connection. The supply voltage should agree with the voltage on the label and the supply capacity should be sufficient for the current on the label.

The supply should be fused at the next size equal to, or higher than the current on the label. A table of the most common fuse ratings is also given towards the back of this manual. When the mains cable is factory fitted, internal fuses are also fitted. It is essential that the operator ensures that the product is correctly fused.

Products with a factory fitted supply cable are designed to be wired directly to an isolator or fitted with a line plug.

Products without a factory fitted supply cable require a permanent connection to a fused and isolated supply. The product's electrical access panel should be temporarily removed, and connections made to the internal terminals.

If the product is to be connected by line plug. The plug should be within reach of the operator and should be easy to remove.

When connecting the product to an isolating switch ensure that both conductors (single phase) or on all live conductors (three phase), and should be within reach of the operator.

The supply MUST incorporate an earth (ground).

Electrical Connection Details:

<table>
<thead>
<tr>
<th>Supply</th>
<th>Terminal Label</th>
<th>Cable Colour</th>
<th>Supply Types</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Live - Neutral</td>
</tr>
<tr>
<td>1-phase</td>
<td>L</td>
<td>Brown</td>
<td>Reversible or Live-Live</td>
</tr>
<tr>
<td></td>
<td>N</td>
<td>Blue</td>
<td>to live</td>
</tr>
<tr>
<td></td>
<td>PE</td>
<td>Green/ Yellow</td>
<td>to earth (ground)</td>
</tr>
<tr>
<td>2- or</td>
<td>L1</td>
<td>Black</td>
<td>to phase 1</td>
</tr>
<tr>
<td>3-phase</td>
<td>L2</td>
<td>Black</td>
<td>to phase 2</td>
</tr>
<tr>
<td></td>
<td>L3</td>
<td>Black</td>
<td>to phase 3 (except 2-phase)</td>
</tr>
<tr>
<td></td>
<td>N</td>
<td>Light Blue</td>
<td>to neutral (except delta)</td>
</tr>
<tr>
<td></td>
<td>PE</td>
<td>Green/ Yellow</td>
<td>to earth (ground)</td>
</tr>
</tbody>
</table>
DO NOT connect an model ordered for three phase use to a single phase supply or to the wrong type of three phase supply.
3.0 Temperature Controller

If this product is fitted with a temperature controller, instructions are provided separately.
4.0 2132 Over-Temperature Controller Description (if fitted)

4.1 Description

This over-temperature controller is fitted and supplied ready to use by Carbolite Gero. It is a digital instrument with a latching alarm, requiring no additional panel controls. The controller features easy setting of over-temperature setpoint and reading of current temperature by the over-temperature sensor.

4.2 Operation

4.2.1 Controls

Most Carbolite Gero products are fitted with an instrument switch which cuts off power to the controller and other parts of the control circuit.

To operate the controller, power must be supplied to the product and the instrument switch must be on. If a time switch is included in the product circuit, this must be in the 'ON' position.

When an over-temperature condition occurs, the controller cuts the power to a contactor, which in turn cuts power to the heating elements. Power is not restored until the controller is 'reset'.

Some components will operate after the over-temperature feature isolates the power supply e.g. cooling fans will continue to operate, provided that there is a power supply to the product. In some cases the product may not do so, if other options (such as a door switch) are fitted.
4.2.2 Operation

When switched on, the controller lights up, goes through a short test routine and then displays the measured temperature or the over-temperature setpoint.

The page key allows access to parameter lists within the controller.

A single press of the page key displays the temperature units, normally set to °C; further presses reveal the lists indicated in the navigation diagram. See section 4.4.

The scroll key allows access to the parameters within a list. Some parameters are display-only; others may be altered by the operator.

A single press of the scroll key in the 'Home' list displays the temperature units; further presses reveal the parameters in the current list indicated in the navigation diagram.

To return to the 'Home' list at any time, press page and scroll together, or wait for 45 seconds.

The down and up keys are used to alter the setpoint or other parameter values.

4.2.3 Over-Temperature Operation

Use down and up to alter the over-temperature setpoint. This should normally be set a little above the working temperature (for example 15 °C above). The product is supplied with the over-temperature set at 15 °C above the furnace or oven maximum working temperature.

Press scroll twice view the present temperature as measured by the over-temperature controller. Press it twice, the first press shows the temperature units (°C).

4.2.4 Over-Temperature Alarm

If an over-temperature condition occurs, the OP2 indicator flashes and an alarm message 2FSH also flashes, alternating with the setpoint. Power to the heating elements is disconnected.

4.2.5 Resetting the Over-Temperature Alarm

To acknowledge the alarm press scroll and page together.

If the alarm is acknowledged while there is still an over-temperature condition, the OP2 indicator stops flashing but continues to glow. The 2FSH alarm continues to flash until the over-temperature condition is cleared (by the temperature falling), when normal operation resumes.

If the alarm is acknowledged when the temperature has dropped (or after the over-temperature setpoint has been raised) so that the over-temperature condition no longer exists, then the furnace or oven immediately resumes normal operation.

4.2.6 Sensor Break

The over-temperature cut-out system also operates if the over-temperature control thermocouple breaks or becomes disconnected. The message S.br flashes where the measured temperature is normally displayed.
4.3 Audible Alarm

If an audible alarm is supplied for use with the over-temperature controller, it is normally configured to sound on over-temperature condition and to stop sounding when the alarm is acknowledged as given in section 4.2.

Note: the alarm may sound during controller start-up.

4.4 Navigation Diagram

<table>
<thead>
<tr>
<th>HL</th>
<th>Home List</th>
<th>Page Key</th>
<th>Black = Progress</th>
</tr>
</thead>
<tbody>
<tr>
<td>OTSP</td>
<td>Over-Temperature Setpoint</td>
<td>Scroll Key</td>
<td>Dashed = Through to other options</td>
</tr>
<tr>
<td>AL</td>
<td>Access List</td>
<td>!</td>
<td>For factory access to list and parameters not available to the operator.</td>
</tr>
</tbody>
</table>
5.0 Operation

5.1 Operating Cycle

This product is fitted with an instrument switch which cuts off power to the control circuit.

Connect the product to the electrical supply.

There is also a heater switch which can be used to disconnect power to the elements.

Operate the instrument switch to activate the temperature controller. The controller becomes illuminated and goes through a short test cycle.

**Over-Temperature option only.** If the digital over-temperature option has not yet been set as required, set and activate it according to the over-temperature controller instructions.

The product will heat up according to the controller setpoint or program, unless a time switch is fitted and switched off.

As the product heats up, the heat light glows steadily at first and then flashes as the product approaches the desired temperature. For more information on temperature control see the controller instructions.

**Over-Temperature option only.** If the over-temperature circuit has tripped, an indicator on the over-temperature controller flashes and the heating elements are isolated. Find and correct the cause before resetting the over-temperature controller according to the instructions supplied.

To switch off power to the heating elements, use the heater switch. To switch the product off, use both the heater switch and the instrument switch. If the product is to be left switched off and unattended, isolate it from the electrical supply.

5.2 General Operating Advice

Heating element life is shortened by overheating. Do not leave the product at high temperature when it is not required. The maximum temperature is shown on the product rating label and in section 11.0 towards the back of this manual.

Lightweight ceramic fibre insulation can easily be marked by accidental contact. Some fine cracks may develop in the surface of the insulation due to the progressive shrinkage of the insulation materials. Cracks are not usually detrimental to the functioning or the safety of the product.
5.3 Operator Safety

The ceramic materials used in the product manufacture become electrically conductive to some extent at high temperatures. DO NOT use any conductive tools within the product without isolating it. If a metal work tube is used, it must be earthed (grounded).

Switch off the heater switch whenever loading or unloading the product. The elements are isolated when the heater switch is OFF. This switch cuts both sides of the circuit via a contactor.

5.4 Tube Life

A ceramic work tube may crack if work pieces are inserted too quickly or at temperatures below 900 °C (when the tube is more brittle). Large work pieces should also be heated slowly to ensure that large temperature differences do not arise.

Poor thermal contact should be encouraged between the work piece and the tube; crucibles or boats should be of low thermal mass and should have feet to reduce the contact with the tube (fig. 4).

![Fig 4 - Avoidance of thermal contact](image)

Do not set too high a heating or cooling rate. As tubes are susceptible to thermal shock and may break. Tubes which extend beyond the heated part of the furnace are more at risk. A general rule for maximum heating or cooling rate is \( 400 \div \text{internal diameter in mm} \) to give \( ^\circ\text{C} / \text{min} \); for 75 mm i/ d tubes this comes to 5 °C per minute. The controller can be set to limit both the heating and cooling rate.

5.5 Pressure

Work tubes are not able to accept high internal pressure. When gas seals or similar fittings are in use, the gas pressure should be restricted to a maximum of 0.2 bar (3 psi). A pressure of approximately half of that should normally be sufficient to achieve the desired flow rate. The operator must ensure that the exhaust path from the tube is not blocked, so that excess pressure does not occur.

A suitably regulated gas supply should always be used.
5.0 Operation

It is recommended that a pressure relief system should be used to avoid an over pressurisation of the work tube.

Please note: A product should not be heated up if any valves that have been fitted are closed to create a sealed volume. A sealed work tube should not be heated from cold due to the pressure increase caused by the trapped air or gas expanding during the heating process.

5.6 Power Adjustment

The product control system incorporates electronic power limiting. The power limit parameter OP.Hi is accessible to the operator and can be used to adjust the product to the actual supply voltage.

Some models covered by this manual are fitted with 208 V elements and are designed for use over the range of voltages 200 V - 250 V; the power limit parameter is set accordingly. These models may be relocated to a different voltage within the range: the power limit should be reset to match the voltage.
To check whether the furnace is a 208 V model:

- look at the OP.Hi parameter
- make a note of the value and compare with the 10.0;
- observe the rating label; if a range of voltages is stated, it is not a 208 V multi voltage model;
- if in doubt, check with Carbolite Gero – each product has its own record card.

Refer to the controller instructions for how to change the power limit.

5.7 Running at Low Temperatures

The power limit may be adjusted to a low level in order to achieve better control when operating the product at a low temperature. Before changing the power limit, record the default settings for possible future use. Refer to the Power Settings section of this manual for default power limits. If the product fails to reach the desired temperature, refer to the Temperature Controller and Fault Analysis sections.
6.0 Maintenance

6.1 General Maintenance
Preventive rather than reactive maintenance is recommended. The type and frequency depends on the product use; the following are recommended.

6.2 Maintenance Schedule

CUSTOMER QUALIFIED PERSONNEL

![DANGER! ELECTRIC SHOCK. Risk of fatal injury. Only electrically qualified personnel should attempt these maintenance procedures.]

<table>
<thead>
<tr>
<th>Maintenance Procedure</th>
<th>Method</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Safety</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Over-Temperature Safety Circuit (if fitted)</td>
<td>Set an over-temperature setpoint lower than the displayed temperature and check for an over-temperature alarm as detailed in this manual</td>
<td>Daily Weekly Monthly Bi-Annually Annually</td>
</tr>
<tr>
<td>Over-Temperature Safety Circuit (if fitted)</td>
<td>Electrical measurement</td>
<td>6</td>
</tr>
<tr>
<td>Safety Switch Function (split models only)</td>
<td>Set a safe temperature above ambient, and open the furnace to see if the heater light goes out</td>
<td>Daily Weekly Monthly Bi-Annually Annually</td>
</tr>
<tr>
<td>Safety Switch Function (split models only)</td>
<td>Electrical measurement</td>
<td>6</td>
</tr>
<tr>
<td>Electrical Safety (external)</td>
<td>Visual check of external cables and plugs</td>
<td>Daily Weekly Monthly Bi-Annually Annually</td>
</tr>
<tr>
<td>Electrical Safety (internal)</td>
<td>Physically check all connections and cleaning of the power plate area</td>
<td>6</td>
</tr>
<tr>
<td>Function</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Temperature Calibration</td>
<td>Tested using certified equipment, frequency dependent on the standard required</td>
<td>Daily Weekly Monthly Bi-Annually Annually</td>
</tr>
<tr>
<td>Operational Check</td>
<td>Check that all functions are working normally</td>
<td>Daily Weekly Monthly Bi-Annually Annually</td>
</tr>
<tr>
<td>Operational Check</td>
<td>Thorough inspection and report incorporating a test of all functions</td>
<td>Daily Weekly Monthly Bi-Annually Annually</td>
</tr>
<tr>
<td>Work Tube Position</td>
<td>Visually check that the tube is central to the heated zone (horizontally / vertically)</td>
<td>Daily Weekly Monthly Bi-Annually Annually</td>
</tr>
<tr>
<td>End Plugs / Radiation Shields</td>
<td>Visual check for damage or wear, and correct positioning</td>
<td>Daily Weekly Monthly Bi-Annually Annually</td>
</tr>
</tbody>
</table>
### 6.0 Maintenance

<p>| | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Seals (if fitted)</strong></td>
<td>Check all seals and O-rings and clamps</td>
<td><img src="image" alt="Icon" /></td>
<td><img src="image" alt="Icon" /></td>
<td><img src="image" alt="Icon" /></td>
</tr>
<tr>
<td><strong>Performance</strong></td>
<td><strong>Element Circuit</strong></td>
<td>Electrical measurement</td>
<td><img src="image" alt="Icon" /></td>
<td><img src="image" alt="Icon" /></td>
</tr>
<tr>
<td><strong>Power Consumption</strong></td>
<td>Measure the current drawn on each phase / circuit</td>
<td><img src="image" alt="Icon" /></td>
<td><img src="image" alt="Icon" /></td>
<td><img src="image" alt="Icon" /></td>
</tr>
<tr>
<td><strong>Cooling Fans (if fitted)</strong></td>
<td>Check whether the cooling fans are working</td>
<td><img src="image" alt="Icon" /></td>
<td><img src="image" alt="Icon" /></td>
<td><img src="image" alt="Icon" /></td>
</tr>
</tbody>
</table>
6.2.1  Cleaning

Soot deposits may form inside the furnace, depending on the process. At appropriate intervals remove these by heating as indicated in the General Operation Notes.

The product's outer surface may be cleaned with a damp cloth. Do not allow water to enter the interior of the case or chamber. Do not clean with organic solvents.

6.3  Calibration

After prolonged use, the controller and/or thermocouple may require recalibration. This is important for processes that require accurate temperature readings or for those that use the product close to its maximum temperature. A quick check using an independent thermocouple and temperature indicator should be made from time to time to determine whether full calibration is required. Carbolite Gero can supply these items. Depending on the controller fitted, the controller instructions may contain calibration instructions.

6.4  After-Sales Service

Carbolite Gero Service has a team of Service Engineers who can offer repair, calibration and preventive maintenance of furnace and oven products both at the Carbolite Gero factory and at customers’ premises throughout the world. A telephone call or email often enables a fault to be diagnosed and the necessary parts to be despatched.

In all correspondence please quote the serial number and model type given on the rating label of the product. The serial number and model type are also given on the back of this manual when supplied with the product.

Carbolite Gero Service and Carbolite Gero contact information can be found on the back page of this manual.

6.5  Recommended Spare Parts and Spare Parts Kit

Carbolite Gero can supply individual spare parts or a kit of the items most likely to be required. Ordering a kit in advance can save time in the event of a breakdown.

Each kit consists of one thermocouple, one solid state relay and one heating element. When ordering spare parts please quote the model details as requested above.
7.0 Repairs and Replacements

7.1 Safety Warning - Disconnection from Power Supply

Immediately switch the product off in the event of unforeseen circumstances (e.g. large amount of smoke). Allow the product to return to room temperature before inspection.

Always ensure that the product is disconnected from the electrical supply before repair work is carried out.

Caution: Double pole/neutral fusing may be used in this product.

7.2 Safety Warning - Refractory Fibre Insulation

Insulation made from High Temperature Insulation Wool
Refractory Ceramic Fibre, better known as (Alumina silicate wool - ASW).

This product contains alumino silicate wool products in its thermal insulation. These materials may be in the form of blanket or felt, formed board or shapes, slab or loose fill wool.

Typical use does not result in any significant level of airborne dust from these materials, but much higher levels may be encountered during maintenance or repair.

Whilst there is no evidence of any long term health hazards, it is strongly recommended that safety precautions are taken whenever the materials are handled.

Exposure to fibre dust may cause respiratory disease.

When handling the material, always use approved respiratory protection equipment (RPE-eg. FFP3), eye protection, gloves and long sleeved clothing. Avoid breaking up waste material. Dispose of waste in sealed containers.

After handling, rinse exposed skin with water before washing gently with soap (not detergent). Wash work clothing separately.

Before commencing any major repairs it is recommended to make reference to the European Association representing the High Temperature Insulation Wool industry (www.ecfia.eu).

Further information can be provided on request. Alternatively, Carbolite Gero Service can quote for any repairs to be carried out either on site or at the Carbolite Gero factory.

7.3 Temperature Controller Replacement

Refer to the controller instructions for more information on how to replace the temperature controller.
7.4 Solid-State Relay Replacement

Disconnect the product from the power supply and remove the appropriate cover as given above.

Make a note of the wire connections to the solid state relay and disconnect them.
Remove the solid state relay from the base panel or aluminium plate.
Replace and reconnect the solid state relay ensuring that the bottom of it has good thermal contact with the base panel or aluminium plate.
Replace the access panel.

7.5 Thermocouple Replacement

The coverings and guards which must be removed to gain access to the thermocouple depend on the model, its orientation (horizontal or vertical), and possibly other options and fittings.
It will usually be necessary to separate the product from its base or stand. On horizontal models one outer end-cap will need to be removed and on vertical models the terminal cover. Within some models the thermocouple lies inside the product body; the body must be removed from the control base and the end-cap and insulation ring removed from one end.

<table>
<thead>
<tr>
<th>thermocouple leg</th>
<th>colour</th>
</tr>
</thead>
<tbody>
<tr>
<td>positive (type N)</td>
<td>pink</td>
</tr>
<tr>
<td>negative</td>
<td>white</td>
</tr>
</tbody>
</table>

Disconnect the thermocouple from its terminal block. Withdraw the thermocouple from its sheath and remove any broken bits of thermocouple.
Bend the new thermocouple carefully to match the shape of the original (working from the terminal end). Should the length differ from that of the original this will usually not be important provided that the thermocouple tip is within a tube diameter's distance from the product centre.
Insert the new thermocouple into position, restoring any removed porcelain spacers and ensuring correct polarity. Re-assemble the product.

7.6 Fuse Replacement

Fuses are marked on the wiring diagram with type codes, e.g. F1, F2. For more information on fuses refer to section 10.0.
Depending on model and voltage, the different fuse types may or may not be fitted.
If any fuse has failed, it is advisable for an electrician to check the internal circuits.
Replace any failed fuses with the correct type. For safety reasons do not fit larger capacity fuses without first consulting Carbolite Gero.
The fuses are located at the cable entry point. Remove the back panel or control box back panel to gain access to the fuses.
7.7 Element Replacement

The coverings and guards which must be removed to enable replacement of the wound tube element depend on the furnace model, its orientation (horizontal or vertical), and other options and fittings. The general procedure is:

Disconnect the product from the electrical supply.

Remove all outer guards, meshes and terminal covers from the product’s body. For a horizontally mounted product remove the product body from its base; to reach the bolts or screws which fix the body to the base, remove the back panel from the base.

Disconnect all electrical leads from the terminal blocks on the product case. Note the colours and positions of the connecting leads to enable correct reassembly. Take care not to crack porcelain terminal blocks - use two spanners where appropriate.

Remove the thermocouple.

Lay the furnace body horizontally with the split in the cylindrical case uppermost. In the case of the CTF models undo the self-tapping screws which hold the terminal strip to the case join. The case will spring open slightly. Remove the ceramic board disc from one end.

Use a sharp knife to cut right through the insulation down to the wire-wound tube element along the whole length of the body, but do not cut either of the ceramic board end discs. The knife cut must be in line with the element lead wires. Slide the element gently out through the end of the product body.

Check the cylindrical case and clean out as appropriate.

Remove any insulation sleeving from the tails of the old element and fit to the replacement element.

Slide in the new element(s). Close up the product again, refitting the terminal strip (where applicable) and the end-caps. Any cut made in the insulation should close up completely: if the insulation appears loose or damaged in any way, please contact the Carbolite Gero service division.

Reverse the rest of the disassembly process. Take care to make all connections to the correct terminals. Do not over tighten the connectors in porcelain terminal blocks.

Let the product heat up at its maximum rate to 900 °C without interruption and then soak for 1 hour. Fumes may be emitted: this should be done in conditions of good ventilation.

Check that the product is controlling properly to rule out the possibility that the element failed because of a fault in the control system.

If you have any problems with this procedure, please contact the Carbolite Gero service division.
## 8.0 Fault Analysis

### A. Furnace Does Not Heat Up

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>The HEAT light is ON</td>
<td>The heating element has failed</td>
</tr>
<tr>
<td>2.</td>
<td>The HEAT light is OFF</td>
<td>The controller shows a very high temperature or code such as S.br</td>
</tr>
<tr>
<td></td>
<td>The controller shows a low temperature</td>
<td>The door switch(es) (if fitted) may be faulty or need adjustment</td>
</tr>
<tr>
<td></td>
<td></td>
<td>The controller may be faulty or not receiving a supply due to a faulty switch or a wiring fault.</td>
</tr>
</tbody>
</table>
### 8.0 Fault Analysis

#### B. Product Overheats

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1.</strong></td>
<td><strong>Product only heats up when the instrument switch is ON</strong></td>
<td><strong>The controller shows a very high temperature</strong></td>
</tr>
<tr>
<td></td>
<td><strong>The controller shows a low temperature</strong></td>
<td><strong>The thermocouple may be faulty or may have been removed out of the heating chamber</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>2.</strong></td>
<td><strong>Product heats up when the instrument switch is OFF</strong></td>
<td><strong>The SSR has failed &quot;ON&quot;</strong></td>
</tr>
</tbody>
</table>
9.0 Wiring Diagrams

9.1 WA-11-30
Connections below show single phase with indirect safety switch(es).

Key
- F1, F2, F3: Fuses
- FIL: Filter
- R1/1, R1/2: Relay Contactor
- R1: Relay
- C: Temperature Controller
- TC: Control Thermocouple
- SSR: Solid State Relay
- SSW: Safety Switch
- H: Heat Lamp
- EL: Element(s)
- SW: Instrument Switch(es)
- N: Neutral
- L: Live
- PE: Earth

Cables
- BU: Blue
- R: Red
- GR/Y: Green + Yellow
- G: Grey
- P: Pink
9.2 WA-11-31

Connections below show single phase with safety switches and over-temperature control.

Key

<table>
<thead>
<tr>
<th>Component</th>
<th>Symbol</th>
</tr>
</thead>
<tbody>
<tr>
<td>F1, F2, F3</td>
<td>Fuses</td>
</tr>
<tr>
<td>FIL</td>
<td>Filter</td>
</tr>
<tr>
<td>R1/1, R1/2</td>
<td>Relay Contactor</td>
</tr>
<tr>
<td>R1</td>
<td>Relay</td>
</tr>
<tr>
<td>C</td>
<td>Temperature Controller</td>
</tr>
<tr>
<td>OT</td>
<td>Over-Temperature Controller</td>
</tr>
<tr>
<td>OTC</td>
<td>Over-Temperature Thermocouple</td>
</tr>
<tr>
<td>TC</td>
<td>Control Thermocouple</td>
</tr>
<tr>
<td>SSR</td>
<td>Solid State Relay</td>
</tr>
<tr>
<td>SSW</td>
<td>Safety Switch</td>
</tr>
<tr>
<td>H</td>
<td>Heat Lamp</td>
</tr>
<tr>
<td>EL</td>
<td>Element(s)</td>
</tr>
<tr>
<td>SW</td>
<td>Instrument Switch(es)</td>
</tr>
<tr>
<td>N</td>
<td>Neutral</td>
</tr>
<tr>
<td>L</td>
<td>Live</td>
</tr>
<tr>
<td>PE</td>
<td>Earth</td>
</tr>
<tr>
<td>*</td>
<td>If Fitted</td>
</tr>
</tbody>
</table>

Cables

<table>
<thead>
<tr>
<th>Cable</th>
<th>Color</th>
</tr>
</thead>
<tbody>
<tr>
<td>BU</td>
<td>Blue</td>
</tr>
<tr>
<td>R</td>
<td>Red</td>
</tr>
<tr>
<td>GR/Y</td>
<td>Green + Yellow</td>
</tr>
<tr>
<td>G</td>
<td>Grey</td>
</tr>
<tr>
<td>P</td>
<td>Pink</td>
</tr>
</tbody>
</table>
9.3 WA-22-30
Connections below show 2-phase +N with indirect safety switches.

Key
- F1, F2, F3: Fuses
- FIL: Filter
- R1/1, R1/2: Relay Contactor
- R1: Relay
- C: Temperature Controller
- TC: Control Thermocouple
- SSR: Solid State Relay
- SSW: Safety Switch
- H: Heat Lamp
- EL: Element(s)
- SW: Instrument Switch(es)
- N: Neutral
- L1/L2: Live
- PE: Earth

Cables
- BU: Blue
- R: Red
- GR/Y: Green + Yellow
- G: Grey
- P: Pink
9.4 WA-22-31
Connections below show 2-phase +N with indirect safety switches and over-temperature control.

Key

| F1, F2, F3 | Fuses          |
| FIL        | Filter         |
| R1/1, R1/2 | Relay Contactor|
| R1         | Relay          |
| C          | Temperature Controller |
| TC         | Control Thermocouple |
| OT         | Over-Temperature |
| OTC        | Over-Temperature Thermocouple |
| SSW        | Safety Switch  |
| H          | Heat Lamp      |
| EL         | Element(s)     |
| SW         | Instrument Switch(es) |
| N          | Neutral        |
| L1/L2      | Live           |
| PE         | Earth          |

* If fitted

Cables

| BU | Blue |
| R  | Red  |
| GR/Y | Green + Yellow |
| G  | Grey  |
| P  | Pink  |
10.0 Fuses and Power Settings

10.1 Fuses

F1 - F3: Refer to the circuit diagrams.

| F1 | Internal Supply Fuses | Fitted if supply cable fitted. Fitted on board to some types of EMC filter. | GEC Safeclip of the type shown (glass type F up to 16 A) 38 mm x 10 mm type F fitted on EMC filter circuit board(s) |
| F2 | Auxiliary Circuit Fuses | Fitted on board to some types of EMC filter. May be omitted up to 25 Amp/phase supply rating. | 2 Amps glass type F On board: 20 mm x 5 mm Other: 32 mm x 6 mm |
| F3 | Heat Light Fuses | May be omitted up to 25 Amp/phase supply rating. | 2 Amps glass type F 32 mm x 6 mm |
|     | Customer Fuses | Required if no supply cable fitted. Recommended if cable fitted. | See rating label for current; See table below for fuse rating. |

<table>
<thead>
<tr>
<th>Model</th>
<th>Phases</th>
<th>Volts</th>
<th>Supply Fuse Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>CTF 12/75/700</td>
<td>1-phase</td>
<td>110-120</td>
<td>25 A</td>
</tr>
<tr>
<td>CTF 12/75/700</td>
<td>1-phase</td>
<td>220-240</td>
<td>16 A</td>
</tr>
<tr>
<td>CTF 12/75/700</td>
<td>1-phase</td>
<td>208</td>
<td>16 A</td>
</tr>
<tr>
<td>CTF 12/75/700</td>
<td>2-phase+N</td>
<td>380-415</td>
<td>10 A</td>
</tr>
</tbody>
</table>

10.2 Power Settings

<table>
<thead>
<tr>
<th>Model Volts:</th>
<th>200 V</th>
<th>208 V</th>
<th>220 V 380 V</th>
<th>230 V 400 V</th>
<th>240 V 415 V</th>
</tr>
</thead>
<tbody>
<tr>
<td>USA</td>
<td>100</td>
<td>100</td>
<td>89</td>
<td>82</td>
<td>75</td>
</tr>
<tr>
<td>Rest of the World</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
</tbody>
</table>

Please refer to the rating label for product specific information.
11.0 Specifications

Carbolite Gero reserves the right to change the specification without notice.

<table>
<thead>
<tr>
<th>Model</th>
<th>Max Temp (°C)</th>
<th>Max Power (kW)</th>
<th>Work Tube Bore (mm)</th>
<th>Work Tube Length (mm)</th>
<th>Heated Length (mm)</th>
<th>Net Weight (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tube furnaces with a ceramic work tube wound with resistance wire</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CTF 12/75/700</td>
<td>1200</td>
<td>3.0</td>
<td>75</td>
<td>750</td>
<td>700</td>
<td>28</td>
</tr>
</tbody>
</table>

Note: Weights are approximate for horizontal models and do not include fittings or vertical stands.

11.1 Environment

The models listed in this manual contain electrical parts and should be stored and used in indoor conditions as follows:

Temperature: 5 °C - 40 °C

Relative humidity: Maximum 80 % up to 31 °C decreasing linearly to 50 % at 40 °C
<table>
<thead>
<tr>
<th>Engineer Name</th>
<th>Date</th>
<th>Record of Work</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
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<td></td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
The products covered in this manual are only a small part of the wide range of ovens, chamber furnaces and tube furnaces manufactured by Carbolite Gero for laboratory and industrial use. For further details of our standard or custom built products please contact us at the address below, or ask your nearest stockist.

For preventive maintenance, repair and calibration of all furnace and oven products, please contact:

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Fax: +44 (0) 1433 624243
Email: ServiceUK@carbolite-gero.com

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