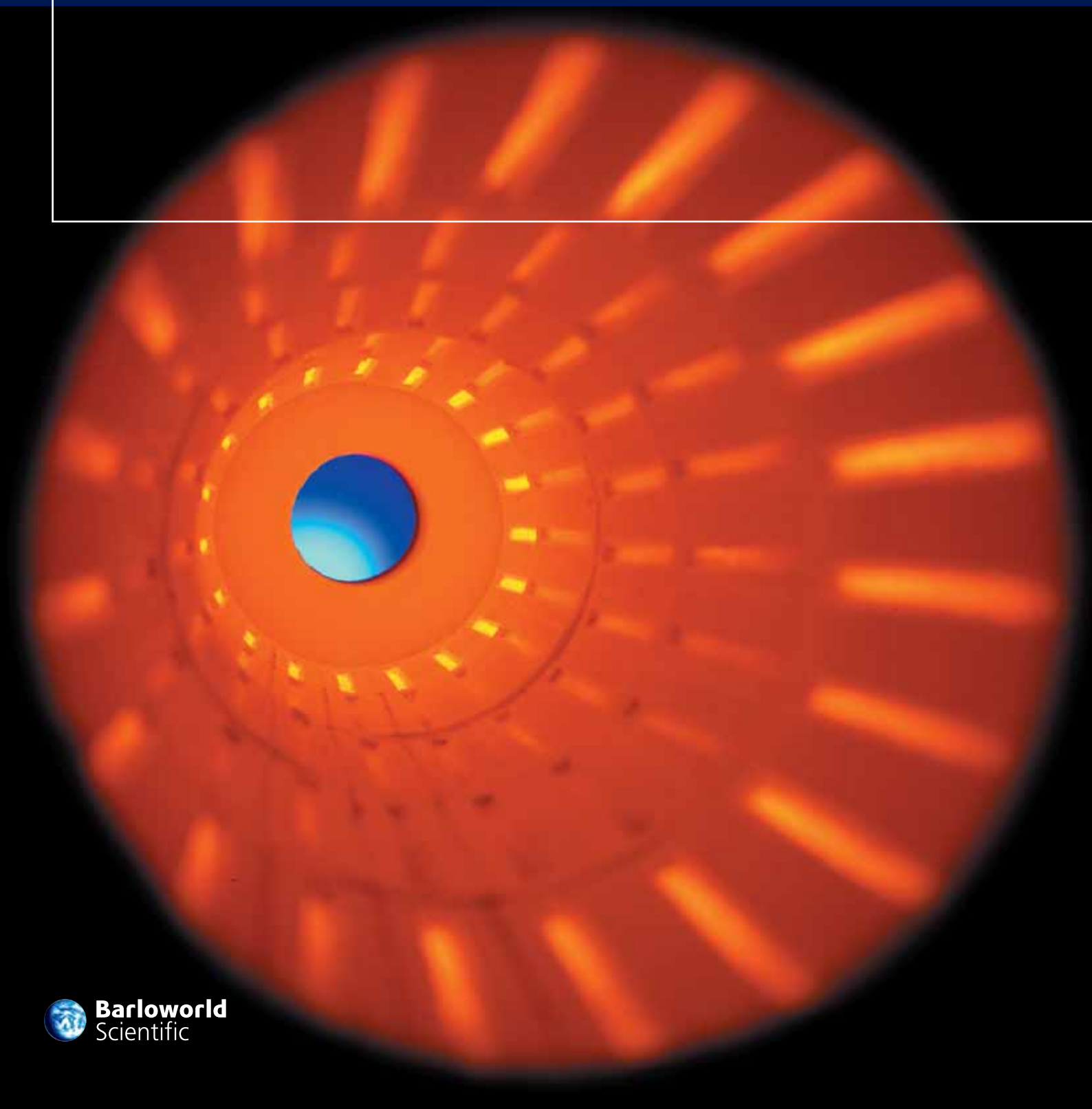
CARBOLITE GERO

PRODUCT UPDATE

Laboratory Chamber & Tube Furnaces



Barloworld Scientific

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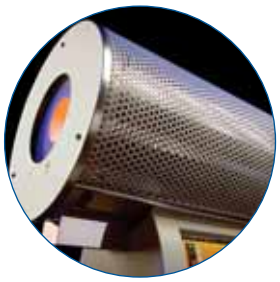

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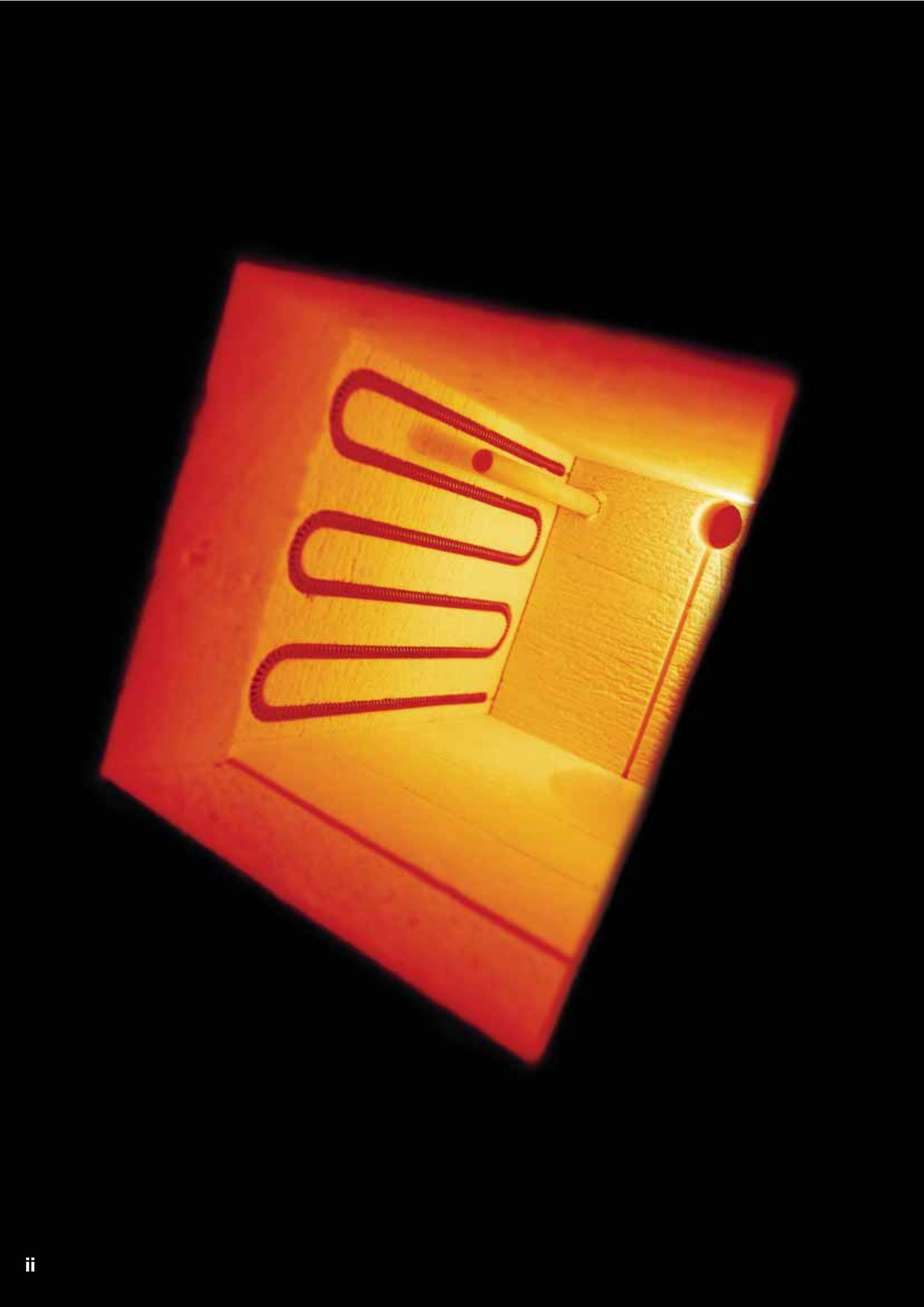

Carbolite is the UK's largest manufacturer of laboratory ovens and furnaces, producing a wide range of research and production equipment with maximum operating temperatures up to 2000°C. Carbolite equipment is exported to over 100 countries world-wide for use in such markets as aerospace, ceramics, metals, mining, pharmaceuticals, electronics and other composites.

Carbolite has a worldwide reputation for flexibility, with the ability to solve specific problems from individual customers with quality engineering solutions. Sizes range from 3 litre standard product to 10,000 litre bespoke production plant.

Carbolite's expertise in production of thermal equipment dates back to 1938 . Today, all Carbolite products are produced in a state of the art, modern production facility at Hope in the heart of the Peak District. Carbolite are one of the few companies which have all of the in-house capabilities necessary to cover the design and production of furnaces, ovens and related equipment. Very little work is subcontracted out and only a relatively small number of components bought in.

For many years exports have accounted for the vast majority of sales and the company is recognised as a world leader in laboratory furnaces. This has been helped by the introduction of new ranges of standard laboratory product, including new High temperature chamber furnaces with maximum temperatures of 1700°C or 1800°C and a new range of horizontal and vertical 1200°C tube furnaces. Both of these new models have improvements in heat up time and uniformity, utilising new technology that has become available.

All of the products featured in this catalogue are available via an extensive worldwide network of dealers. Technical advice and guidance on product selection is available from qualified engineers based at Hope, or via our website **www.carbolite.com.**

Some of the most famous names in science...

Barloworld Scientific is one of the largest broad based manufacturers of laboratory products worldwide, providing internationally recognised brands with reputations for product quality and high performance. These famous brands are now brought together in a single package to offer an incomparable level of quality, service and support.

Science Equipment

Barloworld Scientific manufactures one of the biggest ranges of benchtop equipment available under four famous brand names.

- The extensive **Stuart®** range includes block heaters, blood tube rotators, colony counters, hotplates, hybridisation ovens, rockers, shakers, stirrers and water baths.
- **Techne®** is a world leader in the manufacture of temperature control equipment, including water baths, Dri-Block® heaters and molecular biology products including hybridisation incubators and thermal cyclers.
- **Jenway** makes a wide range of scientific instruments including UV/Vis spectrophotometers, flame photometers, colorimeters, portable and laboratory meters for the measurement of dissolved oxygen, pH, conductivity and specific ions.
- **Carbolite®** has built up an enviable reputation for quality and service, manufacturing furnaces and ovens for both standard and completely bespoke applications. All products can be dispatched worldwide from its' custom built modern manufacturing facility in the UK.

Laboratory Glassware

Barloworld Scientific is one of the world's leading manufacturers of laboratory glassware. Production at our UK plant in Stone, Staffordshire combines the latest technology with the traditional skills of the glassblower to make over 3000 products branded with some of the most famous names in science, including

- **Pyrex®** borosilicate glassware
- **Quickfit®** interchangeable jointed glassware
- **E-Mil®** high accuracy volumetric glassware
- **MBL®** volumetric glassware including burettes, cylinders, flasks and pipettes
- **Rotaflo®** stopcocks for a variety of applications including general purpose and high vacuum usage.

Disposable Plastics

As a pioneer of single use laboratory plastics the Sterilin® brand continues to set world standards for quality and reliability in the field of life science. With an extensive range of consumables for medical and research laboratories. the policy of ongoing improvement means that the, **Sterilin®** brand also incorporates a wide range of products for the pharmaceutical, food, dairy and water testing industries.

Cell Biology

Supplying the increasingly sophisticated field of life sciences, Barloworld Scientific offer one of the widest ranges of biotechnology products available today, including tissue culture plasticware from the leading edge Japanese cell biology company **Iwaki®**.

Reusable Plastics

Leadership in polymer science and many important innovations have combined to make **Azlon®** one of the most widely known and respected brands in durable plastic labware. **Azlon®** reusable plastics cover a broad range of applications in the modern laboratory including bottles, wash bottles, measuring cylinders and beakers. The **Azlon®** fabrication unit can also manufacture specialist plastic products designed to customer requirements.

Silicone Products

Esco® branded products comprise an extensive range of silicone compression and extruded items, including specialist custom made parts. Since 1936 Esco® has established an unrivalled reputation for quality and service of silicone rubber and mouldings to healthcare and an increasingly diverse range of industrial clients.

... all from one company with an unrivalled reputation for quality and service.

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Chamber Furnaces

Product performance and quality

Temperature Uniformity

Carbolite tube and chamber furnaces combine uniquely designed heating elements with low thermal mass insulation materials to provide highly uniform temperatures throughout the working chamber zone. Insulating chamber vestibules and effective chamber size configurations also enhance temperature uniformity in both chamber and tube furnaces. Many 3-zone tube furnaces are offered when enhanced linear uniformity is required.

Responsiveness

All furnaces are designed to provide the responsiveness demanded for many of today's critical process requirements. Necessary heat-up and uniformity are achieved through the total furnace and control system design.

A unique integral design of powerful heating elements and superior insulation materials make up a product that provides the heating performance you demand. Combine this with today's latest and most sophisticated temperature control technology and you understand why Carbolite laboratory furnaces are known for their responsiveness.

Precise Temperature Control

Sophisticated temperature controls are precisely tuned to the furnace temperature and operating characteristics. These PID instruments deliver the exact desired temperature and process repeatability you can count on, run after run.

Versatility

Each product is designed to provide the greatest efficiency and versatility to the end user.* Tube furnace tube adaptors facilitate quick and convenient switching to alternate diameter tubes. Specific tube furnace models are designed to be used in horizontal or vertical operation, with the use of specially designed stands. Multiple accessories and options allow convenient configuration of a furnace for the specific application.

*Not available for all models of tube furnace

Design/Construction

Carbolite laboratory furnaces are recognised for their superior aesthetic and mechanical designs. The quality components and workmanship that goes into every unit further enhances the long-life performance you can expect from a Carbolite furnace. Each furnace is combined with a sophisticated temperature control system, normally positioned in the lower front of the furnace, providing convenient observation and access to the temperature and power controls. The compact furnace designs have a small footprint which conserves valuable bench space.

Safety

Safety and performance are the highest priority in every Carbolite laboratory furnace design. Some chamber furnaces incorporate a vertical counterbalanced door mechanism that keeps the hot face insulation away from the operator when the door is opened. Every Carbolite chamber and hinged tube furnace incorporates a positive break safety switch that isolates power to the heating elements when the door or chamber is opened, eliminating the possibility of direct contact with electrically live elements. The double shell construction of Carbolite laboratory furnaces provides and air gap between the inner furnace assembly and outer case. This promotes convective air flow, providing a safe outer case temperature.

Heating Elements

Carbolite laboratory furnaces rated with maximum operating temperatures from 1000°C to 1300°C utilise long-life resistive metallic wire heating elements. Our 1400°C, 1500°C & 1600°C furnaces use silicon carbide heating elements. As SiC elements resistance slowly changes, Carbolite's unique control system allows easy voltage adjustment to the element circuit, assuring that the furnace heat-up and performance characteristics remain unchanged. Molybdenum disilicide heating elements, used in 1700°C & 1800°C furnaces, offer the advantages of excellent mechanical strength, long-life performance, installation with old elements in series connections, and operation continuously or intermittently.

Insulation

All laboratory furnaces are designed with today's latest and most efficient insulation materials. Low thermal mass ceramic fibre insulation is incorporated into every furnace insulation assembly. This advanced high performance insulation allows for faster heat-up and recovery rates, and energy savings. High temperature furnaces use graded insulation materials to provide enhanced thermal efficiencies. Many Carbolite chamber furnaces incorporate dense refractory materials around the chamber opening and in the floor to provide resistance to abrasive wear and spillage.

Introduction to Chamber Furnaces

The Carbolite range of laboratory chamber furnaces can be used for a wide variety of applications and in many different sectors of industry and research.

It is impossible to define all possible uses for the models highlighted in this catalogue, but typical applications include:

- Heat treating - hardening, tempering and annealing
- Thermal aging processes
- Ignition tests
- Firing of ceramic materials
- Enamelling, bonding, fusing and sintering
- Non ferrous melting
- Decomposition in chemical analysis
- Digestion of samples
- Gravimetric analysis
- High temperature curing and debonding

All furnaces are fitted with a chimney or exhaust vent. Furnaces may sometimes be damaged by chemical attack as a result of corrosive atmospheres generated by the process. Examples include low melting point metal oxides (eg lead, sodium and potassium) fluxes, hardening salts, sulphur compounds and halides.

Please refer to Guide to Furnace Selection Information on page 14. If you are uncertain, please discuss your application with us.

Stylish and sturdy

Both the inner and outer case are constructed from zinc coated steel. The outer is finished in a hard wearing two tone, stoved epoxy/polyester coating.

Positive break safety switch

An added safety feature on all our chamber furnaces ensure that all power to the chamber is isolated whenever the the door is open. This ensures that there is no risk of electrocution to the operator, even if the elements are touched

Convection cooling

The double skinned construction promotes convected air flow for a cool outer case

Chamber exhaust vent

Promotes the extraction of fumes from the chamber generated by the process

Solid state control

Zero voltage switching and rapid cycle time for smooth and reliable control

Digital temperature control

The control module houses a range of digital instrumentation for precise temperature and process control

Door action

A vertical counterbalanced door mechanism allows full and easy access to the chamber and keeps the hot door insulation away from the operator when the door is opened. The VCF has a parallel door mechanism - easily operated with one hand - which also ensures the hot insulation radiates away from the operator, in this case downwards The ELF has a drop down door, that has the added benefit of being used as a shelf when loading or unloading samples.

Options

- Gas safety systems
- Gas tight retorts
- Overtemperature protection
- Gas inlets
- Flowmeters
- Temperature indicators
- Viewing ports (glazed or unglazed)
- Spares kits
- Stands
- Chart recorders
- Load thermocouple access

ELF 11/6

ELF Chamber Furnaces

The ELF range is bench mounted with a maximum temperature of 1100°C and is available with chamber capacities of 6, 14 and 23 litres. These furnaces are suitable for light duty general laboratory work.

The heating chamber is insulated with vacuum-formed low thermal mass insulation, which offers exceptional performance in achieving maximum temperature quickly and efficiently. A temperature of 1000°C is achieved in as little as 35 minutes. Semi-embedded free radiating wire wound elements are located on the two side walls - elements are not positioned in the hearth. A hard ceramic hearth is fitted as standard, which offers additional protection from spillage.

The drop down door can be used as a shelf when loading and unloading samples. The door insulation also acts as a trap for radiated heat, thus improving the chamber uniformity, whilst the air gap behind the plug minimises the external door temperature.

A ceramic chimney is fitted for the ventilation of the chamber, but if toxic / corrosive fumes are generated then a model from our dedicated ashing range should be recommended.

The digital Carbolite 301 PID controller is fitted as standard and has an adjustable single ramp to set point, as well as an in-built timer which allows for a delayed start or a fixed process duration.

Model	ELF 11/6	ELF 11/14	ELF 11/23
Max. Temperature (°C)	1100	1100	1100
Continuous Temperature (°C)	1000	1000	1100
Chamber Dimensions:			
H (mm)	165	210	235
W (mm)	180	220	255
D mm	210	310	400
External Dimensions:			
H (mm)	580	630	715
W (mm)	410	450	505
D (mm)	420	520	660
Heat up time (mins)	35	40	29
Temperature uniformity @ 1000°C in a uniform envelope of:	±5°C	±5°C	±5°C
H (mm)	115	130	665
W (mm)	130	140	455
D (mm)	130	220	610
Max. (W)	2000	2600	5000
Holding Power (W)	900	1300	1500
Internal volume (l)	6	14	23
Thermocouple Type	K	K	K
Weight (kg)	24	31	-

1) Holding power is measured at 100°C below max. temperature, based on 240V supply, with an empty chamber.
2) Uniformity graphs are available on request, for most models.
3) All external dimensions are taken with the door closed and include a chimney.
4) Heat up time is measured at 100°C below max. temperature with an empty chamber.

CWF Furnaces

These furnaces integrate the best of traditional and modern materials to produce an outstanding combination of performance and reliability.

The unique concept for this furnace is the heating module - with one situated on either side of the chamber. Each heating module consists of a high quality alumina based hard wearing element carrier, housing a free radiating coiled wire element. With the use of graded winding, the elements compensate for heat loss and optimise temperature uniformity within the chamber. The furnaces reach working temperature quickly and efficiently.

Hard wearing refractories around the chamber entrance and in the chamber base provide excellent resistance to everyday wear and tear, whilst secondary low thermal mass insulation ensures maximum thermal efficiency.

Service is aided by the removable instrument panel and easy access to the element modules and thermocouple through the rear of the case.

Chamber sizes are 5, 13 and 23 litres with maximum temperatures of 1100°C, 1200°C and 1300°C.

CWF 12/13/301

Model	CWF 5 litre	CWF 13 litre	CWF 23 litre
Max. Temperature (°C)	1100	1100	1100
	1200	1200	1200
	1300	1300	1300
Continuous Temperature (°C)	1000	1000	1000
	1100	1100	1100
	1200	1200	1200
Chamber Dimensions:			
H (mm)	135	200	235
W (mm)	140	200	245
D (mm)	250	325	400
External Dimensions:			
H (mm)	585	655	705
W (mm)	375	435	505
D (mm)	485	610	675
Max. Power (W)	2400	3100	7400
Holding Power (W)			
Model 1100 (°C)	790	1500	1900
Model 1200 (°C)	850	1550	2250
Model 1300 (°C)	1000	1800	2500
Heat Up Time (mins)			
Model 1100 (°C)	30	80	40
Model 1200 (°C)	35	65	45
Model 1300 (°C)	40	80	55
Internal Volume (l)	5	13	23
H x W x D (mm)			
Model 1100 (°C)	85 x 90 x 110	120 x 120 x 185	155 x 165 x 285
Model 1200 (°C)	85 x 90 x 125	120 x 120 x 200	155 x 165 x 325
Model 1300 (°C)	85 x 90 x 150	120 x 120 x 225	155 x 165 x 340
Thermocouple Type			
Model 1100 (°C)	K	K	K
Model 1200 (°C)	R	R	R
Model 1300 (°C)	R	R	R
Weight (kg)	30	47	68

1) Holding power is measured at 100°C below max. temperature, based on 240V supply, with an empty chamber.
2) Uniformity graphs are available on request, for most models.
3) All external dimensions are taken with the door closed and include a chimney.
4) Heat up time is measured at 100°C below max. temperature with an empty chamber.

RWF 12/5/301

RWF Furnaces

These furnaces are designed for light to medium duty applications where rapid thermal response is a primary requirement.

Powerful, free radiating coiled wire elements are held firmly in the sides and roof of the chamber, which are constructed from rigidised low thermal mass insulation. A hard, dust-free, ceramic hearth provides a robust base for the furnace charge. This combination of high power and low thermal mass gives a heat up time from ambient to 1100°C in as little as 10 minutes, whilst rapid cooling can be induced by opening the furnace door during cool down. Other performance criteria are not compromised, with temperature uniformity, efficiency and control precision remaining excellent.

Chamber sizes are 5, 13 and 23 litres with maximum temperatures of 1100°C and 1200°C.

Model	RWF 11/5	RWF 11/13	RWF 11/23	RWF 12/5	RWF 12/13	RWF 12/23
Max. Temperature (°C)	1100	1100	1100	1200	1200	1200
Continuous Temperature (°C)	1000	1000	1000	1100	1100	1100
Chamber Dimensions:						
H (mm)	130	195	220	130	195	220
W (mm)	160	210	260	160	210	260
D (mm)	250	325	400	250	325	400
External Dimensions:						
H (mm)	585	655	705	585	655	705
W (mm)	375	435	505	375	435	505
D (mm)	485	610	675	485	610	675
Max. Power (W)	2750	5000	9100	2750	5000	9100
Holding Power (W)	680	1200	1800	820	1450	2100
Heat up times (mins)	10	11	13	12	13	15
Thermocouple type	K	K	K	R	R	R
Weight (kg)	28	45	65	28	45	65

GPC 12/36/3216P1

GPC Furnaces

These furnaces offer the large capacity and robust construction required for general workshop use, together with the performance capabilities and case style of our smaller laboratory models.

Traditional hard wearing refractory materials used for the chamber entrance and hearth plate provide good resistance to accidental damage and a solid support for heavier furnace loads.

Free radiating coiled wire elements supported in open grooves, together with low thermal mass insulation, allowing these furnaces to reach working temperature in approximately 40 minutes, and provide efficient and reliable operation.

Removable instrument and back panels allow good service access to the case interior, whilst heating element coils are easily and quickly replaced through the door opening.

Model	GPC 12/36	GPC 12/65	GPC 12/131	GPC 12/200	GPC 13/36	GPC 13/65	GPC 13/131
Max. Temperature (°C)	1200	1200	1200	1200	1300	1300	1300
Continuous Temperature (°C)	1100	1100	1100	1100	1200	1200	1200
Chamber Dimensions:							
H (mm)	250	278	350	400	250	278	350
W (mm)	320	388	500	600	320	388	500
D (mm)	450	595	750	900	450	595	750
External Dimensions:							
H (mm)	810	885	1652	1702	810	885	1652
W (mm)	690	780	1110	1350	690	780	1110
D (mm)	780	945	1280	1350	780	945	1280
Internal Volume (l)	36	65	131	200	36	65	131
Thermocouples Type	All GPC'S use Type R thermocouples						
Max. Power (W)	9000	14000	18000	24000	9000	14000	18000
Weight (kg)	100	165	400	518	120	165	400

1) Holding power is measured at 100°C below max. temperature, based on 240V supply, with an empty chamber.
2) Uniformity graphs are available on request, for most models.
3) All external dimensions are taken with the door closed and include a chimney.
4) Heat up time is measured at 100°C below max. temperature with an empty chamber.

Vertical Loading Chamber Furnaces

These furnaces are top loading and particularly suited for applications involving tall crucibles or heavy components.

The coiled resistance wire elements are embedded in robust panels of cast refractory and line the four sides of the chamber ensuring even heat transfer to the load. Elements are not placed in the bottom of the chamber where they may be damaged by spillage. The elements are easily replaced by removal from the top of the furnace.

The door contains a simple vent to help remove fumes from the chamber.

The temperature controller is recessed into the furnace housing - and is inclined upwards ensuring the display is clearly visible. Push button operation allows precise, repeatable setting and the digital display gives a clear indication of both actual furnace temperature and set-point.

The platinum/platinum 13% Rh Type R thermocouple gives a stable output over a long life and is located in a protective ceramic sheath in a corner of the chamber where it is unlikely to be accidentally damaged.

Chamber sizes are 5, 10, 23 and 100 litres, with a maximum temperature of 1200°C

VCF 12/5/3508P10

Model	VCF12/5	VCF12/10	VCF12/23	VCF12/100
Max.Temperature (°C)	1200	1200	1200	1200
Continuous Temperature (°C)	1100	1100	1100	1100
Chamber Dimensions:				
H (mm)	260	365	450	600
W (mm)	155	180	250	410
D (mm)	130	155	200	410
External Dimensions:				
H (mm)	660	765	850	1100
W (mm)	530	555	600	930
D (mm)	405	430	500	950
Max. Power (W)	2500	3000	6000	15000
Holding Power (W)	900	1200	2500	6000
Heat Up Time (mins)	102	138	125	150
Internal Volume (l)	5	10	23	100
Thermocouple Type	R	R	R	R
Weight (kg)	50	60	130	200

1) Holding power is measured at 100°C below max. temperature, based on 240V supply, with an empty chamber.
2) Uniformity graphs are available on request, for most models.
3) All external dimensions are taken with the door closed and include a chimney.
4) Heat up time is measured at 100°C below max. temperature with an empty chamber..

HRF 7/22/301

Air Recirculating Furnaces

The HRF range of horizontal air recirculating chamber furnaces is available with a maximum operating temperature of 750°C and is particularly suitable for stress relieving, tempering, normalising, annealing and other low temperature heat treatment processes.

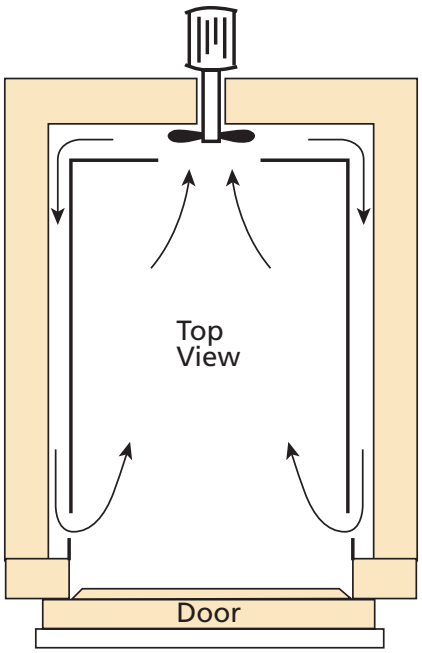
They feature an easy clean, stainless steel inner chamber and a zinc coated outer case, finished with a hardwearing stoved epoxy polyester coating. The double skin construction ensures a cool, safe outer case temperature.

Heating is provided by resistance wire elements on both sides of the chamber. A powerful centrifugal fan and airguide system forces air over the elements and back through the work chamber, providing uniform temperature distribution and rapid heat transfer to the workpiece. (see the drawing labelled HRF Air Flow) A combination of insulation is used: low thermal mass ceramic fibre insulation, which ensures low energy losses and refractory board below the hearth provide load bearing capacity,

Model	HRF7/22	HRF 7/45	HRF7/112	HRF7/324
Max. Operating Temperature (°C)	750	750	750	750
Thermocouple Type	K	K	K	K
Internal Volume (l)	22	45	112	324
Chamber Dimensions:				
H (mm)	220	295	400	600
W (mm)	200	265	400	600
D (mm)	495	575	700	900
External Dimensions:				
H (mm)	590	755	1550	1800
W (mm)	450	605	1000	1200
D (mm)	870	1100	1600	2280
Max. Power (W)	3000	6000	18000	24000
Weight (kg)	61	110	480	1000

1) Holding power is measured at 100°C below max. temperature, based on 240V supply, with an empty chamber.
2) Uniformity graphs are available on request, for most models.
3) All external dimensions are taken with the door closed and include a chimney.
4) Heat up time is measured at 100°C below max. temperature with an empty chamber.

HRF Air Flow



Top Hat Furnace

This compact top hat furnace for laboratory applications allows for easy handling of samples, fast heating and cooling cycles and particularly uniform temperature profiles. It reaches 1000°C in under 20 minutes.

The use of double skin construction provides a cool and safe outer case temperature. The outer case is manufactured from zinc coated sheet steel and finished with an attractive stoved epoxy polyester finish.

The heated chamber, which accepts crucibles and work pieces up to 200mm (h) x 140mm (Ø), has an attractive stainless steel retractable element cover which provides total operator safety. The element chamber lifts away from the hearth and is electrically operated by a rocker switch located on the furnace base. When opened, a cool air flow provides rapid cooling and allows unrestricted access to the hearth, permitting easy handling of the furnace load. During loading/unloading, the elements are totally isolated from the working area as they are fully withdrawn into the case, keeping the hot face away from the operator at all times.

Powerful free radiating coiled wire elements are held firmly in the vacuum formed low thermal mass insulation, which forms a cylindrical chamber allowing maximum heat transfer and temperature uniformity. The use of low thermal mass ceramic fibre insulation material provides rapid heating and fast cooling.

A version with a refractory metal bell jar fitted within the furnace chamber is also available, allowing samples to be treated under special sealed atmospheres, using a sand seal.

LTH 12/3

Model	LTH 12/3
Max. Temperature (°C)	1200
Continuous Temperature (°C)	1100
Internal Volume (l)	3.5
Chamber Size (mm)	150 (Ø) x 200 (h)
External Dimensions:	
H (mm)	655
W (mm)	410
D (mm)	540
Max Power (W)	3000
Chamber Raising/Lowering Time	5 seconds
Thermocouple type	R
Weight (kg)	38

1) Holding power is measured at 100°C below max. temperature, based on 240V supply, with an empty chamber.
2) Uniformity graphs are available on request, for most models.
3) All external dimensions are taken with the door closed and include a chimney.
4) Heat up time is measured at 100°C below max. temperature with an empty chamber.

RHF 16/3/3508P1

1400°C, 1500°C and 1600°C

Silicon Carbide Heated Furnaces

This comprehensive range is available at 1400, 1500 and 1600°C with four popular capacities of 2.9, 7.8,15 and 35 litres. Powerful silicon carbide heating elements provide fast heat up rates, typically 40 minutes to 1400°C depending on the model.

Silicon carbide heating elements are ideally suited to the rigorous firing cycles often required in laboratory furnaces. These elements withstand the stresses of intermittent operation and give long life at elevated temperatures. Furnaces using these elements are designed with excess power to ensure that ageing is easily corrected and heating performance is maintained. The average life of the elements may be several years, depending on operating temperatures and conditions.

Two types of insulation are used: Hard wearing refractory brick around the doorway and in the floor to give resistance to abrasion and spillage. Lightweight ceramic fibre is used in all other areas to ensure energy efficiency and fast heating/cooling.

Model	RHF 14/3	RHF 14/8	RHF 14/15	RHF 14/35	RHF 15/3	RHF 15/8	RHF 15/15	RHF 15/35	RHF 16/3	RHF 16/8	RHF 16/35	RHF 16/35
Max. Temperature (°C)	1400	1400	1400	1400	1500	1500	1500	1500	1600	1600	1600	1600
Temperature (°C)	1300	1300	1300	1300	1400	1400	1400	1400	1500	1500	1500	1500
Internal Volume (l)	2.9	7.8	15	35	2.9	7.8	15	35	2.9	7.8	15	35
Chamber Dimensions:												
H (mm)	120	170	220	250	120	170	220	250	120	170	220	250
W (mm)	120	170	220	300	120	170	220	300	120	170	220	300
D (mm)	205	270	310	465	205	270	310	465	205	270	310	465
External Dimensions:												
H (mm)	655	705	810	885	655	705	810	885	655	705	810	855
W (mm)	435	505	690	780	435	505	690	780	435	505	690	780
D (mm)	610	675	780	945	610	675	780	945	610	675	780	945
Heat up time (min)	33	22	35	38	45	40	45	46	42	35	58	56
Max. Power (W)	4500	8000	10000	16000	4500	8000	10000	16000	4500	8000	10000	16000
Holding Power (W)	1900	3200	2900	6000	2000	3500	3000	6200	2300	4000	3500	1100
Weight (kg)	42	64	125	179	46	61	125	178	42	61	140	179

1) Holding power is measured at 100°C below max. temperature, based on 240V supply, with an empty chamber.
2) Uniformity graphs are available on request, for most models.
3) All external dimensions are taken with the door closed and include a chimney.
4) Heat up time is measured at 100°C below max. temperature with an empty chamber.

High Temperature Chamber Furnaces

The 1700°C models are available in three chamber sizes and the 1800°C models in four chamber sizes.

These furnaces are heated by molybdenum disilicide elements – the elements are either on the sides, or sides and rear of the chamber, depending on the model. The elements provide improved performance and temperature uniformity within the chamber and are suitable for intermittent or continuous operation.

Advanced high temperature hot face insulation is combined with graded low thermal mass insulation to improve energy efficiency and heat up rates; the 1700°C 10 litre model reaches 1600°C in only 44 minutes, whilst the 1800°C 8 litre model reaches 1700°C in only 56 minutes.

A low outer case temperature is achieved through fan cooling.

Fitted with 3216P1 programmer and overtemperature protection as standard.

RS 232 digital communication is provided as standard on models HTF 17/5, HTF 17/10, HTF 18/4 and HTF 18/8.

HTF 17/10/3216P1

Model	HTF 17/5	HTF 17/10	RHF 17/25
Max. Temperature (°C)	1700	1700	1700
Continuous Temperature (°C)	1600	1600	1600
Chamber Dimensions:			
H (mm)	158	232	300
W (mm)	150	200	300
D (mm)	225	225	300
External Dimensions:			
H (mm)	565	565	1800
W (mm)	830	830	1100
D (mm)	650	650	680
Internal Volume (l)	5.3	10.4	25
Heat up Time to (mins)	50	44	45
Max. Power (W)	4190	5920	9600
Thermocouple Type	B	B	B

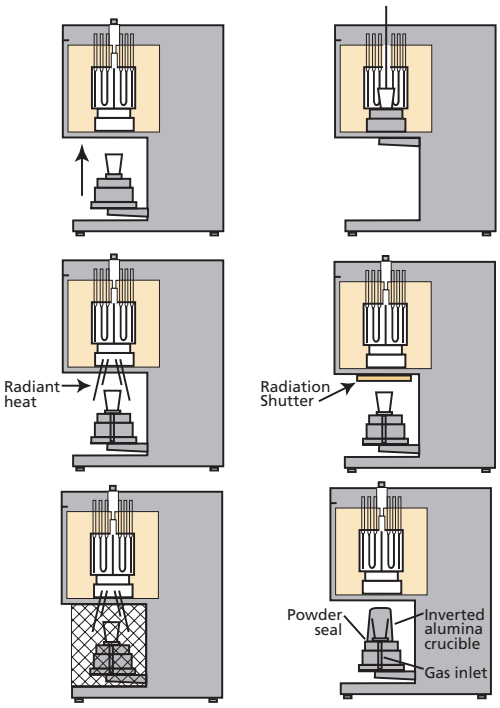
Model	HTF 18/4	HTF 18/8	HTF 18/15	HTF 18/27
Max. Temperature (°C)	1800	1800	11800	1800
Continuous Temperature (°C)	1700	1700	1700	1700
Chamber Dimensions:				
H (mm)	140	210	220	300
W (mm)	140	190	220	300
D (mm)	190	190	300	300
External Dimensions:				
H (mm)	565	565	1580	1610
W (mm)	830	830	690	780
D (mm)	650	650	800	945
Internal Volume (l)	3.7	7.6	15	27
Heat up Time (mins)	65	56	70	55
Max. Power (W)	4650	6200	9000	18000
Thermocouple type	20/40	20/40	20/40	20/40

HTF 18/27/3216P1

1) Holding power is measured at 100°C below max. temperature, based on 240V supply, with an empty chamber.
2) Uniformity graphs are available on request, for most models.
3) All external dimensions are taken with the door closed and include a chimney.
4) Heat up time is measured at 100°C below max. temperature with an empty chamber.

BLF 17/3/3508P1

BLF 17/8/3508P1



Bottom loading furnaces

Included in Carbolite's innovative designs are the six models which comprise the range of high temperature bottom loading furnaces.

There are three models at 1700°C with capacities of 3.4, 7.9, and 21 litres. Capacities of 3.4 and 7.9 litres are available at 1800°C.

This range of furnaces offers several advantages and is suitable for firing and sintering of advanced ceramics and high temperature glass melting. Excellent temperature uniformity is obtained by the inclusion of molybdenum disilicide heating elements which are positioned around the walls of the chamber ensuring uniform heating of the sample.

The electrically operated elevator hearth ensures operator safety and prevents direct radiation of heat from the chamber walls. It also ensures smooth loading and unloading of the workpiece/crucible and allows both heavy and delicate loads to be handled easily. The loading platform has a full travel which allows the complete chamber height to be used.

Fast heating and cooling of the sample is obtained by having the ability to move the sample in and out of the furnace when hot or cold.

The furnace can be adapted to accommodate an atmosphere other than air. This is possible by placing a large inverted alumina crucible in a groove in the hearth. It is possible to partly fill this groove with alumina (Al2O3) or Zirconia (ZrO2) powder to improve the sealing. Gas inlet and outlet connections allow atmospheres to be introduced from below the hearth and spread by radial channels cut into the surface of the hearth so that the inlet cannot be blocked by the sample positioned on the hearth. The top of the furnace can be adapted to include the facility to insert a probe thermocouple or provide access for a stirrer.

Versions with rotating hearths are also available, please ask for details.

A choice of programmable controllers is available together with other advanced temperature control options, including computer communications. An independent overtemperature control is fitted as standard and can either be set to protect the furnace or adjusted to a lower temperature to protect a valuable load.

Options include flowmeters, radiation shutters, crucibles and hearth cages.

Model	BLF 17/3	BLF 17/8	BLF 17/21	BLF 18/3	BLF 18/8
Max. Temperature (°C)	1700	1700	1700	1800	1800
Continuous Temperature (°C)	1600	1600	1600	1700	1700
Internal Volume (l)	3.4	7.9	21	3.4	7.9
Internal Dimensions:					
H (mm)	190	250	300	190	250
(Ø)	150	200	300	150	200
External Dimensions:					
H (mm)	975	1950	1850	975	1950
W (mm)	750	1360	1250	750	1360
D (mm)	530	800	850	530	800
Heat up Time (mins)	80	80	180	110	110
Max. Power (W)	5000	9000	12000	6000	10000
Weight (kg)	155	424		155	424

1) Holding power is measured at 100°C below max. temperature, based on 240V supply, with an empty chamber.
2) Uniformity graphs are available on request, for most models.
3) All external dimensions are taken with the door closed and include a chimney.
4) Heat up time is measured at 100°C below max. temperature with an empty chamber.

Ashing & Burn off Furnaces

AAF 11/3 & AAF 11/7

Introduction to Ashing & Burn Off Furnaces

Laboratory furnaces must fulfil many preconditions to meet all the requirements of heating your samples efficiently and reliably.

Amongst others, these include being tough enough to withstand mechanical wear and tear, and resistance to aggressive substances, as well as providing good temperature uniformity throughout the chamber.

- If the sample being heated is combustible, and your requirement is to burn away that material to leave the workpiece clean, then resistance to mechanical wear and tear and good ventilation to remove the ignited fumes are most important.
- If the sample being heated is combustible and your interest is in the ash remaining, then resistance to mechanical wear and tear, resistance to aggressive substances and good temperature uniformity are all important characteristics.
- If the sample being heated must not be contaminated by alumina or silica dust, then the use of a furnace with a dust-less chamber is important.
- If the sample being heating is non-combustible then the most important characteristic is to achieve consistent uniformity.

Selecting the correct furnace

For heating of combustible materials for material removal or analysis of ash residue, Carbolite has developed the ashing and burn-off furnace range, which has specific features to enhance ventilation and maintain good temperature uniformity, as well as protect the sample from contamination. To assist you with the selection of the most appropriate furnace please refer to the information on below. If you are unsure, please discuss your application with us.

Guide to chamber furnace selection

Ashing for material analysis

Heat treatment of non combustible material

Which materials need to be used?

Man made & natural hydrocarbons (eg plastics paint, oil, rubber, coal)

AAF range

Suitable for ashing

Natural materials & fibres (eg wheat, flour, cereal crops, grass)

AAF range
BWF range

Suitable for ashing

Ashing for dust free analysis (eg ceramic fibre content)

GSM range

Suitable for heat treatment

Suitable for ashing

Metals (eg steel, alloys) 1100OC, 1200OC and 1300OC

CWF range
ELF range

Suitable for heat treatment

Ceramics (eg silica, cement) 1100OC to 1800OC

CWF range
RHF/HTF range
ELF range

Suitable for heat treatment

AAF range
A furnace designed for ashing and burning with protected elements and preheated air giving a high level of uniformity.

GSM 11/8
A fused silica muffle minimises residual ceramic dust for specific analysis applications. Resistant to chemical attack.

BWF range
A flexible furnace, which can be used for light duty ashing. It is ideal for heat treatment applications due to its robust construction.

ELF range
A furnace which is ideally suited to light duty work.

Rapid heat up.

RHF/HTF range
For sintering of technical ceramics and testing silicon based materials a higher temperature may be required. The RHF/HTF ranges provide up to 1800°C.

AAF Furnaces

These models are heated by wire heating elements protected from chemical and mechanical damage by a high quality, hard wearing alumina based liner. The graded winding and powerful double sided heating elements compensate for the heat loss, as well as preheating the air prior to it entering the chamber. Temperature uniformity within the chamber is therefore excellent, despite the higher airflow through the chamber.

The AAF 11/3 and AAF 11/7 have a large floor area which allows many samples to be accommodated and because of the low chamber height the airflow is held close over the samples to promote burning. High airflow of between 4-5 changes per minute is ensured by use of an air inlet and a tall chimney, however it is not too high to disturb the samples in the crucibles, or chill them, as the incoming air is preheated.

The AAF range is ideal for ashing materials such as food, plastics, coal and other hydrocarbons. The AAF 11/7 furnace complies with the following industry standards BS 1016 part 4, ISO 344 and 1171, ASTM D2361, D2795 and D3174.

The AAF 11/18 has high grade heating wire mounted behind silicon carbide tiles to protect against carbon or corrosive atmospheres. A two tier shelf is supplied as standard, which doubles the furnace capacity.

AAF 11/7/301

Trays supplied with AAF furnaces

Model	AAF 11/3	AAF 11/7	AAF 11/18
Max. Temperature (°C)	1100	1100	1100
Continuous Temperature (°C)	1000	1000	1000
Internal Dimensions:			
H (mm)	90	90	235
W (mm)	150	170	196
D (mm)	250	455	400
Internal Volume (l)	3	7	18
External Dimensions:			
H (mm)	480	650	705
W (mm)	290	430	505
D (mm)	340	740	675
Height to top of Chimney	780	1060	1015
Max. Power (W)	2100	4000	7080
Holding Power (W)	1270	2300	3500
Heat up Time (mins)	140	155	70
Thermocouple Type	K	K	K
Weight (kg)	22	63	70

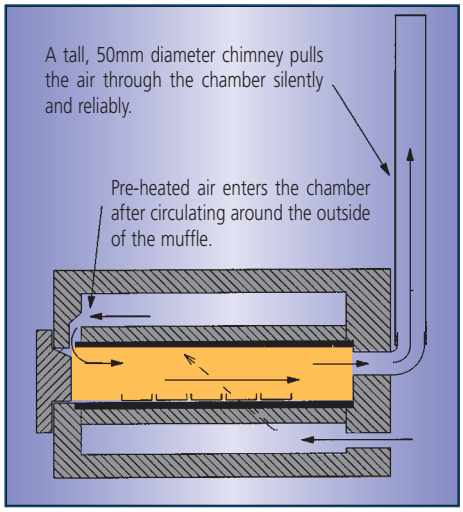
Accessories

AAF 11/3 AAF 11/7 & 11/18 accessories are supplied with the furnace.

GSM 11/8 & CWF/BWF are optional extras.

Model	AAF 11/3	AAF 11/7	AAF 11/18	GSM 11/8	CWF/BWF
Sample Rack & Tray System*	_	_	yes	_	yes
Inconel Hearth Tray	_	_	yes	_	yes
Inconel Sample Trays	yes	yes	yes	yes	yes
Perforated Sample Trays	yes	yes	yes	yes	yes
Loading Handle	yes	yes	yes	yes	yes

1) Holding power is measured at 100°C below max. temperature, based on 240V supply, with an empty chamber.
2) Uniformity graphs are available on request, for most models.
3) All external dimensions are taken with the door closed and include a chimney.
4) Heat up time is measured at 100°C below max. temperature with an empty chamber.
5)* Sample rack and tray system consists of hearth tray, two-tier rack, two sample trays and loading handle.



BWF 11/13/301

BWF Furnaces

These models are heated by free radiating coiled wire heating elements housed in a high quality alumina based hard wearing element carrier. With the use of graded winding, the elements compensate for heat loss and optimise temperature uniformity within the chamber. The elements are located in the sides only and so are protected from contamination by accidental spillage. Hard wearing refractories around the chamber entrance and in the chamber base provide excellent resistance to everyday wear and tear.

Airflow in the BWF is enhanced by the addition of a tall chimney and air inlet holes in the door, which rapidly remove the fumes from the furnace, preventing carbon deposits forming.

GSM 11/8

GSM Furnace

Some analysis techniques may be affected by alumina or silica dust (Al_2O_3 or SiO_2), the materials normally used to construct furnace chambers. To avoid this the GSM furnace chamber is constructed from a fused quartz material.

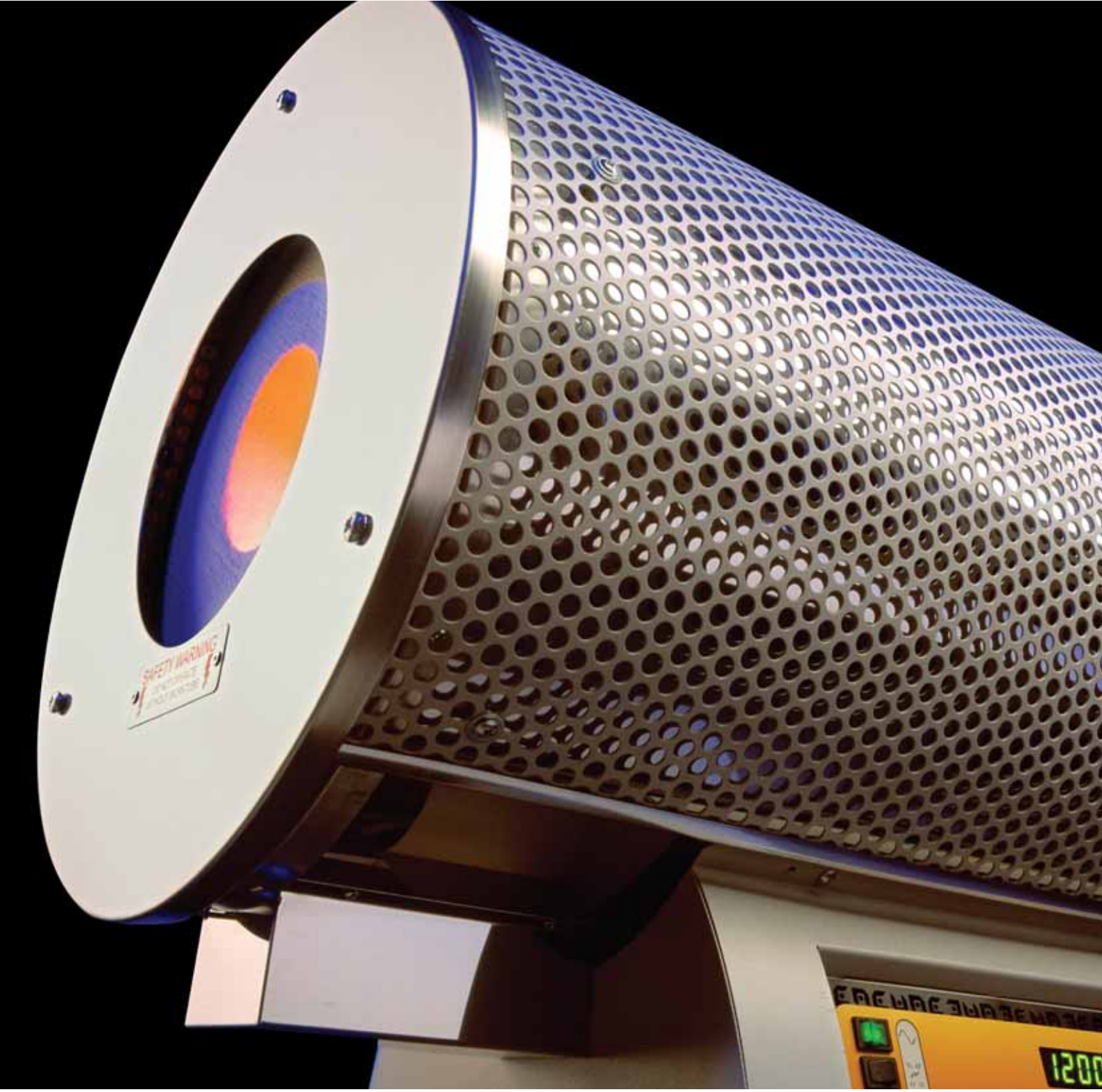
This minimises the risk of dust falling from the chamber roof into the sample crucibles, however the door insulation is moulded ceramic fibre which may produce small dust particles and therefore dust cannot be entirely excluded.

This design also offers superior containment of aggressive and corrosive vapours such a H_2SO_4, HNO_3 HCl, keeping them away from the heating elements.

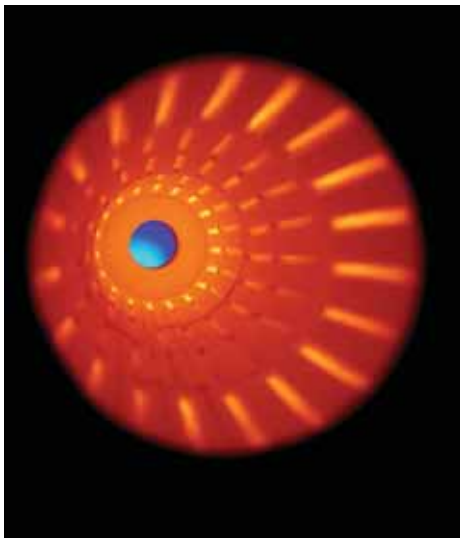
Additionally if an optional gas inlet is specified, the enclosed design minimises gas leakages from the chamber.

Model	GSM 11/8	BWF 11/13	BWF 12/13
Max. Temperature (°C)	1100	1100	1200
Continuous Temperature (°C)	1000	1000	1000
Internal Dimensions:			
H (mm)	120	200	200
W (mm)	175	200	200
D (mm)	345	325	325
Internal Volume	8	13	13
External Dimensions:			
H (mm)	655	705	655
W (mm)	435	505	435
D (mm)	610	725	610
Height to Top of Chimney	800	1750	800
Max. Power (W)	3050	3100	3100
Holding Power (W)	1700	1200	1500
Heat up Time (mins)	70	90	60
Thermocouple Type	K	K	R
Weight (kg)	59	47	47

1) Holding power is measured at 100°C below max. temperature, based on 240V supply, with an empty chamber.
2) Uniformity graphs are available on request, for most models.
3) All external dimensions are taken with the door closed and include a chimney.
4) Heat up time is measured at 100°C below max. temperature with an empty chamber.



Tube Furnaces



Introduction to Tube Furnaces

Carbolite tube furnaces offer precise temperature control, excellent temperature uniformity and the most cost effective solution for heating small workpieces.

The extensive range of tube furnaces is probably the most comprehensive available from a single source and includes wire heated tube furnaces to 1200°C, silicon carbide heated furnaces to 1600°C and molybdenum disilicide heated furnaces up to 1700°C. Tube furnaces at 1800°C are heated by lanthanum chromite or molybdenum disilicide.

Many processes demand the use of a tube furnace – from simple combustion techniques (ideal for carbon determination and organic analysis) to more sophisticated applications requiring accurate and uniform heating.

Specialist models are incorporated in the range, including vacuum and rotating, rotary reactor furnaces, multi-zone and those specifically designed for the calibration of thermocouples, including three-zone control models.

Typical tube furnace applications include:

- Gas analysis
- Materials research
- Sintering & firing of ceramics
- Crystal growing
- Continuous strip & wire heating
- Doping of silicon wafers
- Powder metallurgy
- Thermocouple calibration
- Thermal degradation
- Superconductor research

As in all areas of our production, custom built models are also available to specifically meet your requirements.

Horizontal tube furnaces are mounted on a base unit, whilst vertical models are supplied with a stand and a separate control box with a length of conduit flex. This permits horizontal, vertical or wall mounted use.

Many tube furnaces combine wire wound heating elements and low thermal mass insulation, whilst the split models and G series models combine free radiating wire elements in vacuum formed insulation modules, which provide good support and increase the working life of the elements.

To achieve the most uniform temperature, both ends of the tube furnace should be fitted with tapered ceramic end plugs or radiation shields.

For the G series models, an integral work tube is not fitted and a separate worktube must be used. However, removable tube adaptors at each end of the furnace allow rapid changes for different size worktubes.

Vertically loaded tube furnaces need careful design of the sample support system and effective tube end insulation to prevent heat losses and convection air currents. Please discuss your application with us.

All models use the latest PID microprocessor digital control systems. Stepped and controlled heating and cooling can be achieved with the use of a programmer, which also ensures the possibility of thermal shock is minimised.

Care should be taken to avoid steep temperature gradients and thermal stresses, which could crack a ceramic tube. Please check the recommended heating rates. It is advisable to either pre-heat the sample before loading or heat the sample and furnace simultaneously. Carbolite, in common with other tube furnace manufacturers, does not accept responsibility for tube failures resulting from loading cold crucibles/samples into hot ceramic tubes.

For precise sample temperature monitoring, a digital temperature indicator can be built into the furnace for use with a probe thermocouple, which is inserted into the worktube to measure the temperature close to the workpiece.

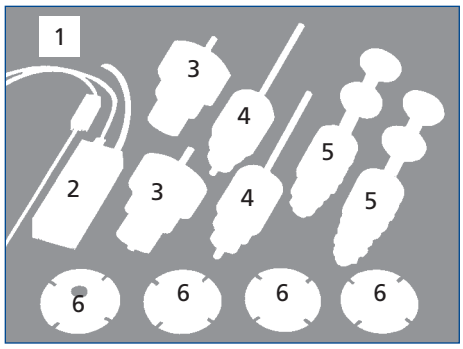
A double skin construction or an outer mesh guard promotes natural air-cooling and protects the operator from hot surfaces. In the event of thermocouple malfunction, the control system automatically cuts power to the heating elements.

A wide range of optional accessories includes:

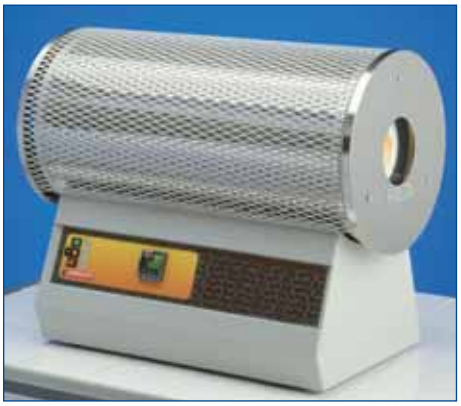
- selection of worktubes including:
  - impervious aluminous porcelain (IAP)
  - mullite
  - recrystalised alumina (RCA)
  - metallic (APM)
  - sillimanite
  - silica
- ceramic insulation plugs
- radiation shields (for use with vacuum)
- worktube seals for vacuum/controlled atmosphere applications
- gas flowmeters
- gas safety systems
- probe thermocouple for calibration and accurate measurement of workpiece temperature
- multi-segment programmers
- remote PC control and software for data logging
- overtemperature protection
- chart recorder
- calibration certificates
- wall mounting brackets
- 'L' stand allowing vertical and/or horizontal operation
- separate control boxes

Safety:

Ceramics can become slightly electrically conductive at high temperatures and therefore tube furnaces should be switched off before loading and unloading.



1. Probe Thermocouple
2. Temperature Indicator
3. Type C Insulation Plugs for heating in air
4. Type D Insulation Plugs for heating in controlled atmosphere
5. Radiation Shields for vacuum use
6. Worktube End Flanges



CTF 12/65/550

MTF 12/38/250/3216
& MTF 10/25/130/301

Wire Wound Tube Furnaces to 1200°C

The majority of these models utilise a resistance wire heating element, which is wound around the outside of a ceramic worktube making it an integral part of the heating element. If the tube is required to contain an atmosphere or is likely to be contaminated by spillage, an additional work tube should be used. The thermocouple is located in a protected position between the outside of the work tube and the heating element, allowing the full work tube diameter to be used and protects the thermocouple from mechanical damage.

Wire Wound Tube Furnaces ~ Single Zone	CTF 12/65/550	CTF 12/75/700	CTF 12/100/900
Max. Temperature (°C)	1200	1200	1200
Continuous Temperature (°C)	1100	1100	1100
Heat up time (mins)	45	45	90
Inside Diameter of Fixed Element Tube (mm)	65	75	100
Heated length (mm)	550	700	900
Overall Furnace length (mm)	600	750	950
Horizontal Mounting on Control Box	✓	✓	✓
Option of mounting: L stand / Wall bracket			
Blank base / Separated base	✓	✓	✓
Uniform length +/-5 (°C)	230	265	640
Thermocouple Type	N	N	N
Max. Power (W)	2000	3000	4500
Holding Power Requirement (W)	600	800	1000
External Dimensions :			
H (mm)	525	525	525
W (mm)	625	775	975
D (mm)	360	360	360
Weight (kg)	25	28	35

Wire Wound Tube Furnaces ~Single Zone	MTF 9/15/ 130	MTF 10/15/ 130	MTF 10/25/ 130	MTF 12/25/ 250	MTF 12/38/ 250	MTF 12/25/ 400	MTF 12/38/ 400	MTF 12/38/ 850
Max.Temperature (°C)	900	1000	1000	1200	1200	1200	1200	1200
Continuous Temperature (°C)	800	900	900	1100	1100	1100	1100	1100
Heat up time (mins)	7	5	10	15	25	30	25	-
Inside diameter of fixed element tube (mm)	15	15	25	25	38	25	38	38
Heated Length (mm)	130	130	130	250	250	400	400	850
Overall furnace Length (or width) (mm)	180	150	150	300	300	450	450	900
Horizontal Mounting on control box	✓	✓	✓	✓	✓	✓	✓	✓
Option of mounting: L stand / Wall bracket / Blank base / Separated base	8	3	3	3	3	3	3	-
Uniform length +/-5 (°C)	30	30	45	60	90	100	130	-
Thermocouple Type	K	K	K	N	N	N	N	-
Max. Power (W)	220	400	400	700	1000	1000	1500	2800
Holding Power (W)	100	100	100	200	300	200	300	-
External Dimensions:								
H (mm)	180	265	265	375	375	430	430	-
W (mm)	90	150	150	370	450	370	450	-
D (mm)	180	175	175	375	375	375	375	-
Weight (kg)	2	3	3	10	15	10	15	-

1200°C G range Tube Furnaces

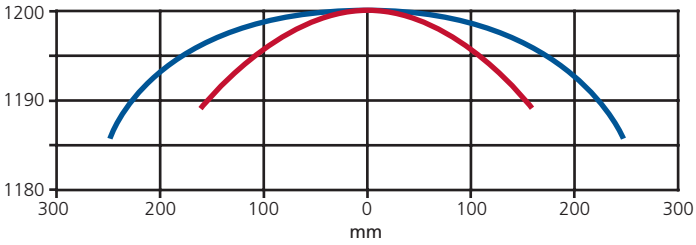
GHA 12/75/600/301

These furnaces can accept worktubes with an outside diameter from 20 – 170mm. The range includes seven heated lengths from 300mm to 1200mm in both horizontal and vertical versions, with either single-zone or three-zone control. The multi-zone models can provide particularly good temperature uniformity.

Heating is provided by semi-embedded, free-radiating wire elements in vacuum formed insulation modules, which provide good support and increase the working life of the element. An integral worktube is not fitted and a separate worktube must be used, but removable tube adaptors at each end of the furnace allow rapid changes for different size worktubes.

The horizontal versions are mounted on an attractive base unit, whilst the versatile models are supplied with a stand kit and a separate control box with a length of conduit flex which permits horizontal, vertical and wall mounted use. (see page 30 for more details)

°C Uniformity profiles



GHC 12/80/450 ±5°C over 300mm GHC 12/80/600 ±5°C over 440mm

Horizontal Tube Furnaces	GHA 12/300	GHA 12/450	GHA 12/600	GHA 12/750	GHA 12/900	GHA 12/1050	GHA 12/1200
Max. Temperature (°C)	1200	1200	1200	1200	1200	1200	1200
Continuous Temperature (°C)	1100	1100	1100	1100	1100	1100	1100
Heat up time (mins)	90	75	~	~	~	100	~
Maximum o/d of Separate Worktube (to hold sample) (min 20mm)	170	170	170	170	170	170	170
Worktube length:							
heating in air (mm)	500	650	800	950	1100	1250	1400
heating with Atmosphere (mm)	900	1050	1200	1350	1500	1650	1800
Heated Length (mm)	300	450	600	750	900	1050	1200
Overall Furnace length (mm)	480	630	780	930	1080	1230	1380
Horizontal Mounting on Control Box	✓	✓	✓	✓	✓	✓	✓
Thermocouple Type	N	N	N	N	N	N	N
Max Power (W)	2300	3100	3900	4600	5400	6200	7000
Holding Power (W)	~	~	~	~	~	~	~
External Dimensions:							
H (mm)	670	670	670	670	670	670	670
W (mm)	526	676	826	976	1126	1276	1426
D (mm)	468	468	468	468	468	468	468
Weight (kg)	~	36.5	40	51	55	~	~

1) Holding power is measured at 100°C below max. temperature, based on 240V supply, with an empty chamber.
2) Uniformity graphs are available on request, for most models.
3) Heat up time is measured at 100°C below max. temperature with an empty tube.

Showing versatile stand for vertical and/or horizontal use

Showing wall mounting brackets

GVA models

The GVA range of vertical tube furnaces have a maximum operating temperature of 1200°C and a tube diameter ranging from 19.5 to 150mm id. An integral worktube is not fitted as standard, but is needed and therefore a worktube must be ordered separately.

Heating is provided by resistance wire heating elements, semi-embedded in rigidised vacuum formed low thermal mass insulation modules, models are available in seven heated lengths from 300 - 1200mm. These elements give both long life and rapid heat up times to operating temperature. Removable tube adapters are available that allow rapid changes for different size worktubes if required.

All of our tube furnaces can be adapted to allow a non-oxidising atmosphere or vacuum, if required, by fitting an additional worktube and end seals (see page 44 for details).

This furnace range is supplied with a versatile stand kit, which allows the furnace to be mounted vertically on a stand or wall mounted, or bench mounted horizontally (shown left), all using the separate control box

Applications include testing of novel materials under strict temperature & various atmosphere conditions, testing electronic components and semiconductor materials under inert atmospheres or vacuum, testing of temperature sensors such as thermocouples and PT100's, which may require enhanced thermal uniformity, as well as many other applications requiring rapid accurate heat up with the option for an atmosphere.

Vertical Tube Furnaces	GVA 12/300	GVA 12/450	GVA 12/600	GVA 12/750	GVA 12/900	GVA 12/1050	GVA 12/1200
Max. Temperature (°C)	1200	1200	1200	1200	1200	1200	1200
Continuous Temperature (°C)	1100	1100	1100	1100	1100	1100	1100
Maximum o/d of separate worktube (to hold sample) (min 20mm)	170	170	170	170	170	170	170
Separate worktube length required:							
heating in air (mm)	500	650	800	950	1100	1250	1400
heating in atmosphere (mm)	900	1050	1200	1350	1500	1650	1800
Heated length (mm)	300	450	600	750	900	1050	1200
Overall furnace length (mm)	480	630	780	930	1080	1230	1380
Versatile mounting: L stand / Wall bracket	✓	✓	✓	✓	✓	✓	✓
Thermocouple type	N	N	N	N	N	N	N
Max Power (W)	2340	3120	3900	4680	5460	6240	7020
Holding power (W)							
Weight (kg)	~	~	~	50	57	68	~
External Dimensions:							
H (mm)	1345	1418	1418	1793	1860	1943	2018
W (mm)	468	468	468	468	468	468	468
D (mm) Depth includes stand	662	662	662	662	662	662	662
Clearance under furnace:							
min & max (mm)	251-778	177-702	177-550	177-777	100-702	26-627	26-551
V model control box dimensions:							
H x W x D 222 x 570 x 375 (mm)	✓	✓	✓	✓	✓	✓	✓

1) Holding power is measured at 100°C below max. temperature, based on 240V supply, with an empty chamber.
2) Uniformity graphs are available on request, for most models.
3) Heat up time is measured at 100°C below max. temperature with an empty tube.

Split Tube Furnaces

These furnaces are manufactured in two halves and are hinged together for easy loading of a worktube reactor vessel, or large workpiece. The design offers the flexibility to place the furnace around a fixed item - such as a pipe with flanges which are too large to pass through a solid tube furnace, or around a sample which is fixed into a materials test rig.

The HST models are ideally suited for horizontal, bench use, whilst the VST models have the same maximum internal diameter, but smaller external dimensions and are primarily designed to fit within test rigs. The VST models can also be mounted on a stand with either near or far hinge,* wall mounted with a bracket.**

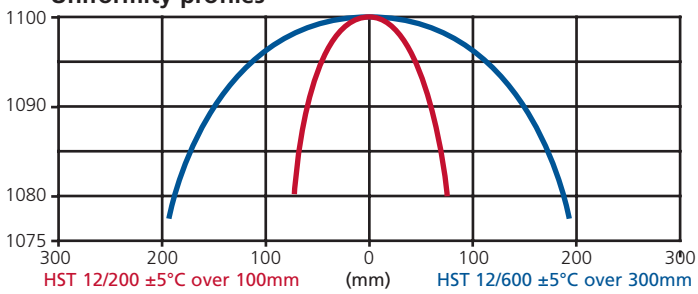
Both models have extended insulation beyond the heated length which provides the opportunity to accept any tube diameter up to 110mm maximum od, by cutting away part of the unheated insulation.

* Far hinges allow much larger openings but take up more room

** Alternatively vertical models can be wall mounted with a bracket

HST 12/70/600

°C Uniformity profiles



Horizontal Split Tube Furnaces	HST 12/200	HST 12/300	HST 12/400	HST 12/600	HST 12/900
Max. Temperature (°C)	1200	1200	1200	1200	1200
Continuous Temperature (°C)	1100	1100	1100	1100	1100
Heat up time (mins)	45	45	45	45	45
Maximum o/d of Separate Worktube (to hold sample) (min 20mm)	110	110	110	110	110
Separate Worktube Length required :					
heating in air (mm)	350	450	550	750	1050
heating with atmosphere	650	750	850	1050	1350
Heated Length (mm)	200	300	400	600	900
Overall Furnace Length (mm)	350	450	550	750	1050
Horizontal Mounting with remote control box	✓	✓	✓	✓	✓
Uniform Length +/-5°C	100	150	200	300	450
Thermocouple Type	N	N	N	N	N
Max. Power (W)	1000	1500	2000	3000	4500
Holding Power (W)	~	~	900	1100	~
External Dimensions:					
H (mm)	350	350	350	350	350
W (mm)	325	425	525	725	1025
D (mm)	410	410	410	410	410
Weight (kg)	26	28	32	38	60
Control Box Dimensions :					
H x W x D 222 x 570 x 375 (mm)	✓	✓	✓	✓	✓

1) Holding power is measured at 100°C below max. temperature, based on 240V supply, with an empty chamber.
2) Uniformity graphs are available on request, for most models.
3) All external dimensions are taken with the chamber closed.
4) Heat up time is measured at 100°C below max. temperature with an empty tube

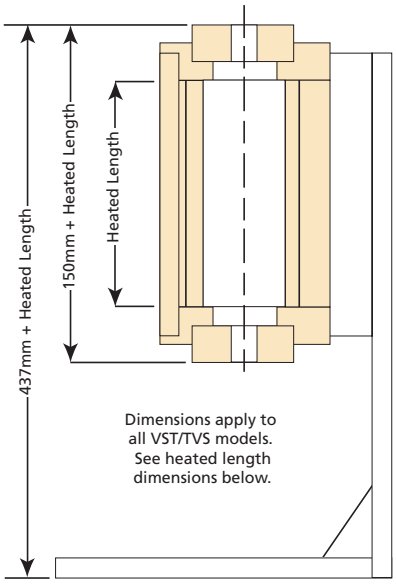
VST 17/250

General Features

Standard vertical hinged tube furnaces are provided with a vertical support stand. Optional far hinge support stand or wall bracket are available if you need a wide opening. (See below)

Wire embedded split tube furnaces ~ single zone	VST 12/200	VST 12/300	VST 12/400	VST 12/600	VST 12/900	VST 17/250
Max. Temperature (°C)	1200	1200	1200	1200	1200	1700
Continuous Temperature (°C)	1100	1100	1100	1100	1100	1600
Heat up time (mins)	45	45	45	45	45	~
Maximum o/d of Separate Worktube (to hold sample) (min 20mm)	110	110	110	110	110	90
Separate Worktube Length required:	500	600	700	900	1200	550
Heating in air (mm)	500	600	700	900	1200	550
Heating with Atmosphere (mm)	800	900	1000	1200	1500	850
Heated Length (mm)	200	300	400	600	900	250
Overall Furnace Length (or width) mm	350	450	550	750	1050	900
Vertical Stand mounted near hinge.						
Optional wall bracket, far hinge, no stand	✓	✓	✓	✓	✓	✓
Thermocouple Type	N	N	N	N	N	B
Max. Power (W)	1000	1500	2000	3000	4500	4500
Holding Power (W)	800	~	900	1100	~	~
External Dimensions:						
H (mm)	300	400	500	700	1000	865
W (mm)	350	350	350	350	350	600
D (mm)	350	350	350	350	350	705
Weight (kg)	24	25	26	32	44	~
Control Box Dimensions : H x W x D 222 x 570 x 375 (mm)	✓	✓	✓	✓	✓	~

1) Holding power is measured at 100°C below max. temperature, based on 240V supply, with an empty chamber.
2) Uniformity graphs are available on request, for most models.
3) All external dimensions are taken with the chamber closed
4) Heat up time is measured at 100°C below max. temperature with an empty tube



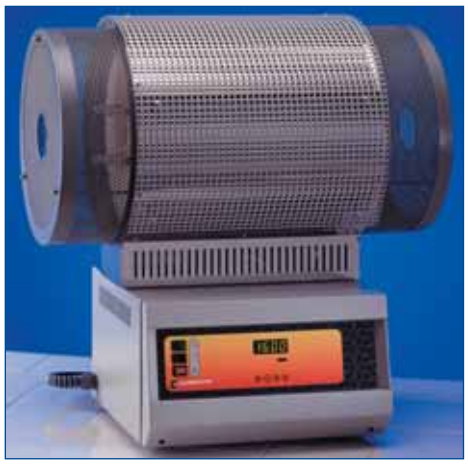
VST / TVS Tube Furnace on Standard Support Stand

High Temperature Tube Furnaces

The 1500°C and 1600°C tube furnace ranges utilise silicon carbide (SiC) heating elements arranged in a heated chamber surrounding the work tube, and provide even heating of the tube surface for maximum temperature uniformity. SiC furnaces can be mounted for use horizontally or vertically with an optional "L stand" please enquire for details.

High temperature furnaces ~ single zone	**STF 15/180**	**STF 15/450**	**STF 15/610**	**STF 16/180**	**STF 16/450**	**STF 16/610**
Max. Temperature (°C)	1500	1500	1500	1600	1600	1600
Continuous Temperature (°C)	1400	1400	1400	1500	1500	1500
Heat up Time (mins)			heat up rate will vary			
Maximum o/d of Separate Worktube	60	90	90	60	90	90
Inside Diameter of fixed element tube (mm)	~	~	~	~	~	~
Heated Length (mm)	180	450	610	180	450	610
Overall Furnace Length (or width) (mm)	600	900	1200	600	900	1200
Horizontal Mounting on Control Box	✓	✓	✓	✓	✓	✓
Option of Mounting:						
L stand / Wall bracket / Blank base / Separated base	✓	✓	✓	✓	✓	✓
Vertical mounting with remote control box as standard	✘	✘	✘	✘	✘	✘
Uniform Length +/-5 (°C) (a)(d)	80	350	400	80	350	400
Thermocouple Type	R	R	R	R	R	R
Maximum Power Requirement (W)	1500	5500	6000	2500	6000	7000
Holding Power (W)	~	3800	4200	~	4000	4500
External Dimensions:						
H (mm)	500	660	660	500	660	660
W (mm)	600	830	1130	600	830	1130
D (mm)	375	445	445	375	445	445
Weight (kg)	29	34	45	29	40	50

1) Holding power is measured at 100°C below max. temperature, based on 240V supply, with an empty chamber.
2) Uniformity graphs are available on request, for most models.
3) Heat up time is measured at 100°C below max. temperature with an empty tube.



STF 15/180/301

STF 15/610/3216P1 with vertical option L stand

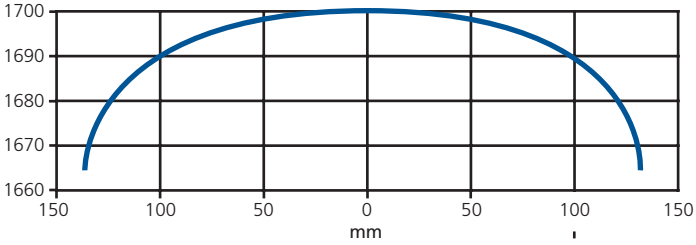
CTF 17/75/300/3216P1

CTF 1700°C and 1800°C tube furnaces use molybdenum disilicide ($MoSi_2$) heating elements suspended down each side of a horizontal tube. At elevated temperatures these heating elements become very soft and therefore this furnace is only suitable for horizontal use.

PVT 1800°C tube furnaces use lanthanum chromite heating elements, which generally achieve slower heating rates. These furnaces are for use in the vertical position only, and the elements are suspended around a vertical tube. Although the elements give off a small amount of chromium vapour the work tube shields all but the most sensitive work pieces from contamination or pink colouration.

Three zone versions are available which give improved uniform length with three zone control (see pages 35, 36 and 37).

°C Uniformity profile



CTF 17/75/300 ±5°C over 205mm
±2°C over 150mm
±1°C over 75mm

High temperature furnaces ~ single zone	CTF 17/300	CTF 17/600	CTF 18/300	CTF 18/600	PVT 18/50 /200	PVT 18/75 /350	PVT 18/100 /350	PVT 18/125 /350
Max. Temperature (°C)	1700	1700	1800	1800	1800	1800	1800	1800
Continuous Temperature (°C)	1600	1600	1700	1700	1700	1700	1700	1700
Heat up time (mins)			heat up rate will vary					
Maximum o/d of separate worktube	90	90	90	90	60	90	115	140
Heated Length (mm)	300	600	300	600	200	350	350	350
Overall Furnace Length (mm)	650	950	650	950	~	~	~	~
Horizontal Mounting on Control Box	✓	✓	✓	✓	✘	✘	✘	✘
Option of Mounting: L stand / Wall Bracket / Blank base / Separated base	✘	✘	✘	✘	✘	✘	✘	✘
Vertical Mounting with Remote Control Box as standard	✘	✘	✘	✘	✓	✓	✓	✓
Uniform length +/-5 (°C)	200	400	200	400	~	~	~	~
Thermocouple Type	B	B	2	2	2	2	2	2
Maximum Power (W)	5500	9000	6000	9300	6000	8000	8000	12000
Holding Power Requirement W	2500	3800	~	~	4000	5000	5000	7000
External Dimensions:								
H (mm)	755	900	755	755	850	1000	1000	1000
W (mm)	600	950	600	900	700	700	700	700
D (mm)	555	630	555	555	810	810	810	810
Weight (kg)	126	220	130	230	270	300	400	500

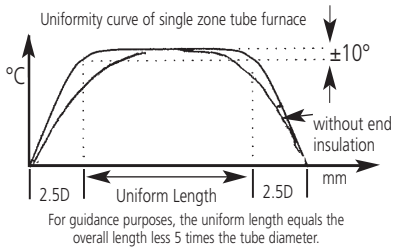
1) Holding power is measured at 100°C below max. temperature, based on 240V supply, with an empty chamber.
2) Uniformity graphs are available on request, for most models.
3) Heat up time is measured at 100°C below max. temperature with an empty tube.

Three Zone Tube Furnace

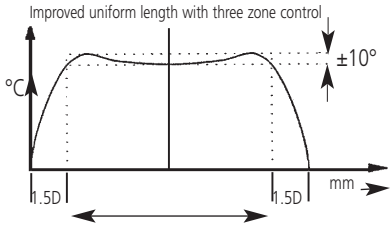
Similar in construction to the CTF and MTF models, the TZF offers excellent temperature uniformity as the heated length is divided into three zones, each with its own temperature controller and thermocouple. The power supplied to the end zones is automatically adjusted to compensate for the heat loss at the ends of the tube irrespective of whether the ends are left open or have insulation plugs fitted. This system provides a longer uniform zone temperature than that achieved by using a single zone furnace of the same length. The three temperature controller thermocouples are linked "back to back" so that they act to keep all three zones at the same temperature.

TZF 12/75/700/3216P1

Uniformity profiles

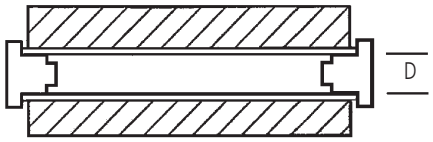


For guidance purposes, the uniform length equals the overall length less 5 times the tube diameter.



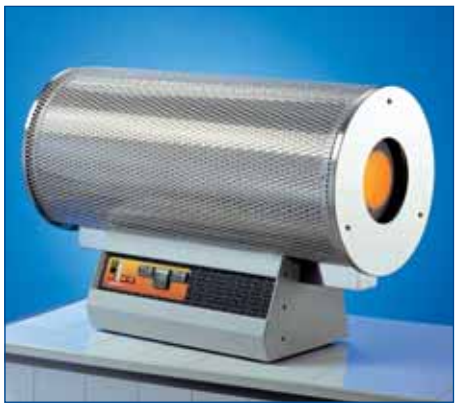
For guidance purposes, the uniform length equals the overall length less 3 times the tube diameter.

Tube furnace cross section



Wire wound tube furnaces ~ three zone	TZF12/38/400	TZF12/65/550	TZF12/75/700	TZF12/100/900
Max. Temperature (°C)	1200	1200	1200	1200
Continuous Temperature (°C)	1100	1100	1100	1100
Heat up Time (mins)	25	45	45	120
Inside Diameter of fixed element tube (mm)	38	65	75	100
Heated length (mm)	400	550	700	900
Overall Furnace Length (mm)	450	600	750	950
Horizontal Mounting on control box	✓	✓	✓	✓
Option of Mounting:				
L stand / Wall bracket / Blank base / Separated base	✓	✓	✓	✓
Uniform Length +/-5 (°C)	305	390	540	745
Thermocouple Type	N	N	N	N
Max. Power (W)	1175	1817	2755	4150
Holding Power (W)	700	600	800	1000
External Dimensions:				
H (mm)	430	525	525	525
W (mm)	450	625	775	975
D (mm)	375	360	360	360
Weight (kg)	18	30	32	4

1) Holding power is measured at 100°C below max. temperature, based on 240V supply, with an empty chamber
2) Uniformity graphs are available on request, for most models.
3) Heat up time is measured at 100°C below max. temperature with an empty tube.



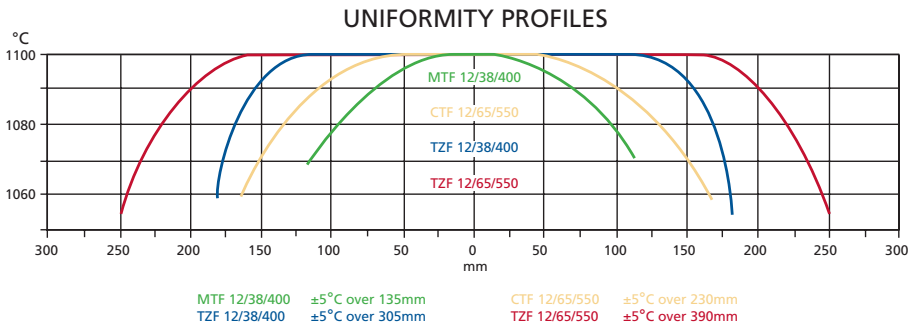


Table shows horizontal options

Wire embedded tube furnaces ~ three zone	GHC 12/450	GHC 12/600	GHC 12/750	GHC 12/900	GHC 12/1050	GHC 12/1200	HZS 12/600	HZS 12/900
Max.Temperature (°C)	1200	1200	1200	1200	1200	1200	1200	1200
Continuous Temperature (°C)	1100	1100	1100	1100	1100	1100	1100	1100
Heat up time (mins)	50	100	115	95	100	~		
Maximum o/d of Separate Worktube (to hold sample) (min 20mm)	170	170	170	170	170	170	110	110
Separate Worktube Length Required:								
heating in air (mm)	750	900	1050	1200	1350	1500	900	1200
heating with atmosphere (mm)	1050	1200	1350	1500	1650	1800	1200	1500
Heated Length (mm)	450	600	750	900	1050	1200	600	900
Overall Furnace Length (mm)	630	780	930	1080	1230	1380	750	1050
Horizontal Mounting on control box	✓	✓	✓	✓	✓	✓	✓	✓
Uniform length +/-5 (°C)	300	440	500	640	880	~	500	750
Thermocouple Type	N	N	N	N	N	N	N	N
Max .Power (W)	3100	3900	4600	5400	6200	7000	3000	4500
Holding Power (W)	1500	1800	2200	2800	2800	3100	~	1100
External Dimensions:								
H (mm)	672	672	672	672	672	672	350	350
W (mm)	676	827	976	1126	1276	1426	725	1050
D (mm)	468	468	468	468	468	468	410	410
Weight (kg)	6.5	40	51	55	~	~	40	65

1) Holding power is measured at 100°C below max. temperature, based on 240V supply, with an empty chamber.
2) Uniformity graphs are available on request, for most models.
3) Heat up time is measured at 100°C below max. temperature with an empty tube.

Table shows vertical options

Wire embedded tube furnaces ~ three zone	**GVC 12/450**	**GVC 12/600**	**GVC 12/750**	**GVC 12/900**	**GVC 12/1050**	**GVC 12/1200**	**TVS 12/600**	**TVS 12/900**
Max. Temperature (°C)	1200	1200	1200	1200	1200	1200	1200	1200
Continuous Temperature (°C)	1100	1100	1100	1100	1100	1100	1100	1100
Heat up time (mins)	75	80	92	111	122	81		
Maximum o/d of separate worktube	170	170	170	170	170	170	110	110
Separate worktube length required:								
Heating in air (mm)	750	900	1050	1200	1350	1500	900	1200
Heating with atmosphere (mm)	1050	1200	1350	1500	1650	1800	750	1050
Heated Length (mm)	450	600	750	900	1050	1200	600	900
Overall furnace Length (mm)	630	780	930	1080	1230	1380	750	1050
Versatile mounting:								
L stand / Wall bracket	✓	✓	✓	✓	✓	✓	✓	
Uniform length +/-5 (°C)	300	440	500	640	880	~	500	750
Thermocouple Type	N	N	N	N	N	N	N	N
Max Power (W)	3100	3900	4600	5400	6200	7000	3000	4500
Holding Power (W)	1500	1800	2200	2800	2800	3100		
H model (kg)	~	~	50	57	68	~	34	46
V model external dimensions:								
Height of stand to top of furnace								
H (mm)	1418	1418	1793	1860	1943	2018	700	1000
W (mm)	468	468	468	468	468	468	350	350
D (mm) Depth Includes stand	662	662	662	662	662	662	350	350
Weight (kg)	~	~	50	57	68	~	34	44
Clearance under furnace min & max (mm)	177-702	177-550	177-777	100-702	26-627	26-551		
V model control box dimensions:								
H x W x D 222 x 570 x 375 (mm)	✓	✓	✓	✓	✓	✓		

High temperature furnaces ~ three zone	**TZF15/610**	**TZF16/610**	**TZF17/600**	**TZF18/600**
Max. Temperature (°C)	1500	1600	1700	1800
Continuous Temperature (°C)	1400	1500	1600	1700
Heat up Time (mins)	75	~	150	150
Maximum o/d of separate worktube	90	90	90	90
Heated Length (mm)	610	610	600	600
Overall Furnace Length (mm)	1200	1200	950	950
Horizontal mounting on control box	✓	✓	✓	✓
Uniform Length +/-5 (°C)	450	450	500	500
Thermocouple Type	R	R	B	2
Max. Power (W}	8000	9000	9000	1000
External Dimensions:				
H (mm)	660	660	900	945
W (mm)	1130	1130	950	1020
D (mm)	445	445	630	740
Weight (kg)	44	44	180	200

1) Holding power is measured at 100°C below max. temperature, based on 240V supply, with an empty chamber.
2) Uniformity graphs are available on request, for most models.
3) Heat up time is measured at 100°C below max. temperature with an empty tube.

HVT 12/60/700

Vacuum Tube Furnaces

This range of 1200°C and 1500°C horizontal vacuum tube furnaces, offers vacuum levels of better than 10^{-5} mbar with a clean empty worktube.

The vacuum system and all controls are housed in the base with one end of the worktube joined to the vacuum system via a stainless steel radiused bend. Access to the tube is via the other end which is fitted with a removable stainless steel flange. Radiation shields are provided for both ends of the furnace to ensure maximum temperature uniformity with minimum loss of pumping speed.

These furnaces include two stage sliding vane rotary pump, water cooled oil diffusion pump, high vacuum baffle valve, roughing/backing valve(s) and Pirani and Penning gauges.

A number of special options is available including gas systems, automatic/semi-automatic vacuum systems, air cooled diffusion pump, cooling water failure alarm, special vertical and custom built designs.

Model	HVT 12/50/550	HVT 12/60/700	HVT 12/80/700	HVT 15/50/450	HVT 15/75/450
Max. Temperature (°C)	1200	1200	1200	1500	1500
Continuous Temperature (°C)	1100	1100	1100	1400	1400
Tube Inside Diameter (mm)	50	60	80	50	75
Heated Length (mm)	550	700	700	450	450
Max. Power (W)	2000	3000	3500	5500	5500
Holding Power (W)	1600	1800	2800	4800	4800
External Dimensions:					
H (mm)	1450	1450	1450	1565	1565
W (mm)	1700	1700	1700	1700	1700
D (mm)	600	600	600	600	600

1) Holding power is measured at 100°C below max. temperature, based on 240V supply, with an empty chamber.
2) Uniformity graphs are available on request, for most models.
3) Heat up time is measured at 100°C below max. temperature with an empty tube.
4) Extra information on Uniformity and heat up rate is available on request, due to information varying with application

Rotary Reactor Furnace

The Carbolite Rotary Reactor Furnace was developed by the Imperial College of Science and Technology, London and is designed for laboratory scale calcination and the production of high temperature reactions in a wide range of materials.

The Rotary Reactor combines all the advantages of the flo-solid (fluidised bed) furnace and the rotary kiln by providing both a controlled atmosphere and simultaneous agitation of powdered solids. Additionally, the unit overcomes the problem of long reaction times experienced by combustion in a muffle furnace or under flowing gases in a static tube.

Although originally designed for calcining colliery spoils at temperatures up to 1000°C, other applications include:

- calcining arsenical gold ores under neutral and oxidising atmospheres to remove sulphur and arsenic;
- analysis of sulphur in ores and metallurgical slags;
- as a low temperature rotary vacuum drier to remove organic solvent from oxide pigment materials;
- roasting sulphide ores to convert them to oxides;
- determination of silica content of rice husks;
- low temperature calcination of limestone and dolomite.

General Features

The latest PID microprocessor digital control system is incorporated, while stepped heating can be achieved by the use of an eight or twenty segment programmer. For maximum heat transfer and excellent temperature uniformity, high quality resistance wire elements are used. A positive break switch isolates power to the long-life resistance wire elements whenever the heating chamber is open. A removable exhaust box is provided for occasional cleaning and removal of condensates.

The oscillating fused silica reaction tube is fluted on the internal surface to ensure good mixing and uniform exposure of the particles to the atmosphere. The material is heated by radiation through the silica tube and the smooth internal profile allows easy loading, unloading and cleaning with minimal powder loss. Oscillation of the reaction tube is provided by an electric motor with variable speed control. Gas tight connections ensure the vessel is sealed.

An adjustable gas flowmeter with a 30mm scale, calibrated for N^2, is supplied as standard. Single or multiple flowmeters for different gases are available as options. The hinged heated chamber design allows easy access for removal and insertion of the quartz vessel. Atmosphere enters the quartz vessel through a flexible silicon rubber tube. The outlet end of the quartz vessel extends into a stainless steel exhaust box. A single gasket seal surrounding the quartz tube prevents atmosphere leakage. A gas outlet port in the exhaust box may be piped to an extraction system.

A wide range of microprocessor based temperature controllers and programmers is available.

Model	HTR11/75	HTR11/150
Max.Temperature (°C)	1100	1100
Internal vessel Dimensions	dia 75 x 100	dia 150 x 200
Internal vessel Capacity grams	120	950
Max capacity (ml)	50	700
Oscillation Frequency per min	1 to 8	1 to 8
Rotation angle in each direction	315°	315°
Heat up time (mins)(a)(b) without charge or gas flow	11	21
Cooling Time from 1000°C to 300°C with lid open (mins)	15	15
Thermocouple Type	K	K
Max. Power (W)	1500	3000
Holding Power (W)	400	1000
External Dimensions:		
lid position down:		
H (mm)	480	540
W (mm)	1140	1300
D (mm)	550	690
lid position up:		
H (mm)	800	950
W (mm)	1140	1300
D (mm)	680	900
Weight (kg)	40	95

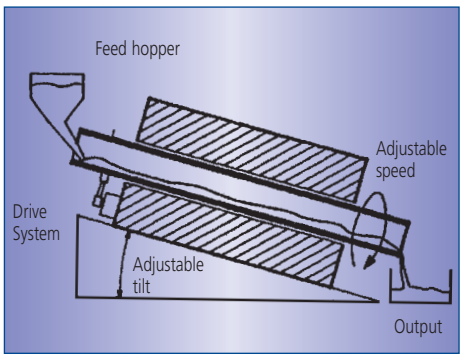


Illustration of rotating tube furnace operation

Rotating Tube Furnace

This type of furnace allows powders to be heated and agitated inside a tube by using a rotating drive system. This ensures that all the powder is exposed to the atmosphere and provides laboratory scale simulation of industrial rotary calcining kilns.

Standard tube furnaces can be fitted with various options, including plain tubes in ceramic, quartz or heat resisting metal alloys, shaped vessels in metal or quartz incorporating agitation blades. The design includes a 0-5° tilting mechanism to control the throughput and can be fitted with vibration or screw inlet mechanisms, and output hoppers for continuous operation. Variable speed drives of 1-10rpm and atmosphere control systems are also available.

Based on standard furnaces CTF 12/75/700 or CTF 12/100/900, and STF 15 or 16/610.

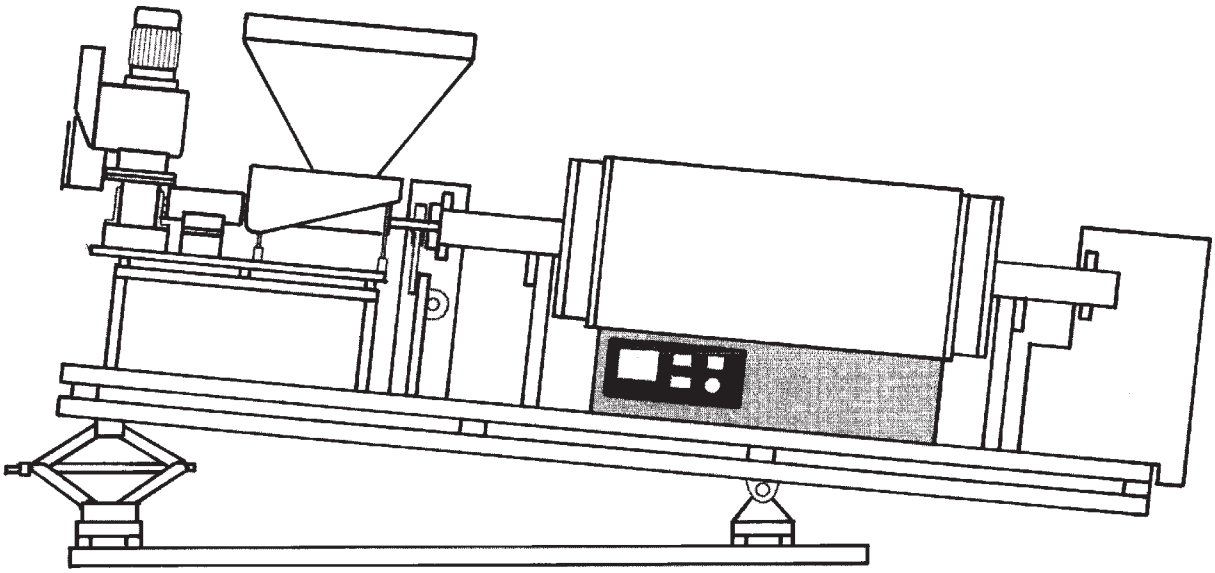


Illustration shows a standard tube furnace with rotating tube furnace accessories

Portable Thermocouple Calibration Furnace PTC12/20

The Portable Thermocouple calibrator is a high stability heat source designed for the calibration of thermocouples up to Ø7.5 mm, with a maximum operating temperature of 1200°C.

Thermocouples are inserted into the worktube through an insulation plug and can be compared with the temperature indicator.

It is portable and self contained, with built in PID microprocessor controller and separate digital temperature indicator giving 1°C resolution.

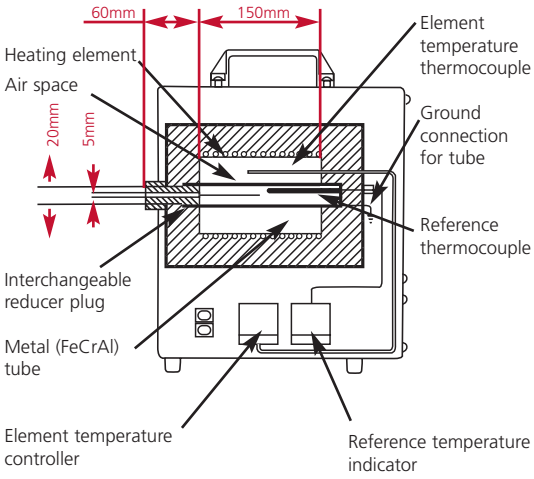
The special worktube design results in a much higher temperature uniformity than is normally associated with a furnace of this size.

The metallic work tube is earthed for operator safety when used with metal sheathed mineral insulated thermocouples.

The PTC 12/20 can be used in a laboratory or in site as its rapid heat up and stabilisation make it ideal for quick set up.

PTC 12/20

1200°C Portable Thermocouple Calibration Furnace **Model**	**PTC 12/20**
Max. Temperature (°C)	1200
Continuous Temperature (°C)	1150
Temperature Range (°C)	400 - 1200
Stability	Better than +1°C
Overall Dimensions:	
H (mm)	399
W (mm)	310
D (mm)	225
Heated Length (mm)	150
Controller	Eurotherm 2132
Indicator	Eurotherm 2132
Heating Rate	20 mins (to 1150°C)
Cavity Diameter (mm)	20
Weight (kg)	8.8
Furnace Voltage	120/240 externally selectable
Max .Power (W)	1100
Thermocouple type	N



A Carbolite calibration certificate stating temperature error between work space temperature and indicated temperature, at 700°C, 900°C & 1100°C is provided as standard.
A NAMAS traceable calibration certificate is available for customer specified set points (as an optional extra). Price on Application.
A NAMAS traceable thermocouple is available and can be used for the customer to calibrate the unit at specified time intervals.

1) Holding power is measured at 100°C below max. temperature, based on 240V supply, with an empty chamber.
2) Uniformity graphs are available on request.
3) Heat up time is measured at 100°C below max. temperature with an empty chamber.

AGD 12

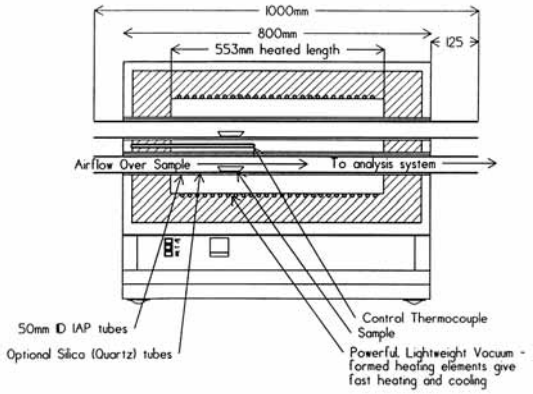
Acid Gas Determinator

Designed for the combustion of electrical cable insulation BS 6425: Part 1 and 2 1990

In this test, cable samples are heated within a worktube at a programmed rate of rise; four samples can be processed simultaneously. A small flow of air is passed over the samples and then collected and analysed for acidity.

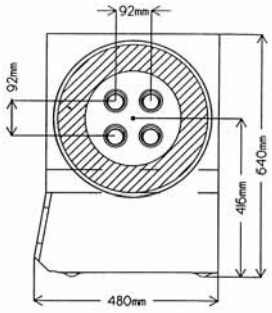
Features:

- Four tube design offers increased working capacity
- Powerful elements provide 1200°C maximum temperature and fast heating - greater than 20°C/minute to 1000°C
- Low thermal mass insulation allows fast cooling between tests
- Digital temperature control offers precise setting of temperature, repeatability and stability. The rate of rise of temperature and maximum temperature can be pre-set. A programmer is available to give automatic cooling after the timed hold at maximum temperature, as an option.



Model	AGD 12/4
Max. Temperature (°C)	1200
Furnace Tubes (included)	Four IAP tubes 50 x 60 x 800mm, arranged 2 above 2
Inner Tubes (optional)	Four clear fused silica (SiO_2) tubes 41 x 45 x 1000mm (Note: silica tends to devitrify when used above 1000°C)
Heated Length (mm)	550
Heating Rate	Less than 40 minutes to 800°C (better than 20°C/min to 1000°C)
Temperature Uniformity	The temperatures at the centre of each of the four silica tubes will be within ±5°C of each other over a 300mm length, with no gas flow (BS 6425 requires ±17.5°C over 300mm with a small gas flow)
Heating Elements	Resistance wire spirals embedded in the inner surface of vacuum formed ceramic fibre cylinders
Thermocouple Type	N
Power Control	Solid state relay incorporating zero voltage switching
Power Supply	220/240V, 50/60Hz, single phase, 20 amp
External Dimensions	640mm (h) x 800mm (w) x 480mm (d) excluding tubes

1) Uniformity graphs are available on request, for most models.
2) Heat up time is measured at 100°C below max. temperature with an empty chamber.



Cupellation furnaces

For the assay of precious metals

The assay of gold alloys by cupellation is the standard method used by the United Kingdom Assay Offices and a reference method laid down by the International Hallmarking Convention.

The range of batch furnaces from Carbolite has gained an international reputation for close temperature uniformity, low heat loss and maximum fume control.

The outer case is fabricated from zinc coated steel sheet which is finished with an easy to clean hard wearing stoved epoxy/polyester coating. The work chamber, roof and hearth are lined with silicon carbide tiles which will withstand the corrosive lead fumes emitted during the process. Double skin construction ensures a safe and cool outer case temperature

Silicon carbide heating elements are mounted above and below the work chamber providing even heating of the cupels. Silicon carbide elements offer high resistance to thermal shock and offer an extended working life at elevated temperatures.

The combination of low thermal mass ceramic fibre and hard wearing refractories provides maximum thermal efficiency.

The insulated door, with observation hole, operates with a vertical counterbalanced action keeping the hot door insulation away from the operator. A positive break safety switch activates isolation of the elements from all power lines when the door is opened.

The air, which is controlled by an adjustable valve at the rear of the furnace, is preheated by passing over the lower elements prior to entering the chamber. This ensures rapid heat transfer and even temperature distribution throughout the work chamber.

Fumes are extracted through an insulated exhaust duct and a removable container, situated below the chimney, collects any condensed lead. The furnace should be positioned beneath an efficient extraction system preferably fitted with a proprietary lead filter.

The furnace temperature is regulated by a three term microprocessor based controller which provides temperature stability of ±1°C. A back up two term overtemperature controller protects the heating elements and furnace load. A 24 hour, 7 day time switch is fitted as standard.

Model	CF 15	CF 24	CF 50	CF 60
Type	Bench mounted	Floor standing	Floor standing	Floor standing
Max. Temperature (°C)	1200	1200	1200	1200
Continuous Temperature (°C)	1200	1200	1200	1200
Thermocouple Type		Pt/Pt 13% Rh Type R thermocouple		
Maximum Power Rating (W)	9000	14500	20000	31000
Chamber Dimensions:				
H (mm)	125	205	230	250
W (mm)	220	255	350	400
D (mm)	350	460	540	650
External Dimensions*:				
H (mm)	1050	2110	2100	2100
W (mm)	950	1050	1150	1200
D (mm)	950	1070	1100	1200
Power supply required		380/415V, 50Hz, 3 phase + neutral supply Other voltages available on request, please ask for details		

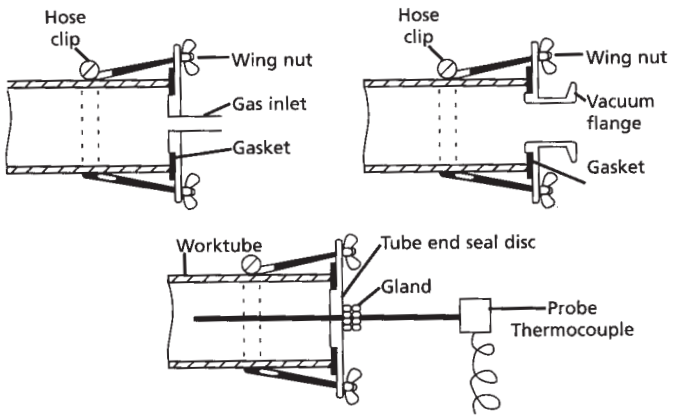
* Please note that the CF15 model has a separate control box, which is additional to these measurements.

1) Uniformity graphs are available on request, for most models.
2) All external dimensions are taken with the door closed and include a chimney.
3) Heat up time is measured at 100°C below max. temperature with an empty chamber.

Work Tube Accessories

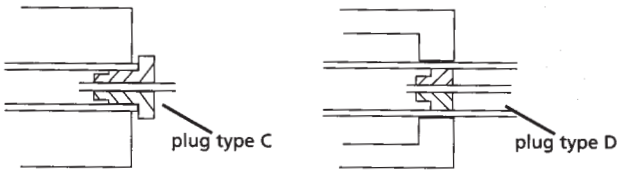
Gas Tight End Seals

Gas tight end seals provide a convenient method of sealing each end of an open end process tube. Each end seal is fitted with a 6mm hose connection for gas inlet or outlet. Optional vacuum flanges and glands for probe thermocouples can also be installed in the end seals. Gas tight end seals are appropriate for tube diameters of 15mm or larger. Standard end seals are suitable for vacuums to 10^{-3} mbar. For higher vacuums to 10^{-5} mbar, a double flange end seal design is available. (Contact Carbolite).



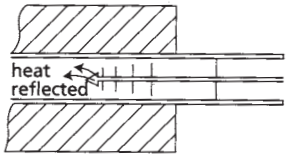
Insulating Plugs

Ceramic fibre insulating plugs installed near the ends of process tubes reduce heat losses and improve uniformity. Type C insulating plugs are designed for applications when processing will be done under air, and are suitable for use with tubes of 15mm ID and larger. Type D insulating plugs are normally used in conjunction with gas tight end seals when processing is carried out under an atmosphere. Suitable for use with tubes of 25mm ID and larger.



Radiation Shields

Radiation shields are typically used for applications where ceramic fibre plugs are unsuitable, e.g. where a high purity atmosphere or vacuum is required. Normally used in conjunction with gas tight end seals when processing is carried out under atmosphere. Suitable for use with tubes or 25mm ID and larger. Radiation shields designed for operating temperatures up to 1200°C are fabricated of inconel, and above 1200°C, are fabricated of alumina.



Process Tubes

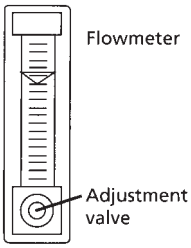
Carbolite offers multiple diameters and lengths of process tubes suitable for use with Carbolite or other manufacturer tube furnaces. Impervious aliminous porcelain (IAP), mulite, recrystalised alumina (RCA), metalic (APM), sillimanite and silica.

Gas Control Options

Contact Carbolite regarding application questions, and for detailed description, specifications and pricing of all gas control options.

Gas Flowmeters

Multiple gas flowmeters with a standard scale length of 100mm (3% accuracy) with needle valve are available for use with gas inlets and retorts. A mounting bracket is included.



Inert Gas Inlet

See description under Chamber Furnace Options. (See page 45)

Solenoid Valves

An electric valve used to start and stop a gas flow may be activated manually by a panel mounted switch, or automatically through a program segment output or temperature alarm relay.

Atmosphere Control System

Recommended when hydrogen gas is required for processing. Provides greater safety and convenience in control of hydrogen and nitrogen purge gas. Protects H^2 introduction at low temperatures, provides a monitored burn-off pilot flame, and senses failure of the gas supplies. Includes H^2 and N^2 flowmeters and is provided in a separate cabinet. Suitable for use with chamber furnace Type A105 atmosphere retorts or gas tight tubes installed in tube furnaces. Uses a pressure system. For mass flow system, please contact Carbolite.

Temperature Measurement Options

Contact Carbolite regarding application questions, and for detailed descriptions, specifications and pricing of all temperature measurement options.

Temperature Indicator

A digital temperature indicator is built into the furnace control panel and wired to a panel mounted thermocouple socket. Intended for use with a probe thermocouple. Also available in a separate stand alone cabinet, so it can be used as a portable temperature checker.

Chamber Furnace Options

Contact Carbolite regarding application questions, and for detailed descriptions, specifications, and pricing of all chamber furnace options.

Access and/or Viewing Port

A 25mm diameter hole is placed through the furnace door. Optionally select an open hole with a stainless steel cover disc that pivots, or a quartz window that is permanently fitted in the hole.

Additional Thermocouple

An additional thermocouple, similar to the control thermocouple, is built into the furnace and connected to a thermocouple socket. This TC socket is mounted in the furnace control panel. Typically used by the customer for connection to a recorder or other temperature measurement device.

Thermocouple Calibration Port

An additional thermocouple ceramic sheath is installed adjacent to the control thermocouple and accessed through the back of the furnace. Allows insertion of a customer's reference thermocouple for checking or calibration of the existing controller/thermocouple system.

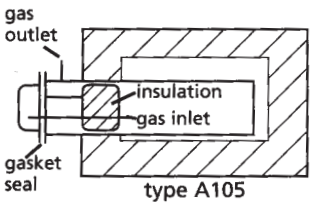
Inert Gas Inlet

A 6mm hose connection, usually on the side of the furnace is connected to a ceramic tube that extends into the chamber. This option is suitable only for inert gases or oxygen.

NOTE: Carbolite chamber furnaces are not gas tight. Gas introduction may affect the furnace heating characteristics and/or the performance of some heating elements. (Contact Carbolite with questions).

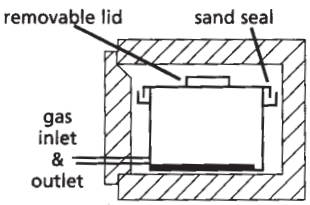
Atmosphere Retorts (1100°C)

Gas tight inconel enclosures designed specifically to fit in standard Carbolite chamber furnaces. Type A105 style retort is designed with easily removable insulated front plug door. Gas inlet and outlet pipes are accessible near the front of retort. The normal furnace door mechanism is retained for use when the retort is removed.



type A105

Type A107 style retorts are similar to a pack carburising box using a sand seal between the deep base and shallow removable lid. Gas inlet and outlet pipes extend from the front of the retort through slots in the furnace door.



type A107

Tube Furnace Options

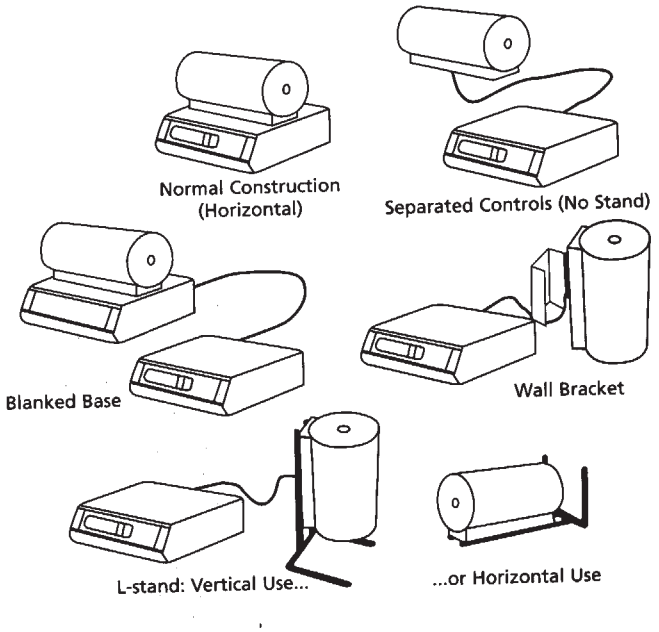
Contact Carbolite regarding application questions, and for detailed descriptions, specifications, and pricing of all tube furnace options.

Special Size Tube Furnaces

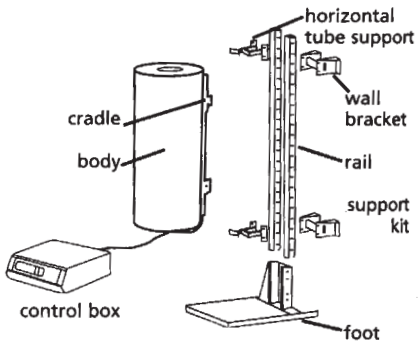
MTF, CTF & TZF wirewound tube furnaces, HST, HZS, VST & TVS split-hinge tube furnaces and GHA & GHC large bore tube furnaces can be provided with special heated and/or zone lengths. Wirewound tube furnaces can also be provided with special diameter work tubes.

Mounting Options

Non-split tube furnaces such as the MTF, CTF and STF, and the matching TZF models are supplied as standard for horizontal use. Alternate mounting options are available as depicted in the sketches.



Large bore "G" style tube furnaces are normally provided for horizontal operation as shown in the photo on page 29 Alternatively, these tube furnaces can be provided for vertical operation. See adjacent sketch.



G range - versatile
No Stand: control box with body & cradle only
No Foot: everything except the foot

Thermocouple Probes

Normally used to monitor temperatures in tube furnaces. Semi-flexible metal sheathed mineral insulated Type K and Type N thermocouples are available in 600mm and 1000mm lengths in 1.5mm and 3.0mm diameters. Type R, B and Pt 20% Rh/Pt 40% Rh thermocouples are available in 550mm, 700mm and 850mm lengths. Because these thermocouples are very fragile, it is recommended that the thermocouple be combined with an optional 10mm diameter alumina protection sheath. Each probe thermocouple is fitted with 1m or 2m of compensating leadwire and plug.

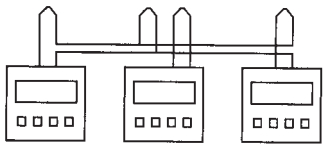
Chart & Data Acquisition Recorders

Carbolite can offer both chart and Data Acquisition Recorders in single and multiple channel models. Assorted optional features are available with all recorders. The recorder is mounted in the furnace control panel when space permits, or alternatively in a separate cabinet.

Control System Options

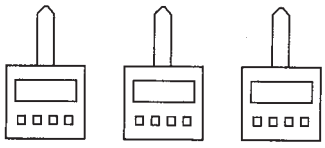
Three Zone Controls

The usual purpose of a three zone furnace and control system is to provide a longer uniform working zone within the furnace. Carbolite's standard three zone control system is a back-to-back thermo-couple system with slave end zone controls.



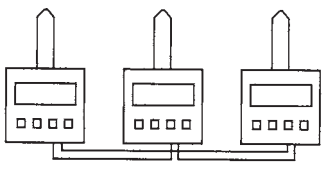
back-to-back

An alternate three zone control system is to provide three totally independent temperature controllers tied directly to individual thermocouples positioned in each zone of the furnace. This is a no charge option.



independent

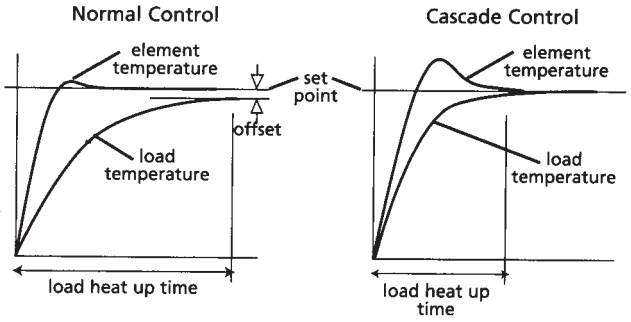
When controlled programmed cooling is a critical requirement in your program, the Retransmission of Setpoint Option must be ordered. Unfortunately , a disadvantage of a programmable three zone system with slave end zones is its inability to effectively cool at a programmed rate.



setpoint retransmission

Cascade Control

This control system adds a second thermocouple and controller to the furnace. The additional thermocouple is placed close to the load and connected to the primary controller (load control). The other thermocouple senses the temperature near the heating elements and is connected to the second controller (element control). The Cascade Control System allows you to heat the furnace load at a faster rate and control it more precisely than the conventional one controller one thermocouple temperature control system. Cascade control is not available with the 301 controller.



Digital Communications

Optionally select RS232 or RS485 digital communications. RS232 permits a single controller to communicate with a computer. RS485 permits multiple controllers to communicate with a computer through "daisy chaining" of the instruments. Digital communications is wired to panel mounted sub-miniature "D" socket on rear of furnace.

RS232/485 converter allows connection of furnace control system with RS485 to PC fitted with RS232.

RS232 and RS485 cables are available for connection between furnace and PC, as well as cable to "daisy chain" several furnaces together when operating with a RS485 connection.

Separate Controls

Where controls are normally built in, an additional control box is supplied, and a blank panel is fitted to the furnace base. This option should be selected when you want the power and temperature controls remotely positioned from the furnace location.

The following controllers and programmers are offered.

301

A PID controller with a large display mounted behind a smooth wipe-clean membrane. It has a single ramp to setpoint facility, and incorporates a process timer function. RS232 comms is available as an option at time of order.

Made by Eurotherm exclusively for Carbolite.

3216P1

An 8 segment-pair programmer, in which each segment pair is a ramp followed by a dwell (the dwell can be of zero time).

RS232 or RS485 comms may be fitted as an option.

This programmer is specially made by Eurotherm for Carbolite.

3216P5

Like the 3216P1, except that 5 different programs may be stored for later retrieval. The programs cannot be linked. Also specially made for Carbolite.

3508P1

The 3508 range comprises enhanced programmers with more display information, and other additional features.

The P1 version has a single program with 20 segments each of which may be a ramp, a step, or a dwell.

RS232 or RS485 comms may be fitted as an option.

3508P10 & 3508P25

These versions are like the 3508P1, but have 10 programs with a total of 50* available segments, and 25 programs with 100*, respectively. For example a single program of 50 segments could be created. The programs may be linked.

* the numbers of segments in the multi-program models is to be increased at some time in 2005.

2132

This is fitted as the basic controller option in certain models where the 301 would be too large. It is a PID controller with ramp-to-setpoint, and a process timer facility.

The 2132 also has uses as an overtemperature controller and as an end-zone controller for tube furnaces.

Cascade Control

The standard control system senses the temperature close to the heating elements: the temperature of the load is usually slightly lower. To correct this a second controller can be added: one senses the load, the other the elements. The load controller sends signals to the element controller, which adjusts the element temperature accordingly. Faster warm up is achieved by boosting the element temperature when the load is cold, and by reducing it as the load approaches the desired temperature.

For cascade control the main controller must be one of the 3508 models. The secondary (element) controller usually fitted is the 3216CC, a non-programmer version from the 3216 range.

Overtemperature Protection

An independent overtemperature protection system is often justifiable to protect expensive heating elements or valuable furnace contents. When ordered with 301 we supply a unit integrated into the main controller but with an independent control circuit. When ordered with other controllers we fit a separate Eurotherm 2132 24x48mm digital controller.

The additional control unit uses a separate thermocouple and operates a contactor to shut down the furnace in the event of the set temperature being exceeded. The adjustability of the limiting temperature means that the system may be set to protect either the furnace itself or, at a lower temperature, the valuable load inside.

Furnaces without Controls

Because each furnace is tested individually, requiring a controller to be configured, fitted and removed, the full saving of omitting a controller cannot be passed on to the customer. Because the controller setting and performance is critical to the life of the furnace, no warranty can be offered where a controller is omitted.

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Scientific

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