CARBOLITE®
a VERDER company

## HOGE TEMPERATUUR LABORATORIUM KAMEROVEN

# HTF

carbolite.com/nl/producten/kamerovens/laboratorium-ovens/htf-high-temperature-chamber-furnaces/

HTF

# HOGE TEMPERATUUR LABORATORIUM KAMEROVEN

The Carbolite HTF chamber furnace range is engineered for precision and performance, offering temperatures up to 1800°C.

These furnaces are ideal for a variety of processes including sintering, annealing, calcination, and other thermal treatments. Each unit in the HTF range is built with high-quality materials and incorporates advanced thermal technology to ensure uniform heat distribution, optimal temperature control, and long-lasting performance.

Whether you're involved in research and development, quality control, or production in sectors such as ceramics, metallurgy, electronics, or materials science, the HTF chamber furnace range is designed to meet your specific requirements. With a focus on user-friendly operation, safety, and efficiency, these furnaces are equipped with intuitive controls, robust safety features, and energy-saving capabilities.

## OVERZICHT

**Maximum temperatuur:** 1700, 1800°C

**Configuration:** Bench mounted: 4, 5, 8 & 10 litre; floor standing: 27, 64, 128, 165 litre

**Control thermocouple:** Type B

**Furnace useable volume:** 1700°C: 5, 10, 27, 64, 128, 165 litre; 1800°C: 4, 8, 27, 64, 128, 165 litre

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# LEADING HEAT TECHNOLOGY

Carbolite's HTF furnace range is at the pinnacle of furnace design. The culmination of over 80 years of experience in thermal engineering; combining the latest technological developments with solid construction and high-quality components.

### HEATING ELEMENT

- Excellent temperature uniformity
- Fast heat-up and cool-down rates
- Unsurpassed temperature uniformity

### HIGH QUALITY THERMAL INSULATION

- Low energy consumption
- Low external case temperature
- Designed for longevity

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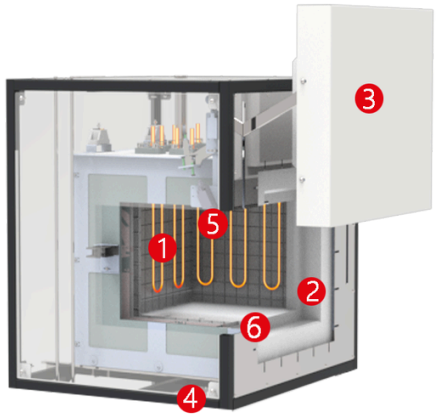
# INSIDE HTF CHAMBER FURNACES




**View inside the 1700 °C and 1800 °C HTF chamber furnace:**

1. Heating elements (MoSi2)
2. Ceramic fibre insulation
3. Front door
4. Supporting frame
5. Thermocouple
6. Usable space

MoSi2 U-shaped heating elements are installed in a vertical, hanging position within the HTF. The heat is insulated using ceramic fiber boards, layered with an appropriate thickness to enhance temperature uniformity. The maximum temperature of these boards is chosen based on the furnace's maximum temperature requirements. Water cooling is unnecessary due to the low thermal conductivity of the insulation material. The system is externally cooled by ambient air convection within the outer case.

MoSi2 heating elements are ideal for high-temperature processes, as they naturally form a protective oxide layer at elevated temperatures. The HTF chamber furnace is distinguished by its exceptional temperature uniformity and compact design.

## HTF CHAMBER FURNECES

# FEATURES & OPTIONS

**The HTF high temperature furnace range comprises 1700 °C and 1800 °C models.** The four smaller models are bench mounted and the larger units are floor-standing. These furnaces may be customised in order to satisfy specific customer requirements, e.g. the addition of debinding options for ceramic binder burn-off applications.

### STANDARD FEATURES

- 1700°C & 1800°C maximum operating temperature
- From 4 to 165 litre capacities
- High quality molybdenum disilicide heating elements
- Vertical lift door keeps heated surface away from the user
- Manual door operation on the 4 to 10 litre models
- Electrical door actuation on the 27 to 165 litre models
- Advanced refractory interior, used in combination with energy efficient low thermal mass insulation
- Programmable EPC3016P1 controller
- Over-temperature protection
- Ethernet communications
- Fan cooling for low external case temperature
- Motorised exhaust vent

### OPTIONS

- A range of sophisticated digital controllers, multisegment programmers and data loggers with digital communication options is available
- Inert gas inlet
- 100mm flowmeter for inert gas
- Solenoid valve with manual switch
- Solenoid valve with automatic switch
- Fast cooling comprising an air blower and utilising the standard motorised exhaust vent
- Debinding and sintering with pre-heated air flow
- Debinding and sintering with pre-heated air flow and gas flame after burner
- Sheathed thermocouple calibration port
- Unsheathed thermocouple calibration port through back wall of chamber (Ø 12 mm)
- Unsheathed thermocouple calibration port through centre of door (Ø 12 mm)

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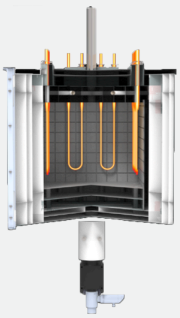
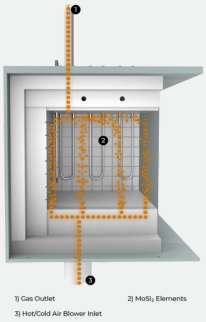
# DEBINDING & SINTERING

Carbolite HTF furnaces may be equipped with debinding and sintering options to accommodate a range of technical ceramic applications. A thermally induced decomposition and evaporation of the binder occurs due to gas flow through the HTF furnace during the debinding phase. The gas flow guides vapours to leave the sample.

The sintering of oxide ceramics in an HTF 1700°C or 1800°C furnace is a critical process in materials engineering, essential for achieving optimal mechanical and structural properties in ceramic components. This high-temperature sintering, particularly relevant for materials like alumina and zirconia, optimizes microstructural characteristics, enhancing performance in demanding applications.



High quality MoSi2 heating elements and preheated air inlet.

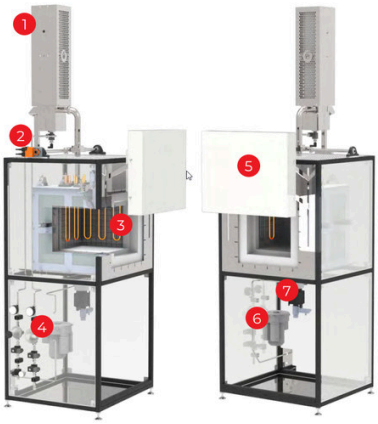



Optimised pre-heated air flow for efficient binder removal.

For safe combustion of binder gases an active propane gas afterburner can be provided.

## OPTIONAL DEBINDING AND SINTERING WITH PRE-HEATED AIR FLOW AND GAS FLAME AFTER BURNER

# HTF PART IDENTIFICATION




1. Gas fired afterburner
2. Motorised damper
3. Molybdenum disilicide elements
4. Gas controls
5. Automatic door
6. Side channel blower
7. Air preheater

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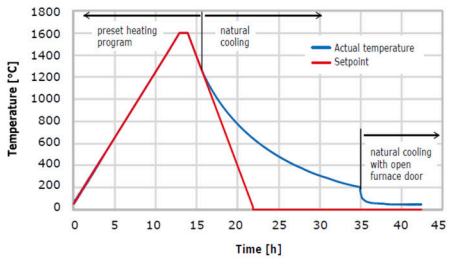
# SINTER RUN IN HTF 18/64




Disclaimer: The information presented shows typical performance. Furnace load ~ 8kg.

**Loading:** The ceramic is placed on a sintering tray in the HTF furnace, using a tray that withstands high temperatures without reacting with the ceramic.

**Ramp-Up:** The furnace's temperature is methodically increased to 1800°C, with a controlled profile to prevent thermal shock and ensure even heating, possibly pausing at certain temperatures for stress relief.

**Soak:** At 1800°C, the ceramic undergoes a critical soak, allowing particles to merge through diffusion, enhancing density and growth.

**Cool Down:** Following the soak, the furnace cools to room temperature at a rate that prevents thermal stress, avoiding cracks or deformation in the ceramic.

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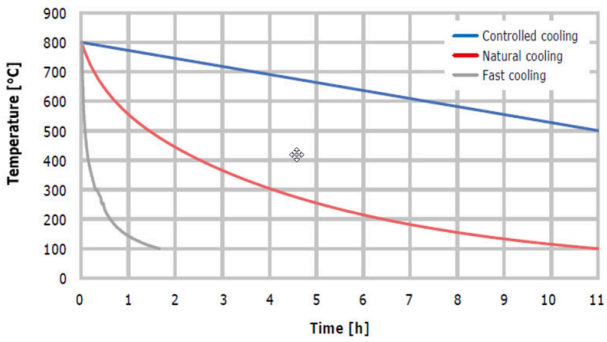
# COOLING OPTIONS

The cool down phase in sintering oxide ceramics is crucial for maintaining structural integrity and achieving desired properties. By utilising the HTF furnace's pre-heated air inlet blower options the user gains flexibility for their sintering processes. This feature allows precise control of cooling from sintering temperatures (1700 or 1800°C) to room temperature, preventing thermal gradients and associated stresses that could damage the ceramic.

For complex shapes or materials prone to thermal shock, step cooling can be used. With the HTF furnace step cooling can be optimised to minimize thermal stress risks by holding at intermediate temperatures to equalize internal and external temperatures. The HTF furnace can be used to tailor the cool down to each ceramic's needs, ensuring high-quality components with optimal properties.

**COOL DOWN RATES FOR HTF 17/430**



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# TEMPERATURE UNIFORMITY

The HTF furnaces ensures exceptional temperature uniformity with its advanced design, high-quality elements, and superior thermal insulation for minimal heat loss and even heat distribution.

Advantages of investing in a Carbolite furnace:

- Efficient removal of binder due to a high airflow
- Great temperature uniformity at low temperatures due to the air pre-heater
- Safe handling of binder by using the thermal afterburner
- Unique uniformity at high temperatures due to an optimized heating element arrangement
- Air blowers can be used for fast cooling to minimize run times

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# TEMPERATUURSCONTROLE & COMMUNICATIES

**HTF furnaces are equipped with ethernet communications and a programmable controller with 24 segments as standard:**

- Single zone furnaces fitted with Carbolite EPC3016P1 controller
- Over-temperature protection to protect valuable contents and for unattended operation

**OPTIES**

- A range of sophisticated digital controllers, multi-segment programmers and data loggers is available.

Aries Plus Touchscreen Besturingseenheid

HTF DEBINDING & SINTERING

# TECHNICAL CERAMICS

Debinding and sintering processes are necessary to remove organic binder and to densify ceramic components.

- Efficient debinding
- Densification of parts
- Uniform shrinkage

**MEER INFORMATIE →** carbolite.com/nl/toepassingen/technical-ceramics/

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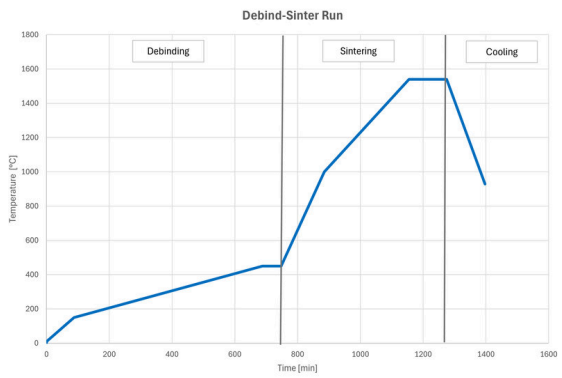
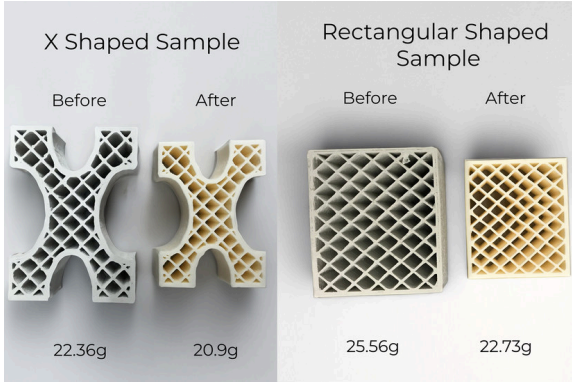
# DEBINDING & SINTERING USING HTF

During the heat treatment process, the 3D-printed components were treated in the same furnace. The X-shaped sample experienced a weight loss of approximately 6.5%, while the rectangular-shaped sample showed a weight loss of about 11.1%.

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# LABORATORY AND INDUSTRIAL OVENS · FAQ

### WHAT MAKES THE 1700 & 1800°C CHAMBER FURNACE RANGE IDEAL FOR THERMAL TREATMENTS?

The 1700 & 1800°C furnace range, designed for precision and performance, excels in processes like sintering, annealing, and calcination. Built with top-notch materials and incorporating advanced thermal technology, it ensures uniform heat distribution, optimal temperature control, and durability. Ideal for sectors such as ceramics, metallurgy, and electronics, it meets diverse research, quality control, and production needs.

### CAN 1700 & 1800°C CHAMBER FURNACES BE CUSTOMIZED FOR SPECIFIC APPLICATIONS?

1700 & 1800°C furnaces offer customization for specific requirements, including debinding options for ceramic binder burn-off. Available in both bench-mounted and floor-standing models, each furnace can be tailored for precise technical needs.

### HOW DOES THE RANGE ENSURE TEMPERATURE UNIFORMITY AND EFFICIENCY?

Featuring high-quality molybdenum disilicide heating elements and advanced thermal insulation, the furnace range achieves excellent temperature uniformity, quick heat-up and cool-down rates, while reducing energy consumption.

### HOW DO HTF CHAMBER FURNACES ACCOMMODATE DEBINDING AND SINTERING?

Equipped with debinding and sintering options, including pre-heated air flow and gas flame afterburners, these furnaces support thermal decomposition and evaporation of binders during debinding.

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# TECHNISCHE GEGEVENS · 1700°C MODELLEN

| Specificatie | HTF 17/5 | HTF 17/10 | HTF 17/27 | HTF 17/64 |
|---|---|---|---|---|
| **Max temp (°C)** | 1700 | 1700 | 1700 | 1700 |
| **Opwarmtijd (min)** | 50 | 44 | -- | -- |
| **Afmetingen: Binnen H × B × D (mm)** | 158 × 150 × 225 | 232 × 200 × 225 | 300 × 300 × 300 | 400 × 400 × 400 |
| **Afmetingen: Extern H × W × D (mm) H (deur open)** | 565 × 830 × 650 (850) | 565 × 830 × 650 (850) | 1835 × 900 × 1000 (1950) | 2530 × 1150 × 1490 |
| **Configuratie** | Tafelmodel | Tafelmodel | Floor standing | Floor standing |
| **Volume (liter)** | 5 | 10 | 27 | 64 |
| **Max vermogen (W)** | 4050 | 5920 | 10000 | 16000 |
| **Digital Ethernet Comms** | Standaard | Standaard | Standaard | Standaard |
| **Thermokoppel type** | B | B | B | B |
| **Gewicht (kg)** | 109 | 133 | 355 | 555 |

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# TECHNISCHE GEGEVENS · 1800°C MODELLEN

| Specificatie | HTF 18/4 | HTF 18/8 | HTF 18/27 | HTF 18/64 |
|---|---|---|---|---|
| **Max temp (°C)** | 1800 | 1800 | 1800 | 1800 |
| **Opwarmtijd (min)** | 65 | 56 | -- | -- |
| **Afmetingen: Binnen H × B × D (mm)** | 140 × 140 × 190 | 210 × 190 × 190 | 300 × 300 × 300 | 400 × 400 × 400 |
| **Afmetingen: Extern H × W × D (mm) H (deur open)** | 565 × 830 × 650 (850) | 565 × 830 × 650 (850) | 1835 × 900 × 1000 (1950) | 2530 × 1150 × 1490 |
| **Configuratie** | Tafelmodel | Tafelmodel | Floor standing | Floor standing |
| **Volume (liter)** | 4 | 8 | 27 | 64 |
| **Max vermogen (W)** | 4650 | 6200 | 10000 | 16000 |
| **Digital Ethernet Comms** | Standaard | Standaard | Standard | Standard |
| **Thermokoppel type** | Pt20%Rh/ Pt40%Rh | Pt20%Rh/ Pt40%Rh | B | B |
| **Gewicht (kg)** | 115 | 128 | 355 | 555 |

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# DOWNLOADS

**PRODUCTINFORMATIEBLAD HTF LABORATORY FURNACE →**
carbolite.com/files/451676/productinformatieblad-htf-laboratory-furnace.pdf

**GLO / HB / HTF / HTK / LHTG / V-L PRODUCTS CATALOGUE →**
carbolite.com/files/442984/glo-hb-htf-htk-lhtg-v-l-products-catalogue.pdf

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## OFFERTE-AANVRAAG

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