

Furnaces for Ceramics, Glass, Solar Cells

Powder Metallurgy, Composites



Drying
Burning out
Debinding
Calcinating
Presintering
Firing
Sintering
Pyrolysis
Annealing
Cooling

Exhaust air purification





Experts in Furnaces

THERMCONCEPT develops, designs and manufactures furnaces and systems for a broad range of production and research applications and fields. Many in our workforce also have decades of experience in furnace engineering. The expertise we have amassed is deployed on a day-to-day basis in order to plan and realise your ideal furnace solution.

Engineering

Our highly-skilled development engineers and designers, hardware and software professionals, technicians and mechanics create cost-efficient and reliable furnace solutions. Direct contact with users enables us to design furnaces that are practical to use. Our aim is to deliver crucial technical and financial benefits.

Fast and flexible

Many applications can be achieved with our extensive range of standard furnaces. The advantages for you are proven, fully-developed models, excellent value for money and quick delivery times. Of course, we also supply customised furnaces specially designed to meet your specific application. In close consultation with you, we develop a furnace system which meets your challenging tasks both reliably and economically.

Global Sales and Service Network

THERMCONCEPT furnaces and systems are proven in daily use at satisfied customers in many countries worldwide. Our international distribution network ensures that our customers receive individual support, rapid responses and expert local service.

THERMCONCEPT *powered by innovation*

Furnaces and industrial heat treatment systems made by THERMCONCEPT are synonymous for

- top quality
- proven technology
- practical and service-friendly design
- customer-specific and application-based solutions
- maximum thermal efficiency and value for money
- eco-friendly materials
- professional service.

THERMCONCEPT is your partner for high-performance furnaces and systems for wide-ranging and challenging applications in production and research.



Contents

High-temperature sintering furnaces 1500 °C – 1800 °C

High-temperature chamber furnaces	4
High-temperature hood furnaces	8
High-temperature bogie-hearth furnaces	14
High-temperature tube furnaces	16



Firing and sintering furnaces 900 °C – 1400 °C

Chamber furnaces	20
Bogie-hearth furnaces	24
Hood furnaces	27
Tube furnaces	28



Combi-furnaces for debinding and sintering

Combi-furnaces up to 1400 °C	30
Gas-fired combi-furnaces up to 1400 °C	32
High-temperature combi-furnaces up to 1750 °C	33



Debinding and drying furnaces 450 °C – 850 °C

Air-circulation chamber furnaces	34
Air-circulation bogie-hearth furnaces	35



Pilot plant furnaces

36



Laboratory furnaces

38



Gas-fired furnaces and systems up to 1600 °C

40



Exhaust air purification systems

Catalytic exhaust air purification systems	44
Thermal exhaust air purification systems	45



Process control and documentation

46



The product range at a glance

48



High-temperature chamber furnaces

T max. 1500 °C, 1600 °C, 1750 °C and 1800 °C



- Broad range of standard furnaces with a chamber volume of 16 – 500 l.
- Furnaces supplied in customised configurations to match the systems precisely to the desired processes
- All furnace models excel with maximum precision and convenience as well as short heat-up and cooling times and low power consumption
- For temperature ranges between 1500 °C and 1600 °C heated with SiC rods and between 1600 °C and 1800 °C with MoSi₂ heating elements
- Outer housing with robust, aesthetic frame construction
- Double-walled housing with forced cooling, hence very low outer-wall temperature
- Stainless steel door and door frame
- Door with parallel motion, swings hot side away from operator
- Furnace insulation made of high-quality aluminium oxide fibre materials with low thermal mass, rapid heating and cooling possible; exhaust opening in furnace roof
- Reinforced bottom for heavy batches
- The furnaces are heated by the side walls. Additional heating by the rear wall is available as optional extra.
- Cutting-edge switching and control system, thyristor-controlled heating elements, high-precision furnace regulation, wear-free, noiseless

Technical Data

Model	T max [°C]	Inner dimensions [mm] Width x Depth x Height	Volume [l]	Outer dimensions [mm] Width x Depth x Height	Power [kW]	Voltage [V]	Weight [kg]
HTK 16/16	1600	200 x 300 x 260	16	820 x 655 x 1650	11	400 3/N	310
HTK 20/16	1600	250 x 320 x 260	20	870 x 675 x 1650	11	400 3/N	325
HTK 40/16	1600	300 x 350 x 350	40	920 x 705 x 1740	11	400 3/N	370
HTK 50/16	1600	250 x 550 x 350	50	870 x 905 x 1740	18	400 3/N	455
HTK 70/16	1600	400 x 400 x 400	65	1100 x 835 x 1740	16	400 3/N	540
HTK 100/16	1600	400 x 600 x 400	100	1100 x 1035 x 1790	21	400 3/N	620
HTK 130/16	1600	400 x 800 x 400	130	1100 x 1235 x 1790	23	400 3/N	780
HTK 160/16	1600	500 x 550 x 550	150	1200 x 975 x 1940	21	400 3/N	670
HTK 220/16	1600	500 x 550 x 800	220	1200 x 975 x 2190	27	400 3/N	1000
HTK 300/16	1600	500 x 1100 x 550	300	1260 x 1605 x 1940	32	400 3/N	1270
HTK 500/16	1600	500 x 1200 x 800	480	1260 x 1705 x 2190	58	400 3/N	1310

Other sizes on request

High-temperature chamber furnaces

- Customised designs -

Chamber furnaces up to 1600 °C

High-temperature chamber furnaces with electromechanical lifting door for sintering technical ceramics. Heated by 45 MoSi₂ heating elements.

Useable volume: approx. 43 m³

Useable space: 13200 x 1800 x 1800 mm (wxdxh)



Technical Data

Model	T max [°C]	Inner dimensions [mm] Width x Depth x Height	Volume [l]	Outer dimensions [mm] Width x Depth x Height	Power [kW]	Voltage [V]	Weight [kg]
HTK 16/17	1750	200 x 300 x 260	16	820 x 655 x 1650	11	400 3/N	310
HTK 20/17	1750	250 x 320 x 260	20	870 x 675 x 1650	11	400 3/N	325
HTK 40/17	1750	300 x 350 x 350	40	920 x 705 x 1740	11	400 3/N	370
HTK 50/17	1750	250 x 550 x 350	50	870 x 905 x 1740	18	400 3/N	455
HTK 70/17	1750	400 x 400 x 400	65	1100 x 835 x 1790	16	400 3/N	540
HTK 100/17	1750	400 x 600 x 400	100	1100 x 1035 x 1790	21	400 3/N	620
HTK 130/17	1750	400 x 800 x 400	130	1100 x 1235 x 1790	23	400 3/N	780
HTK 160/17	1750	500 x 550 x 550	150	1200 x 975 x 1940	21	400 3/N	670
HTK 220/17	1750	500 x 550 x 800	220	1200 x 975 x 2190	27	400 3/N	1000
HTK 300/17	1750	500 x 1100 x 550	300	1260 x 1605 x 1940	32	400 3/N	1270
HTK 500/17	1750	500 x 1200 x 800	480	1260 x 1705 x 2190	58	400 3/N	1310
HTK 16/18	1800	200 x 300 x 260	16	820 x 655 x 1650	11	400 3/N	310
HTK 20/18	1800	250 x 320 x 260	20	870 x 675 x 1650	11	400 3/N	325
HTK 40/18	1800	300 x 350 x 350	40	920 x 705 x 1740	11	400 3/N	370
HTK 50/18	1800	250 x 550 x 350	50	870 x 905 x 1740	18	400 3/N	455
HTK 70/18	1800	400 x 400 x 400	65	1100 x 835 x 1790	16	400 3/N	540
HTK 100/18	1800	400 x 600 x 400	100	1100 x 1035 x 1790	21	400 3/N	620
HTK 130/18	1800	400 x 800 x 400	130	1100 x 1235 x 1790	23	400 3/N	780
HTK 160/18	1800	500 x 550 x 550	150	1200 x 975 x 1940	21	400 3/N	670
HTK 220/18	1800	500 x 550 x 800	220	1200 x 975 x 2190	27	400 3/N	1000
HTK 300/18	1800	500 x 1100 x 550	300	1260 x 1605 x 1940	32	400 3/N	1270
HTK 500/18	1800	500 x 1200 x 800	480	1260 x 1705 x 2190	58	400 3/N	1310

Other sizes on request

High-temperature chamber furnaces

- Customised designs -

Chamber furnaces for temperatures up to 1600 °C

Chamber furnaces with roof heating by 48 MoSi₂ heating elements for preheating precious metal sheets made of platinum, rhodium or palladium. Electromechanical lifting door opening upwards, with footswitch



Double-chamber furnace 1700 °C

Special testing furnace for MoSi₂ heating elements with two separated heating chambers. Furnace doors with observation window, surface temperature of batch is measured using a pyrometer.

Chamber furnaces up to 1600 °C

Chamber furnaces fitted with a second door on the back of the furnace, both doors reinforced to receive batch racks, which can be guided into the chamber from either side.

Fitted with eight heating elements mounted on the two outer walls and in two transverse rows of freely radiating elements inside the furnace chamber.

Siemens PLC (S7-300) controller with LabView process visualisation. Operating unit housed in a pivot arm.



High-temperature chamber furnaces

- Customised designs -

Inert gas chamber furnace up to 1700 °C

This chamber furnace has a gas-tight, water-cooled chamber. The furnace can be operated at temperatures up to 1700 °C under inert gas. An oxygen sensor monitors the oxygen concentration in the exhaust gas. A vacuum pump can be used to evacuate the chamber before starting a heating cycle.



Additional equipment:

- **Heated from three sides (1)**

The standard heating elements along the side walls can be supplemented with additional heating elements on the rear furnace wall.

- **Additional door on the rear furnace wall (2)**

In furnaces with a large chamber depth, the back wall of the furnace can be replaced with a door. This facilitates access and shortens loading and unloading times.

- **Reinforced bottom (3)**

For receiving heavy batches and to relieve strain on the fibre insulation. HTK 70 model and upwards include this feature as standard.

- **Stainless steel exhaust hoods**

- **Automatic exhaust flaps in furnace roof**

- **Exhaust air purification systems**

- **Start-up switch**

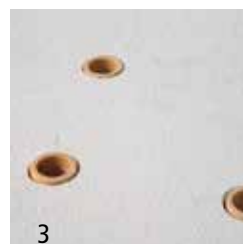
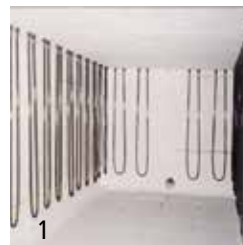
- **Fully automatic furnace regulation**

- **Air preheating for debinding processes**

- **Lifting door**

- **Cooling fan**

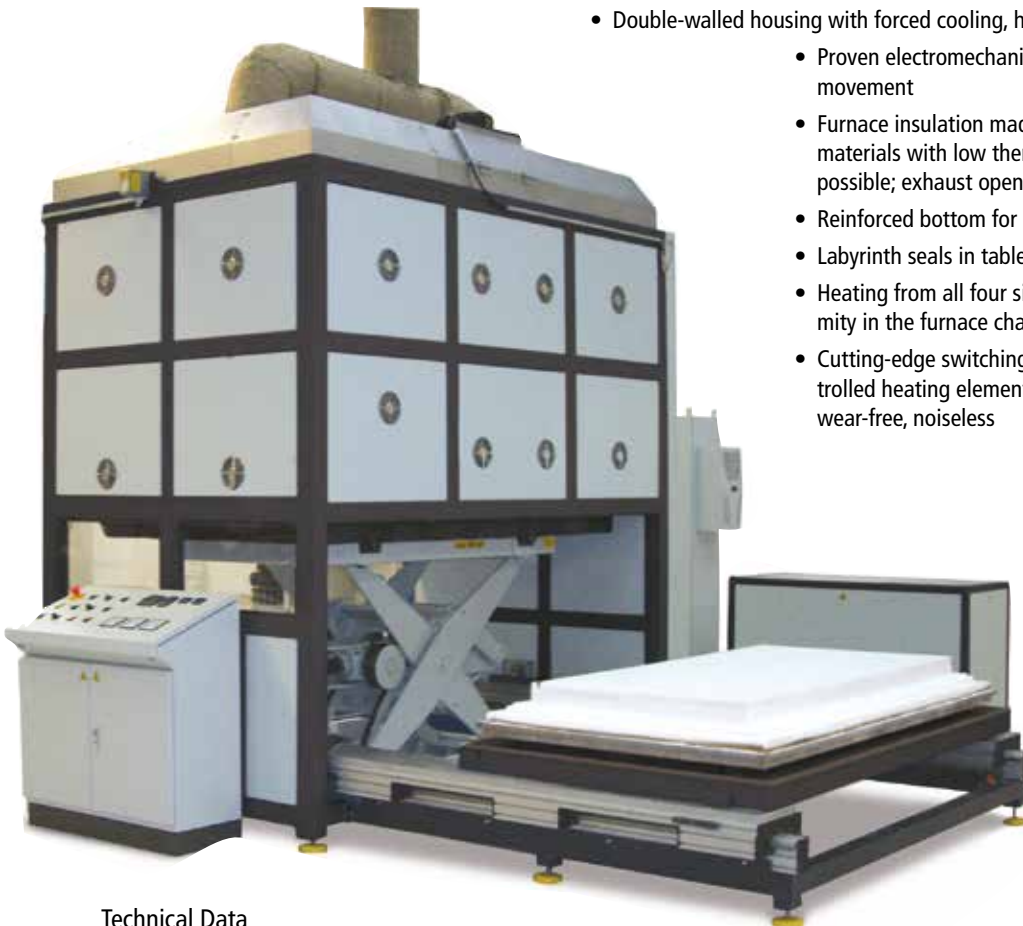
- **Protective gas operation**



High-temperature hood furnaces in lift-bottom design

T max. 1500 °C, 1600 °C, 1750 °C and 1800 °C

- Broad range of standard furnaces with a chamber volume of 70 – 2000 l
- The range of models includes hood furnaces with a fixed or moveable table
- Also with shuttle table systems (turntable or dual-table systems) for semi- or fully automatic operation.
- Furnaces supplied in customised configurations to match systems precisely to the desired processes.
- All furnace models excel with maximum precision and convenience as well as short heat-up and cooling times and low power consumption.
- For temperature ranges between 1500 °C and 1600 °C with SiC heating elements, and between 1600 °C and 1800 °C with MoSi₂ heating elements
- Outer housing with robust, aesthetic frame construction
- Double-walled housing with forced cooling, hence very low outer-wall temperatures
 - Proven electromechanical system for smooth, shock-free table movement
 - Furnace insulation made of high-quality aluminium oxide fibre materials with low thermal mass, rapid heating and cooling possible; exhaust opening in furnace roof
 - Reinforced bottom for heavy batches
 - Labyrinth seals in table and hood ensure tight closure
 - Heating from all four side walls, excellent temperature uniformity in the furnace chamber
 - Cutting-edge switching and control system, thyristor-controlled heating elements, high-precision furnace regulation, wear-free, noiseless



Technical Data

Model	T max [°C]	Inner dimensions [mm] Width x Depth x Height	Volume [l]	Power [kW]	Voltage [V]
HTH 70/16 LB	1600	420 x 420 x 420	70	24	400 3/N
HTH 170/16 LB	1600	550 x 550 x 550	170	32	400 3/N
HTH 300/16 LB	1600	1100 x 500 x 550	300	54	400 3/N
HTH 500/16 LB	1600	1200 x 500 x 800	480	96	400 3/N
HTH 1000/16 LB	1600	1800 x 700 x 800	1000	170	400 3/N
HTH 1500/16 LB	1600	2200 x 850 x 800	1500	225	400 3/N
HTH 2000/16 LB	1600	2400 x 1000 x 800	1920	240	400 3/N

Other sizes on request

High-temperature hood furnaces

in lift-bottom design

- Model variants -

Hood furnaces in lift-bottom design

Hood furnaces with 1 or 2 tables, for loading and un-loading horizontally driven in front of the furnace, for heating moved vertically into the heating chamber.



Technical Data

Model	T max [°C]	Inner dimensions [mm] Width x Depth x Height	Volume [l]	Power [kW]	Voltage [V]
HTH 70/17 LB	1750	420 x 420 x 420	70	24	400 3/N
HTH 170/17 LB	1750	550 x 550 x 550	170	32	400 3/N
HTH 300/17 LB	1750	1100 x 500 x 550	300	54	400 3/N
HTH 500/17 LB	1750	1200 x 500 x 800	480	96	400 3/N
HTH 1000/17 LB	1750	1800 x 700 x 800	1000	170	400 3/N
HTH 1500/17 LB	1750	2200 x 850 x 800	1500	225	400 3/N
HTH 2000/17 LB	1750	2400 x 1000 x 800	1920	240	400 3/N
HTH 70/18 LB	1800	420 x 420 x 420	70	24	400 3/N
HTH 170/18 LB	1800	550 x 550 x 550	170	32	400 3/N
HTH 300/18 LB	1800	1100 x 500 x 550	300	54	400 3/N
HTH 500/18 LB	1800	1200 x 500 x 800	480	96	400 3/N
HTH 1000/18 LB	1800	1800 x 700 x 800	1000	170	400 3/N
HTH 1500/18 LB	1800	2200 x 850 x 800	1500	225	400 3/N
HTH 2000/18 LB	1800	2400 x 1000 x 800	1920	240	400 3/N

Other sizes on request



High-temperature hood furnaces

in lift-bottom design

- Model variants -

Hood furnaces in lift-bottom design with 2 horizontally and vertically moveable tables. While one table is in the furnace, the second table can be loaded.



Hood furnaces in lift-bottom design with 1 horizontally and vertically moveable table. The horizontal movement can be done either manually or by means of an electric drive, the vertical movement into the furnace chamber is always done electrically.



High-temperature hood furnaces

in lift-bottom design

- Model variants -

Hood furnace in lift-bottom design with one double turntable

When one table is moved into the furnace, the second table can be loaded. The tables are lowered electromechanically, swivel outwards and raised to working height.



Large-volume hood furnace in lift-bottom design with two movable tables

When one table is moved into the furnace, the second table can be loaded. The two bottoms are moved to the left and right for loading and unloading.



Additional equipment:

- **Cooling fan**

For better ventilation of the furnace chamber and for reducing cycle times. Fan is operated automatically by the controller, fan speed can be pre-selected segment-wise.

- **Stainless steel exhaust hoods**

For controlled discharge of exhaust gases and hot air from the furnace, adapted to furnace dimensions, custom-built in stainless steel and with matching flange

- **Exhaust air purification systems**

Add-on for furnace systems, with catalytic or thermal exhaust air purification systems as integrated unit

- **Automatic exhaust flaps in furnace roof**

- **Start-up switch**

- **Fully automatic furnace regulation**

- **Air preheating for debinding processes**

- **Protective gas operation**





High-temperature hood furnaces

in lift-top design

T max. 1500 °C, 1600 °C, 1750 °C and 1800 °C

- Broad range of standard furnaces with a chamber volume of 70 - 2000 l
- The range includes hood furnaces with a vertically move-able hood and a fixed table, or alternatively with a horizontally moveable table
- Also with shuttle table systems (turntable or dual-table systems) for semi- or fully automatic operation.
- Customised to match the system precisely to the desired processes.
- All furnace models excel with maximum precision and convenience as well as short heat-up and cooling times and low power consumption.
- For temperature ranges between 1500 °C and 1600 °C with SiC heating, or for temperatures between 1600 °C and 1800 °C with MoSi₂ heating elements
- Outer housing with robust, aesthetic frame construction
- Double-walled housing with forced cooling, hence very low outer-wall temperatures
- Proven electromechanical system for smooth, shock-free movement
- Furnace insulation made of high-quality aluminium oxide fibre materials with low thermal mass, allowing rapid heating and cooling; exhaust opening in furnace roof
- Reinforced bottom for heavy batches
- Labyrinth seals in table and hood ensure tight closure
- Heating from all four side walls, excellent temperature uniformity in the furnace chamber
- Cutting-edge switching and control system, thyristor-controlled heating elements, high-precision furnace regulation, wear-free, noiseless

Technical Data

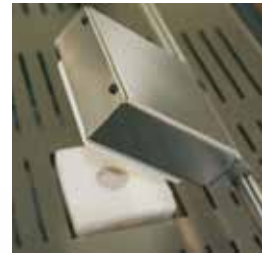
Model	T max [°C]	Inner dimensions [mm] Width x Depth x Height	Volume [l]	Power [kW]	Voltage [V]
HTH 70/16 LT	1600	420 x 420 x 420	70	24	400 3/N
HTH 170/16 LT	1600	550 x 550 x 550	170	32	400 3/N
HTH 300/16 LT	1600	1100 x 500 x 550	300	54	400 3/N
HTH 500/16 LT	1600	1200 x 500 x 800	480	96	400 3/N
HTH 1000/16 LT	1600	1800 x 700 x 800	1000	170	400 3/N
HTH 1500/16 LT	1600	2200 x 850 x 800	1500	225	400 3/N
HTH 2000/16 LT	1600	2400 x 1000 x 800	1920	240	400 3/N

Other sizes on request

High-temperature hood furnaces

Additional equipment

- **Exhaust air flaps in furnace roof**
For faster air extraction from the furnace chamber, regulated manually or automatically by the controller
- **Start-up switch**
The start-up switch ensures that heat-up is slow in the lower temperature range up to 250 °C, in the case of sensitive components that may not be heated up too fast
- **Air preheating for debinding processes**
Programmed injection of preheated fresh air up to max. 500 °C for debinding processes. Owing to the gentle heat input in the lower temperature range, organic components can be safely and reliably removed from the furnace chamber. Transition to sintering process after debinding. No complex reloading of the batch, or change of furnace necessary
- **Stainless steel exhaust hoods**
- **Exhaust air purification systems**
- **Fully automatic furnace regulation**
- **Cooling fan**
- **Protective gas operation**



Technical Data

Model	T max [°C]	Inner dimensions [mm] Width x Depth x Height	Volume [l]	Power [kW]	Voltage [V]
HTH 70/17 LT	1750	420 x 420 x 420	70	24	400 3/N
HTH 170/17 LT	1750	550 x 550 x 550	170	32	400 3/N
HTH 300/17 LT	1750	1100 x 500 x 550	300	54	400 3/N
HTH 500/17 LT	1750	1200 x 500 x 800	480	96	400 3/N
HTH 1000/17 LT	1750	1800 x 700 x 800	1000	170	400 3/N
HTH 1500/17 LT	1750	2200 x 850 x 800	1500	225	400 3/N
HTH 2000/17 LT	1750	2400 x 1000 x 800	1920	240	400 3/N
HTH 70/18 LT	1800	420 x 420 x 420	70	24	400 3/N
HTH 170/18 LT	1800	550 x 550 x 550	170	32	400 3/N
HTH 300/18 LT	1800	1100 x 500 x 550	300	54	400 3/N
HTH 500/18 LT	1800	1200 x 500 x 800	480	96	400 3/N
HTH 1000/18 LT	1800	1800 x 700 x 800	1000	170	400 3/N
HTH 1500/18 LT	1800	2200 x 850 x 800	1500	225	400 3/N
HTH 2000/18 LT	1800	2400 x 1000 x 800	1920	240	400 3/N

Other sizes on request



High-temperature bogie-hearth furnaces

T max. 1600 °C, 1750 °C and 1800 °C

- Range of standard furnaces with a chamber volume up to 2000 l
- Furnaces supplied in customised configurations to match the systems precisely to the desired processes
- The bogie hearth can be removed completely from the furnace for convenient loading and unloading, and is mounted on heavy-duty castors for free movement in front of the furnace
- Rugged bogie-hearth design, fully insulated with high-quality fibre materials, labyrinth seal between hearth and furnace housing
- Reinforced bogie hearth bottom for heavy loads
- Double-walled furnace housing with forced cooling, hence very low outer-wall temperatures
- Furnace insulation made of high-quality aluminium oxide fibre materials with low thermal mass, rapid heating and cooling possible; exhaust openings in furnace roof
- Reinforced bottom for heavy batches
- Heated by high-quality MoSi₂ heating elements
- The furnaces are heated by the side walls. Additional heating by the rear wall is available as optional extra.
- Cutting-edge switching and control system, thyristor-controlled heating elements, high-precision furnace regulation, wear-free, noiseless

Technical Data

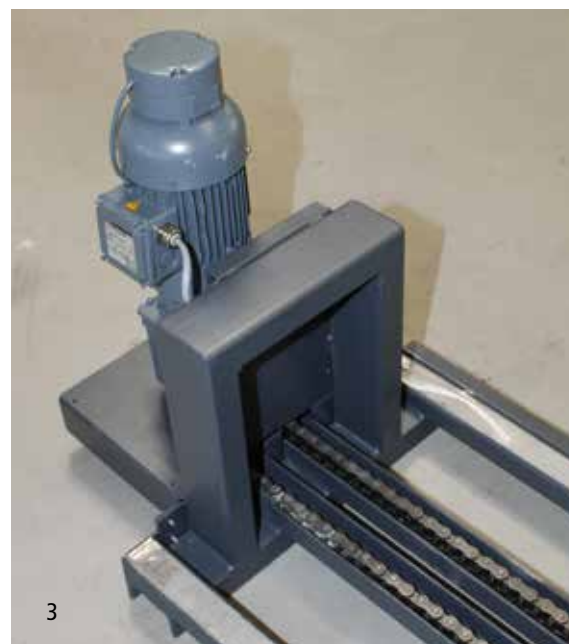
Model	T max [°C]	Inner dimensions [mm] Width x Depth x Height	Volume [l]	Outer dimensions [mm] Width x Depth x Height	Power [kW]	Voltage [V]
HTW 500/16	1600	500 x 1200 x 800	480	1260 x 1380 x 2650	80	400 3/N
HTW 1000/16	1600	700 x 1800 x 800	1000	1460 x 1980 x 2650	143	400 3/N
HTW 1500/16	1600	850 x 2200 x 800	1500	1610 x 2380 x 2650	190	400 3/N
HTW 2000/16	1600	1000 x 2400 x 800	1920	1760 x 2580 x 2650	210	400 3/N
HTW 500/17	1750	500 x 1200 x 800	480	1260 x 1380 x 2650	80	400 3/N
HTW 1000/17	1750	700 x 1800 x 800	1000	1460 x 1980 x 2650	143	400 3/N
HTW 1500/17	1750	850 x 2200 x 800	1500	1610 x 2380 x 2650	190	400 3/N
HTW 2000/17	1750	1000 x 2400 x 800	1920	1760 x 2580 x 2650	210	400 3/N
HTW 500/18	1800	500 x 1200 x 800	480	1260 x 1380 x 2650	80	400 3/N
HTW 1000/18	1800	700 x 1800 x 800	1000	1460 x 1980 x 2650	143	400 3/N
HTW 1500/18	1800	850 x 2200 x 800	1500	1610 x 2380 x 2650	190	400 3/N
HTW 2000/18	1800	1000 x 2400 x 800	1920	1760 x 2580 x 2650	210	400 3/N

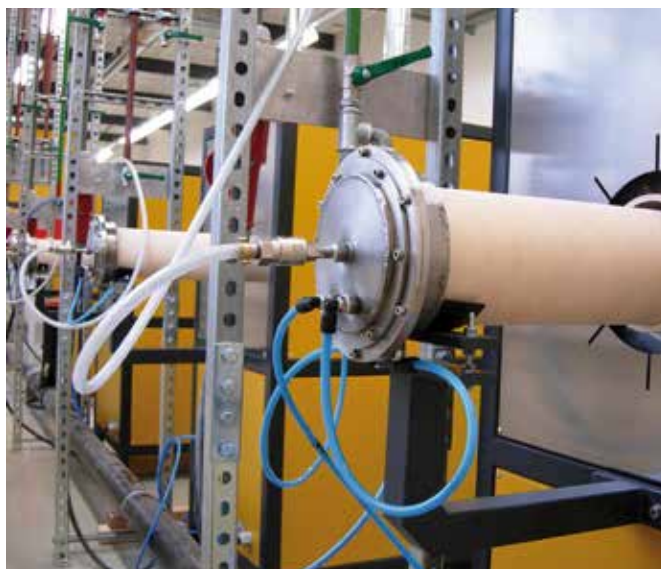
Other sizes on request

High-temperature bogie-hearth furnaces

Additional equipment:

- **Lifting door**
Instead of hinged doors, furnaces can also be fitted with space-saving, vertical lifting doors. Electric or hydraulic drive units are available. The hot side of the insulation faces away from the operator
- **Rail-bound bogie hearth**
Bogie hearth with steel wheels on rails, for ease of movement even with large batch weights
- **Bogie hearth drive unit (3)**
Electrical chain drive for easy movement of rail-bound bogie hearths carrying heavy loads, and when opening the furnace while hot
- **Transverse shunting device**
Customised transverse shunting device in front of the furnace, with parking rails beside the furnace
- **Additional door on the rear furnace wall**
for operation with two bogies
- **Heated from three sides (2)**
The standard heating elements along the side walls can be supplemented with additional heating elements on the rear furnace wall.
- **Start-up switch**
The start-up switch ensures that heat-up is slow in the lower temperature range up to 250 °C, in the case of sensitive components that may not be heated up too fast.
- **Fully automatic furnace regulation**
- **Cooling fan (4)**
For better ventilation of the furnace chamber and for reducing cycle times. Fan is operated automatically by the controller, fan speed can be pre-selected segment-wise.
- **Exhaust flaps**
- **Exhaust hoods**
- **Exhaust air purification systems (1)**
Add-on for furnace systems, with catalytic or thermal exhaust air purification systems as integrated unit.
- **Air preheating for debinding processes**
- **Customised furnace furniture**





High-temperature tube furnaces

T max. 1500 °C, 1600 °C, 1750 °C and 1800 °C

THERMCONCEPT supplies an extensive range of tube furnaces for temperatures up to 1800 °C for research and production. Tube furnaces are configured according to customer requirements and can therefore be matched precisely to the desired processes:

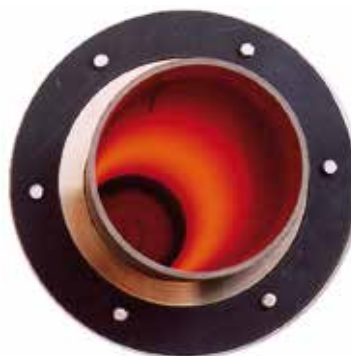
- For temperature ranges between 1500 °C and 1600 °C heated with SiC rods and for temperatures ranges between 1600 °C and 1800 °C with MoSi₂ heating elements
- Single- or multi-zone subdivision of the heated tube length
- Horizontal or vertical design
- Multi-tube furnaces
- Rotary tube furnaces
- Can be operated under standard atmosphere, controlled atmosphere or vacuum
- Extensive range of additional equipment

Tube furnaces 1600 °C (1)

Tube furnaces for the production of ceramic powder under protective gas atmosphere. The working tube is closed with gas-tight, water-cooled flanges made of stainless steel. Installation with gassing station for four furnace systems.

6-tube furnace 1600 °C (2)

High-temperature tube furnace with six ceramic working tubes. The 2000 mm of heated length is subdivided into five heating zones. The MoSi₂ heating elements are freely suspended for maximum temperature homogeneity. All working tubes are fitted with gas-tight flanges made of stainless steel and are water-cooled, for purging with different gases (argon, nitrogen, hydrogen).



High-temperature tube furnaces

T max. 1500 °C, 1600 °C, 1750 °C and 1800 °C

Vertical tube furnace for temperatures up to 1700 °C

This tube furnace contains a gas-tight working tube that is closed on one side, for experiments with a reducing atmosphere and/or corrosive components. The top of the tube is closed with a gas-tight stainless steel flange



Horizontal tube furnace up to 1800 °C

1-zone tube furnace with Alsint-tube, prepared for water-cooled flanges for protective gas atmosphere and vacuum, bench-type furnace with integrated switchgear and controls

Rotary tube furnace for 1600 °C

This rotary tube furnace can be operated at temperatures up to 1600 °C under an inert gas atmosphere. The ceramic tube has an inner diameter of 80 mm and a total length of 1600 mm. In spite of the inert gas atmosphere, the product can be introduced and removed continually through suitable ports. A vacuum pump is used to purge the entire system before operation begins, so that it is possible to change the atmosphere.





High-temperature tube furnaces

T max. 1500 °C, 1600 °C, 1750 °C and 1800 °C

Horizontal tube furnace for temperatures up to 1800 °C

Horizontal tube furnace for T max. up to 1800 °C. The heated length is subdivided into three zones. The outer zones are regulated by coupling them to the middle zone. A closed-loop control system allows limitations on the temperature gradients in the radial direction.

Gas-tight, water-cooled flanges on both ends of the working tube allow any atmosphere to be used. The working tube has a diameter of 130 mm and has special supports.



8-zone gradient tube furnace for temperatures up to 1800 °C

This horizontal gradient furnace is configured with eight zones that can be separately regulated. This means that constant temperatures and gradients can be set for different regions within the working tube.



Calibration furnace for temperatures up to 1700 °C

This furnace was designed for high-temperature calibration of thermocouples. Several thermocouples can be calibrated simultaneously. The heated length is subdivided into three separately regulated zones. All the zones are controlled by a DC power pack.

The furnace casing is water-cooled.

Additional equipment for tube furnaces

Working tubes

Various types of working tubes are available for different applications and temperatures.



Tube plugs

Fibre plugs for closing the ends of all standard working tubes can be supplied.

Also available with connection to protective gas supply.



Flanges

Gas-tight stainless steel flanges for ceramic tubes, with or without water cooling for gas atmosphere or vacuum operation in the working tube.



Gassing station/vacuum operation

The different tube furnace series can be upgraded for operation with non-flammable or flammable gases, or for vacuum operation.



Water cooling

Automatic water cooling of the furnace casing, with recirculating cooler for cooling water.

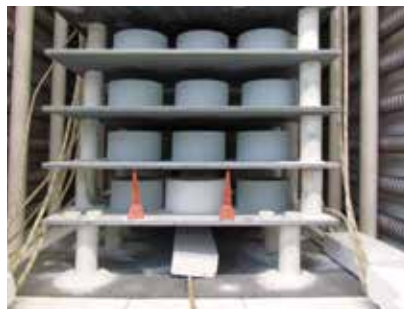




Chamber furnaces

T max. 900 °C, 1280 °C, 1340 °C and 1400 °C

- Robust housing design with double-walled lining, exceptionally low outer-wall temperature
- Door lintel made of stainless steel, corrosion resistant
- Door hinged on the right, easily opened by approx. 180°
- Inlet flap in furnace floor for controlling cooling air inflow, exhaust flap in furnace roof
- Multilayer, asbestos-free insulation (lightweight refractory bricks and rear insulation), low heat loss, low energy consumption
- Heated from five sides (from both sides, rear wall, door and bottom), uniform temperature distribution in furnace chamber
- High-quality heating wire securely mounted to prevent slippage
- Heating elements wound on ceramic tubes and mounted in front of furnace wall, free heat radiation into chamber with resultant energy savings and longer service life
- Bottom heating elements covered by diathermic SiC plates, high mechanical strength, protection for bottom heating elements
- Base for convenient charging or integrated base included as standard



Automatic exhaust flap

Technical Data 900 °C and 1280 °C - Models

Model	T max [°C]	Inner dimensions [mm] Width x Depth x Height	Volume [l]	Outer dimensions [mm] Width x Depth x Height	Power [kW]	Voltage [V]	Weight [kg]
KK 100/09../12	900 / 1280	410 x 470 x 540	100	750 x 970 x 1640	6,6 / 8	400 V 3/N	320
KK 150/09../12	900 / 1280	460 x 470 x 690	150	800 x 950 x 1730	9 / 10,5	400 V 3/N	430
KK 200/09../12	900 / 1200	460 x 630 x 690	200	800 x 1110 x 1730	11 / 13,2	400 V 3/N	460
KK 250/09../12	900 / 1280	520 x 630 x 770	250	860 x 1110 x 1740	13,5 / 16,5	400 V 3/N	480
KK 330/09../12	900 / 1280	580 x 710 x 800	330	920 x 1190 x 1740	16,5 / 22	400 V 3/N	530
KK 480/09../12	900 / 1280	550 x 800 x 800	480	970 x 1250 x 1760	32	400 V 3/N	620
KK 600/09../12	900 / 1280	710 x 820 x 1030	600	1050 x 1300 x 1770	40	400 V 3/N	730
KK 750/09../12	900 / 1280	710 x 1020 x 1030	740	1050 x 1500 x 1770	50	400 V 3/N	780
KK 1000/09../12	900 / 1280	910 x 1005 x 1145	1060	1250 x 1490 x 1890	70	400 V 3/N	1150
KK 1500/09../12	900 / 1280	900 x 1200 x 1400	1510	1590 x 2090 x 2410	58 / 76	400 V 3/N	2250
KK 2000/09../12	900 / 1280	1000 x 1300 x 1500	1950	1690 x 2190 x 2510	76 / 110	400 V 3/N	2890
KK 2500/09../12	900 / 1280	1000 x 1500 x 1650	2480	1690 x 2390 x 2660	110 / 140	400 V 3/N	3000

Chamber furnaces



KK 2000/13

Additional equipment:

- Customised furnace sizes
- Automatic control of inlet and exhaust flaps
- Cooling system with manual or automatic regulation
- Manually operated parallel hinged door opening to the side, or electrohydraulic lifting door opening upwards
- Multi-zone control for optimised temperature uniformity
- Thermal or catalytic exhaust air purification systems (see also pages 44-45)
- Furnace furniture according to customer specifications
- Exhaust hoods for controlled discharge of exhaust
- Operation under protective gas with sealed furnace housing



Technical Data 1340 °C and 1400 °C - Models

Model	T max [°C]	Inner dimensions [mm] Width x Depth x Height	Volume [l]	Outer dimensions [mm] Width x Depth x Height	Power [kW]	Voltage [V]	Weight [kg]
KK 100/13../14	1340 / 1400	410 x 470 x 540	100	910 x 1130 x 1740	8 / 10,5	400 V 3/N	420
KK 150/13../14	1340 / 1400	460 x 470 x 690	150	960 x 1110 x 1830	10,5 / 15	400 V 3/N	530
KK 200/13../14	1340 / 1400	460 x 630 x 690	200	960 x 1270 x 1830	13,2 / 18	400 V 3/N	600
KK 250/13../14	1340 / 1400	520 x 630 x 770	250	1020 x 1270 x 1840	16,5 / 24	400 V 3/N	625
KK 330/13../14	1340 / 1400	580 x 710 x 800	330	1080 x 1350 x 1840	22 / 32	400 V 3/N	690
KK 480/13../14	1340 / 1400	630 x 770 x 995	480	1130 x 1410 x 1860	32 / 40	400 V 3/N	800
KK 600/13../14	1340 / 1400	710 x 820 x 1030	600	1210 x 1460 x 1870	40 / 50	400 V 3/N	990
KK 750/13../14	1340 / 1400	710 x 1020 x 1030	740	1210 x 1660 x 1870	50 / 70	400 V 3/N	1100
KK 1000/13../14	1340 / 1400	910 x 1005 x 1145	1060	1410 x 1650 x 1990	70 / 85	400 V 3/N	1540
KK 1500/13../14	1340 / 1400	900 x 1200 x 1400	1510	1590 x 2090 x 2410	110	400 V 3/N	2290
KK 2000/13../14	1340 / 1400	1000 x 1300 x 1500	1950	1690 x 2190 x 2510	140	400 V 3/N	3010
KK 2500/13../14	1340 / 1400	1000 x 1500 x 1650	2480	1690 x 2390 x 2660	165	400 V 3/N	3250

Chamber furnaces with cubical furnace chamber T max. 1300 °C and 1400 °C



- Chamber furnaces with cubical furnace chamber for complex production processes
- Superb temperature uniformity up to +/- 5 °C in furnace chamber and further improved with heating from five sides (from both sides, rear wall, door and bottom)
- Robust housing design with double-walled lining, exceptionally low outer-wall temperature
- Door lintel made of stainless steel, corrosion resistant
- Door hinged on the right, easily opened by approx. 180°
- Inlet flap in furnace floor for controlling cooling air inflow, exhaust flap in furnace roof
- Multilayer, asbestos-free insulation (lightweight refractory bricks and rear insulation), low heat loss, low energy consumption
- High-quality heating wire securely mounted to prevent slippage
- Heating elements wound on ceramic tubes and mounted in front of furnace wall, free heat radiation into chamber with resultant energy savings and longer service life
- Bottom heating elements covered by diathermic SiC plates, high mechanical strength, protection for bottom heating elements
- Base for convenient charging or integrated base included as standard



Technical Data

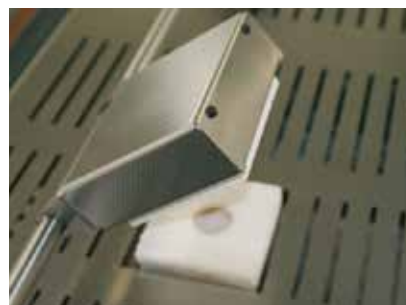
Model	T max [°C]	Inner dimensions [mm] Width x Depth x Height	Volume [l]	Outer dimensions [mm] Width x Depth x Height	Power [kW]	Voltage [V]	Weight [kg]
KC 16/13	1300	250 x 250 x 250	16	660 x 870 x 1360	6	400 V 3/N	155
KC 32/13	1300	320 x 320 x 320	32	730 x 940 x 1430	8	400 V 3/N	185
KC 64/13	1300	400 x 400 x 400	64	810 x 1020 x 1510	10	400 V 3/N	255
KC 128/13	1300	500 x 500 x 500	128	910 x 1120 x 1610	12	400 V 3/N	320
KC 220/13	1300	600 x 600 x 600	216	1010 x 1220 x 1710	20	400 V 3/N	410
KC 520/13	1300	800 x 800 x 800	512	1210 x 1420 x 1910	48	400 V 3/N	730
KC 1000/13	1300	1000 x 1000 x 1000	1000	1640 x 1840 x 1970	76	400 V 3/N	1480
KC 2000/13	1300	1250 x 1250 x 1250	1950	1890 x 2090 x 2220	140	400 V 3/N	2780

Chamber furnaces



Additional equipment:

- Customised furnace sizes
- Automatic control of inlet and exhaust flaps
- Cooling system with manual or automatic regulation
- Manually operated parallel hinged door opening to the side, or electrohydraulic lifting door opening upwards
- Multi-zone control for optimised temperature uniformity
- Thermal or catalytic exhaust air purification systems (see also pages 44-45)
- Furnace furniture according to customer specifications
- Exhaust hoods for controlled discharge of exhaust
- Operation under protective gas with sealed furnace housing



Technical Data

Model	T max [°C]	Inner dimensions [mm] Width x Depth x Height	Volume [l]	Outer dimensions [mm] Width x Depth x Height	Power [kW]	Voltage [V]	Weight [kg]
KC 16/14	1400	250 x 250 x 250	16	660 x 870 x 1360	6	400 V 3/N	155
KC 32/14	1400	320 x 320 x 320	32	730 x 940 x 1430	8	400 V 3/N	185
KC 64/14	1400	400 x 400 x 400	64	810 x 1020 x 1510	10	400 V 3/N	255
KC 128/14	1400	500 x 500 x 500	128	910 x 1120 x 1610	12	400 V 3/N	320
KC 220/14	1400	600 x 600 x 600	216	1010 x 1220 x 1710	20	400 V 3/N	410
KC 520/14	1400	800 x 800 x 800	512	1210 x 1420 x 1910	48	400 V 3/N	730
KC 1000/14	1400	1000 x 1000 x 1000	1000	1640 x 1840 x 1970	76	400 V 3/N	1480
KC 2000/14	1400	1250 x 1250 x 1250	1950	1890 x 2090 x 2220	140	400 V 3/N	2780

Bogie-hearth furnaces

T max. 900 °C, 1280 °C, 1340 °C and 1400 °C

- Robust housing design with double-walled lining and rear ventilation, exceptionally low outer-wall temperature
- Furnace door designed as hinged door, simple and easy to open
- Door lintel made of stainless steel, corrosion resistant
- Stable bogie hearth on highly rigid PU-coated steel wheels, freely movable, easily steered
- Air inlet sliding valve in bogie hearth for controlling cooling air inflow, exhaust flap in furnace roof
- Multilayer, asbestos-free insulation (lightweight refractory bricks and rear insulation), low heat loss, low energy consumption
- Heated from five sides (from both sides, rear wall, door and bottom), uniform temperature distribution in furnace chamber
- High-quality heating wire securely mounted to prevent slippage
- Heating elements wound on ceramic tubes and mounted in front of furnace wall, free heat radiation into chamber with resultant energy savings and longer service life
- Bottom heating elements in bogie hearth covered by diathermic SiC plates, high mechanical strength, protection for bottom heating



Technical Data 900 °C and 1280 °C - Models

Model	T max [°C]	Inner dimensions [mm] Width x Depth x Height	Volume [l]	Outer dimensions [mm] Width x Depth x Height	Power [kW]	Voltage [V]	Weight [kg]
WK 500/09../12	900/1280	600 x 1500 x 600	540	1290 x 2530 x 1610	36 / 40	400 V 3/N	2400
WK 1000/09../12	900/1280	850 x 1200 x 800	1020	1450 x 1800 x 2000	50 / 70	400 V 3/N	2950
WK 1500/09../12	900/1280	1000 x 1500 x 1000	1500	1600 x 2100 x 2000	70 / 95	400 V 3/N	3200
WK 2000/09../12	900/1280	1000 x 2000 x 1000	2000	1600 x 2600 x 2000	95 / 125	400 V 3/N	3920
WK 3000/09../12	900/1280	1250 x 2400 x 1000	3000	1850 x 3000 x 2000	125 / 140	400 V 3/N	4850
WK 4000/09../12	900/1280	1250 x 3200 x 1000	4000	1850 x 3800 x 2000	140 / 160	400 V 3/N	5400
WK 5000/09../12	900/1280	1200 x 3600 x 1200	5180	1890 x 4630 x 2250	140 / 185	400 V 3/N	6380
WK 6000/09../12	900/1280	1200 x 4000 x 1200	6000	1850 x 4600 x 2200	160 / 200	400 V 3/N	7600
WK 7000/09../12	900/1280	1200 x 4000 x 1400	7000	1850 x 4600 x 2400	200 / 240	400 V 3/N	7600
WK 8000/09../12	900/1280	1400 x 4000 x 1400	7840	2090 x 5030 x 2470	186 / 236	400 V 3/N	9900
WK 10000/09../12	900/1280	1250 x 7000 x 1250	10940	1940 x 8030 x 2300	236 / 300	400 V 3/N	10800

Other sizes on request

Bogie-hearth furnaces

- Customised designs -

Furnace system for sintering ceramic fuel cells, consisting of 1 x WKF 1200/09 and 2 x WKF 2600/09

- Prepared for operation with process gas
- T max. 900 °C
- Temperature uniformity +/- 5K
- With horizontal air circulation at 900 °C, speed-controlled circulation motors
- Air duct system made of rustproof heat-resistant steel
- 3-zone regulation
- Automatic cooling system
- Exhaust air extraction via automatic flap control in furnace roof
- Furnace chamber with fibre insulation for short cycle times



Bogie-hearth furnace 1m³ up to 1400 °C

- Bogie-hearth furnace with freely moveable bogie
- Electro-hydraulic lift door, vertically opening, with control element within the viewing range of the door
- Linear cooling system via PLC-control system
- Multi-zone control for high temperature uniformity





Bogie-hearth furnaces

T max. 900 °C, 1280 °C, 1340 °C and 1400 °C

Additional equipment:

- Customised furnace sizes
- Furnaces also available with complete fibre insulation and meander-shaped heating elements for fast firing cycles
- Configuration with second door instead of rear wall and with two bogie hearths for loading batches from both sides
- Lifting doors with electrical or hydraulic drive
- Bogie hearths on rails with steel wheel for heavy loads
- Electrical bogie-hearth drive unit
- Customised transverse shunting device in front of the furnace, with parking rails
- Automatic regulation of inlet and exhaust flaps
- Cooling system with manual or automatic regulation
- Multi-zone control for optimised temperature uniformity
- Thermal or catalytic exhaust air purification systems
- Furnace furniture according to customer specifications

Technical Data 1340 °C and 1400 °C - Models

Model	T max [°C]	Inner dimensions [mm] Width x Depth x Height	Volume [l]	Outer dimensions [mm] Width x Depth x Height	Power [kW]	Voltage [V]	Weight [kg]
WK 500/13../14	1300 / 1400	600 x 1500 x 600	540	1290 x 2530 x 1610	56	400 V 3/N	2400
WK 1000/13../14	1300 / 1400	850 x 1200 x 1000	1020	1450 x 1800 x 2000	70	400 V 3/N	2950
WK 1500/13../14	1300 / 1400	1000 x 1500 x 1000	1500	1600 x 2100 x 2000	95	400 V 3/N	3200
WK 2000/13../14	1300 / 1400	1000 x 2000 x 1000	2000	1600 x 2600 x 2000	125	400 V 3/N	3920
WK 3000/13../14	1300 / 1400	1250 x 2400 x 1000	3000	1850 x 3000 x 2000	140	400 V 3/N	4850
WK 4000/13../14	1300 / 1400	1250 x 3200 x 1000	4000	1850 x 3800 x 2000	160	400 V 3/N	5400
WK 5000/13../14	1300 / 1400	1200 x 3600 x 1200	5180	1890 x 4630 x 2250	236	400 V 3/N	6380
WK 6000/13../14	1300 / 1400	1250 x 4000 x 1200	6000	1850 x 4600 x 2200	200	400 V 3/N	7600
WK 7000/13../14	1300 / 1400	1250 x 4000 x 1400	7000	1850 x 4600 x 2400	240	400 V 3/N	8700
WK 8000/13../14	1300 / 1400	1400 x 4000 x 1400	7840	2090 x 5030 x 2470	300	400 V 3/N	9900
WK 10000/13../14	1300 / 1400	1250 x 7000 x 1250	10940	1940 x 8030 x 2300	360	400 V 3/N	10800

Other sizes on request

Hood furnaces

T max. 900 °C, 1280 °C, 1340 °C and 1400 °C

- Broad range of standard furnaces with a chamber volume of 70 – 2000 l
- Available as lift-bottom version (table retracts into heating mantle) or as lift-top version (heating mantle is lowered onto the table)
- The range of models includes hood furnaces with a fixed or moveable table
- Also with shuttle table systems (turntable or dual-table systems) for semi- or fully automatic operation.
- Furnaces supplied in customised configurations to match the systems precisely to the desired processes
- All furnace models excel with maximum precision and convenience as well as short heat-up and cooling times and low power consumption.
- Outer housing with robust, aesthetic frame construction
- Double-walled housing with forced cooling, hence very low outer-wall temperatures
- Proven electromechanical drive systems for smooth, shock-free movement of table or hood
- Furnace insulation made of lightweight refractory bricks or high-quality fibre materials with low thermal mass, rapid heat-up and cooling possible
- Labyrinth seals in table and hood ensure tight closure
- Heating from five sides (four side walls of the heating mantle and bottom), excellent temperature uniformity
- Cutting-edge control and regulation system, high-precision furnace regulation
- Exhaust opening in furnace roof
- Automatic cooling fan for controlled cooling available as option



(1) Furnace hood with fibre insulation and meander-shaped heating elements
 (2) Hood furnace model HK 2000/12 with fibre insulation and meander-shaped heating elements

Model	T max [°C]	Inner dimensions [mm]		Volume [l]
		Width	Depth x Height	
HK 70/.. LB/LT		420 x 420	420	70
HK 170/.. LB/LT	900/	550 x 550	550	170
HK 300/.. LB/LT	1280/	1100 x 500	550	300
HK 500/.. LB/LT	1340/	1200 x 500	800	480
HK 1000/.. LB/LT	1400	1800 x 700	800	1000
HK 1500/.. LB/LT		2200 x 850	800	1500
HK 2000/.. LB/LT		2400 x 1000	800	1920

Other sizes on request

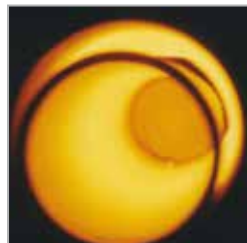


Tube furnaces

up to 1300 °C

THERMCONCEPT manufactures tube furnaces in different variations for applications in research and production. Customised design is our forte.

- Tube furnaces for temperature ranges up to 1300 °C
- Single- or multi-zone subdivision of the heated tube length
- Horizontal or vertical design
- Multi-tube furnaces
- Rotary tube furnaces
- Can be operated under standard atmosphere, controlled atmosphere or vacuum
- Extensive range of additional equipment



Split tube furnace 1200 °C, 5-zone

Split tube furnace with five separately regulated heating zones.

Split housing with half-shell modules for heating and insulation. Heated length of 1200 mm.

Separate switching unit and furnace, allowing vertical or horizontal operation.

Available with different tube diameters and heated lengths.



Tube furnaces

up to 1300 °C

Rotary tube furnace for temperatures up to 1300 °C

Rotary tube furnaces are very versatile for continuous operation. The furnace has a heated length of 750 mm. The tube diameter is 180 mm. Other tube diameters and heated lengths are also available.

The speed of rotation is infinitely variable between 1 and 30 rpm. The tilt of the tube can be infinitely varied up to 10°. A complex mounting system allows the rotating tube to be guided with precision.



4-tube furnace 1250 °C

Custom-designed tube furnace with four ceramic working tubes. The 1500 mm of heated length is subdivided into three heating zones.

Each working tube has an inner diameter of 110 mm and a total length of 2500 mm. A specially designed system compensates the thermal expansion of the ceramic tubes.

5-zone tube furnace 1300 °C

Horizontal five-zone tube furnace. The heated length is subdivided into five separately regulated zones. The working tube is made of gas-tight ceramics. In combination with water-cooled stainless steel flanges, the furnace can be operated with different gas atmospheres.





Combi-furnaces for debinding and sintering

- with air preheating and safety equipment -

T max. 1280 °C - 1400 °C

Combi-furnaces allow debinding and sintering processes to be performed without a change of furnace. For the debinding process in the lower temperature, preheated fresh air is blown in gently through a large number of optimally positioned ceramic tubes with air outlets. The result is excellent temperature uniformity and a high change of atmosphere. This ensures safe and reliable removal of organic components from the furnace.



Perforated ceramic tubes for injecting preheated fresh air



When debinding has finished, the sintering process is initiated by a programmed controller without transition and without intermediate cooling. The system is then operated as a sintering furnace with the advantages of high-temperature capability, a steady sintering atmosphere and long service life.

Safety equipment

Combi-furnaces can be fitted with safety equipment for monitoring the pressure inside the furnace, the volumetric flow of fresh air and exhaust air, with emergency functions for preventing the formation of explosive mixtures.



Combi-furnaces for debinding and sintering

- with air preheating and safety equipment -

T max. 1280 °C - 1400 °C

KK 150/12 DB – KK 500/14 DB furnace series

- Robust housing design with double-walled lining, exceptionally low outer-wall temperature
- Heated from five sides (from both sides, rear wall, door and bottom), uniform temperature distribution in furnace chamber
- Bottom heating elements cover with SiC plates, level base for stacking
- Air preheating: preheated fresh air is blown horizontally into the furnace at temperatures up to max. 500 °C
- Separate exhaust pipes with stainless steel exhaust hood
- Automatic control of exhaust flaps
- Two-zone furnace regulation with separate additional controller for fresh air preheating
- Superb temperature uniformity in the furnace chamber
- Fully automatic systems for control and regulation



Technical Data

Model	T max [°C]	Inner dimensions [mm] Width x Depth x Height	Volume [l]	Outer dimensions [mm] Width x Depth x Height	Power [kW]	Voltage [V]
KK 150/12 DB	1280	430 x 520 x 640	145	940 x 1150 x 1750	23	400 V 3/N
KK 250/12 DB	1280	430 x 660 x 760	215	910 x 1290 x 1870	27	400 V 3/N
KK 350/12 DB	1280	480 x 800 x 800	310	960 x 1430 x 1910	42	400 V 3/N
KK 500/12 DB	1280	580 x 780 x 1000	450	1340 x 1670 x 2010	54	400 V 3/N
KK 150/13 DB	1340	430 x 520 x 640	145	940 x 1150 x 1750	23	400 V 3/N
KK 250/13 DB	1340	430 x 660 x 760	215	910 x 1290 x 1870	27	400 V 3/N
KK 350/13 DB	1340	480 x 800 x 800	310	960 x 1430 x 1910	42	400 V 3/N
KK 500/13 DB	1340	580 x 780 x 1000	450	1340 x 1670 x 2010	54	400 V 3/N
KK 150/14 DB	1400	430 x 520 x 640	145	940 x 1150 x 1750	23	400 V 3/N
KK 250/14 DB	1400	430 x 660 x 760	215	910 x 1290 x 1870	27	400 V 3/N
KK 350/14 DB	1400	480 x 800 x 800	310	960 x 1430 x 1910	42	400 V 3/N
KK 500/14 DB	1400	580 x 780 x 1000	450	1340 x 1670 x 2010	54	400 V 3/N

Other sizes on request



Combi-furnaces for debinding and sintering

- with air preheating and safety equipment -

T max. 1280 °C - 1400 °C

Exhaust air purification

All combi-furnaces can be fitted with systems for thermal or catalytic exhaust air purification. Exhaust air purification is then an integrated part of process control.

Additional equipment:

- Customised designs in respect of furnace size, temperature, furnace regulation
- Multi-zone regulation of furnace heating for optimised temperature uniformity in the furnace chamber
- Thermal or catalytic exhaust air purification
- Controlled atmosphere operation
- Software package for operating the furnace system, for visualisation and for analysis of processes



Gas-fired furnaces systems

for debinding and sintering

- Gas-fired combi-furnaces for debinding and sintering at temperatures up to 1400 °C
- With safety equipment for monitoring chamber pressure and volumetric flow of fresh air and exhaust air
- Emergency function for preventing formation of explosive mixtures
- Supplied with thermal or catalytic exhaust air purification
- Fully automatic program flow control
- Software package for operation, visualisation and analysis
- Customised furnace designs



Combi-furnaces for debinding and sintering

- High-temperature chamber furnaces with air preheating and safety equipment -

T max. 1600 °C - 1750 °C

HTK 70/16 DB – HTK 300/17 DB

- High-temperature chamber furnaces as combi-furnaces with up to 300 l volume and T max. 1750 °C
- Air preheating: preheated air is blown horizontally into the furnace at temperatures up to max. 500 °C
- Automatic transition to sintering process up to the maximum temperature
- Double-walled housing with forced cooling, hence very low outer-wall temperatures
- Furnace insulation made of high-quality aluminium oxide fibre materials with low thermal mass, extremely rapid heat-up and cooling possible
- With reinforced bottom and level base for stacking, to protect the insulation and for receiving heavy loads
- Automatic control of exhaust flaps, with separate exhaust pipes and stainless steel exhaust hood
- Multi-zone furnace regulation with separate additional controller for fresh air preheating
- Fully automatic system regulation by Siemens PLC S7-300



Technical Data

Model	T max [°C]	Inner dimensions [mm] Width x Depth x Height	Volume [l]	Outer dimensions [mm] Width x Depth x Height	Power [kW]	Voltage [V]	Weight [kg]
HTK 70/16 DB	1600	400 x 400 x 400	64	1100 x 835 x 1790	19	400 3/N	550
HTK 160/16 DB	1600	500 x 550 x 550	150	1200 x 975 x 1940	25	400 3/N	700
HTK 300/16 DB	1600	500 x 1100 x 550	300	1260 x 1605 x 1940	50	400 3/N	1300
HTK 70/17 DB	1750	400 x 400 x 400	64	1100 x 835 x 1790	19	400 3/N	550
HTK 160/17 DB	1750	500 x 550 x 550	150	1200 x 975 x 1940	25	400 3/N	700
HTK 300/17 DB	1750	500 x 1100 x 550	300	1260 x 1605 x 1940	50	400 3/N	1300



Air-circulation chamber furnaces

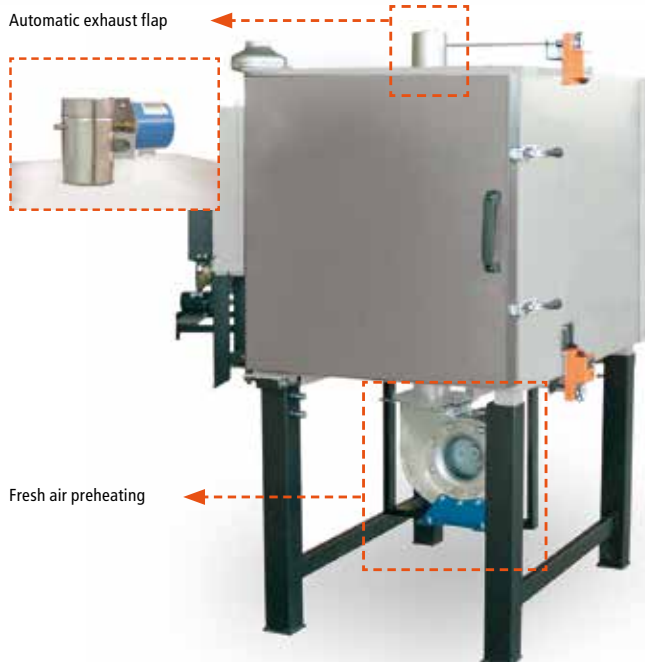
T max. 750 °C

Debinding technical ceramics requires very homogenous distribution of temperatures in the furnace chamber, especially during the heating-up phase. Air-circulation furnaces are particularly suited to this purpose because the controlled circulation of air in the furnace ensures excellent temperature uniformity. These debinding furnaces are also fitted with ventilation and automatic exhaust flap control, and the housing is effectively gas-tight.

- Furnace housing welded for gas-tightness
- Inner lining made of heat-resistant stainless steel
- Furnace door with additional seals
- 3 trays included as standard
- Ball valve for additional ventilation
- Exhaust outlets with automatic flap control
- Gas inlet and outlet for operation under controlled atmosphere

Additional equipment:

- Customised designs
- Fresh air preheating
- Purging with inert gas
- Catalytic or thermal exhaust air purification
- Safety equipment
- Inert-gas retorts
- Charging aids



Technical Data

Model	T max [°C]	Inner dimensions [mm] Width x Depth x Height	Volume [l]	Outer dimensions [mm] Width x Depth x Height	Power [kW]	Voltage [V]
KU 140/07 DB	750	450 x 600 x 500	135	760 x 1260 x 1470	14	400 V 3/N
KU 270/07 DB	750	600 x 750 x 600	270	950 x 1460 x 1610	22	400 V 3/N
KU 540/07 DB	750	750 x 900 x 800	540	1100 x 1610 x 1820	29	400 V 3/N

Air-circulation bogie-hearth furnaces

T max. 650 °C and 850 °C

Air-circulation bogie-hearth furnaces allows charging outside the furnace using the removable bogie hearth. Bogie-hearth furnaces are also suitable for receiving heavy loads. The powerful air circulation system ensures good temperature uniformity of up to +/- 3K.

- Furnaces for maximum temperatures of 650 °C and 850 °C
- Rugged housing design
- Inner lining made of heat-resistant stainless steel
- Bogie hearth can be moved freely
- Powerful air circulation fans in furnace roof, high air change rate
- Vertical air circulation, optimal temperature uniformity

Additional equipment:

- Customised designs
- Atmosphere box for operation under protective gas
- Hydraulic lifting door
- Rail-bound bogie-hearth operation with electrical bogie drive
- Air supply and extraction systems
- Automatic exhaust flaps and cooling systems for fast cooling
- Multi-zone regulation for further improvements



Technical Data

Model	T max [°C]	Inner dimensions [mm] Width x Depth x Height	Volume [l]	Outer dimensions [mm] Width x Depth x Height	Power [kW]	Voltage [V]	Weight [kg]
WM 1000/06/A	650	1000 x 1000 x 1000	1000	2200 x 1800 x 3200	47	400 3/N	1420
WM 1500/06/A	650	1000 x 1500 x 1000	1500	2200 x 2300 x 3200	59	400 3/N	1570
WM 2000/06/A	650	1000 x 2000 x 1000	2000	2200 x 2800 x 3200	75	400 3/N	1950
WM 3600/06/A	650	1300 x 2500 x 1100	3580	2500 x 3100 x 3500	93	400 3/N	2400
WM 5500/06/A	650	1300 x 3100 x 1250	5040	2500 x 3800 x 3700	101	400 3/N	4600
WM 7200/06/A	650	1300 x 3100 x 1250	6980	2800 x 3800 x 3900	117	400 3/N	5300
WM 1000/08/A	850	1000 x 1000 x 1000	1000	2200 x 1800 x 3200	50	400 3/N	1630
WM 1500/08/A	850	1000 x 1500 x 1000	1500	2200 x 2300 x 3200	66	400 3/N	1860
WM 2000/08/A	850	1000 x 2000 x 1000	2000	2200 x 2800 x 3200	86	400 3/N	2190
WM 3600/08/A	850	1300 x 2500 x 1100	3580	2500 x 3100 x 3500	101	400 3/N	2710
WM 5500/08/A	850	1300 x 3100 x 1300	5040	2500 x 3800 x 3700	156	400 3/N	5240
WM 7200/08/A	850	1300 x 3100 x 1250	6980	2800 x 3800 x 3900	168	400 3/N	6050

Other sizes on request



Furnaces for pilot plant

Inert-gas retort furnaces up to 1100 °C

Inert-gas retort furnaces are suitable for processes that must be carried out under a defined atmosphere. The furnace range includes chamber and shaft furnaces. Retort furnaces are supplied with or without gas circulation.

Custom-designed tube furnace for environmental investigations

Horizontal tube furnace up to 1500 °C. Four separately regulated zones, sample transport unit, sample rotation, temperature measurement close to sample, different atmospheres which can be injected near the sample. The furnace itself is not gas-tight.



Special high temperature furnace for melting of granules

- High-temperature chamber furnace up to 1750 °C for melting of granules
- Re-inforced bottom with special crucible fixture and outlet to drain melt into a water bath below the chamber
- Stainless steel hood to collect and remove fumes from the melt



Furnaces for pilot plant

Laboratory furnace for testing of fuel cells

Electrically heated chamber furnace up to 1100 °C, individually adapted to customers specification, with double-wing door and pressure indenter for testing and small scale production of fuel cells.

On the top of the furnace a pneumatic pressure indenter with up to 500 kg is mounted to press stacked fuel cells during the heating cycle.



Apparatus for determining hot bending strength (hot modulus of rupture – HMOR)

This furnace system was developed to determine the hot modulus of rupture of new refractory materials. The furnace is designed for a maximum temperature of 1600 °C. The gas-tight housing allows different gas atmospheres to be used. The oxygen partial pressure is monitored online by an oxygen sensor.

A walking beam system is installed to permit simultaneous introduction of six probes; transport is semi-automatic. Samples with a maximum size of 25 x 25 x 150 mm can be measured using the three-point bending method. All relevant process and experimental data are recorded by the software supplied with the system and can be further processed.

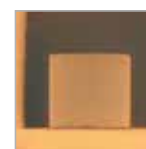


MTA system (multiple thermal analysis)

This system combines several thermal analysis methods in a single unit. Samples with dimensions of up to 50x50 mm (Ø x h) can be studied at temperatures between 1300 °C and 1700 °C.

Due to the large sample size, this method is particularly suitable for heterogeneous samples. Gravimetric changes are recorded continuously as a function of temperature. The geometric changes and appearance of the sample are recorded by a CCD camera. With this newly developed method, physical chemical processes can be studied in up to five samples simultaneously.

The measurements are performed on pressed samples, which allows the study of reactions in real pressed products. The individually recorded data are correlated and analysed using a specially developed software application based on LabView©.



Laboratory furnaces



Compact muffle furnaces T max 1000 °C - 1200 °C

- Compact universal muffle furnaces providing outstanding value for money
- Heating from several sides
- Furnace insulation made completely of high-quality fibre materials with low thermal mass, rapid heat-up
- Power controlled by solid-state relays, high-precision furnace regulation, wear-free, noiseless
- Exhaust opening on back of furnace
- Volumes between 2 and 15 litres



Laboratory chamber furnaces T max 1100 °C - 1600 °C

- Compact laboratory chamber furnaces with heating from several sides by heating wire or SiC rods
- Double-lined housing with rear ventilation for exceptionally low outer casing temperature
- Vertical parallel door, hot inner side of door faces away from operator
- Furnace insulation made completely of high-quality lightweight refractory bricks with low thermal mass, rapid heat-up
- Power controlled by solid-state relays, high-precision furnace regulation, wear-free, noiseless
- Exhaust opening on back of furnace
- Volumes between 5 and 45 litres



Laboratory high-temperature furnaces

T max 1500 °C - 1800 °C

- Compact high-temperature laboratory furnaces with heating from several sides by MoSi₂ heating elements
- Double-lined housing with rear ventilation for exceptionally low outer casing temperature
- Vertical parallel door, hot inner side of door faces away from operator
- Furnace insulation made completely of high-quality aluminium oxide materials with low thermal mass, extremely rapid heat-up and cooling possible
- Power controlled by thyristors, high-precision furnace regulation, wear-free, noiseless
- Exhaust opening in furnace roof
- Volumes between 2 and 16 litres

Laboratory furnaces

Laboratory tube furnaces T max 1100 °C - 1800 °C

- Compact universal tube furnaces providing outstanding value for money
- Available for horizontal, diagonal and vertical operation
- Heating from all sides
- Furnace insulation made completely of high-quality fibre materials with low thermal mass, rapid heat-up
- Power controlled by solid-state relays or thyristors, high-precision furnace regulation, wear-free, noiseless
- Tubes with diameters from 20 to 300 mm
- Heated lengths of tube from 180 to 900 mm
- Tubes made of different materials, such as Sillimantine, Alsint, quartz glass, etc. can be used
- Also available with flanges for protective gas atmospheres or vacuum operation
- Also available in split design



Laboratory elevator furnaces T max 1600 °C - 1800 °C

- Compact elevator furnaces for the laboratory, with heating from several sides by MoSi₂ heating elements
- Double-lined housing with rear ventilation for exceptionally low outer casing temperature
- Smooth, shock-free movement of bottom by means of electromechanical drive
- Furnace insulation made completely of high-quality aluminium oxide materials with low thermal mass, extremely rapid heat-up and cooling possible
- Power controlled by thyristors, high-precision furnace regulation, wear-free, noiseless
- Exhaust opening in furnace roof
- Volumes between 2 and 70 litres



Laboratory drying cabinets T max 200 °C - 300 °C

- Fast, precision laboratory dryer with or without air circulation or vacuum
- Particularly suitable for materials with high moisture content, for complex and exact tests and drying processes
- Chamber volumes 23 – 715 litres
- Temperature range from +10 °C to ambient temperature and up to 300 °C
- High level of operator convenience, exact temperature regulation and short temperature compensation times within the chamber after loading
- Microprocessor controller included in standard version
- Operating elements on membrane keyboard
- Process information on LCD display





Gas-fired furnaces

T max. 900 °C - 1400 °C

For the temperature range between 900 °C and 1400 °C, THERMCONCEPT supplies different furnaces individually designed to meet the specific requirements of customers:

- Furnace systems for temperatures up to 1400 °C
- Various furnace types (chamber furnaces, bogie hearth furnaces, hood furnaces, driving hood furnaces)
- Superb firing results
- Low power consumption due to special multilayer refractory lining with best insulation properties
- Burner systems with large performance range, specially designed to match the furnace
- Automatic control of burner atmosphere
- Start-up of furnace at low temperature with high temperature uniformity and without sudden temperature changes
- Optimal temperature distribution by means of multi-zone control and special flue gas routing system
- Cutting-edge control and regulation system with optimal process control for fully-automatic system operation, perfectly matching the needs of users
- Minimal maintenance required

Bogie-hearth furnaces T max. 1400 °C

Bogie-hearth furnaces for sintering pigments. Useable space: 1100 x 3100 x 1500 mm (wxdxh). Fitted with manually operated revolving door and electrical bogie-hearth drive unit. Each furnace is fitted with two bogie hearths.

The furnaces have a 3-layer insulation lining made of light-weight JM 30 refractory bricks (graded for up to 1600 °C).

Heating is performed by eight high-speed burners each having a rated power of 150 kW. Fully automatic furnace regulation with regulated cooling of batch in furnace. Number of regulated zones: 3.

The furnace system is also designed for operation under a reducing atmosphere.

Gas-fired furnaces

T max. 900 °C - 1400 °C

Chamber furnaces T max. 1100 °C

The system consists of three furnaces and is used for firing SiC catalysts.

Useable space: KK 2400/11: 1650 x 1200 x 1200 mm (wxdxh)
KK 4200/11: 2700 x 1300 x 1200 mm (wxdxh)

The furnaces are fitted with a hydraulic lifting door. Heating is carried out by eight or ten high-speed burners. Fully automatic furnace regulation with regulated cooling of batch in furnace. Number of regulated zones: 2



Hood furnaces T max. 1200 °C

- Useable space: 11000 x 3000 x 1500 (wxdxh)
- Useable volume: approx. 50 m³
- The heating mantle is raised hydraulically. Fast, convenient loading and unloading of the furnace is possible from both sides



Bogie-hearth furnace for temperatures up to 1200 °C

- Useable space: 6000 x 8000 x 4000 mm (wxdxh)
- Useable volume: approx. 200 m³
- Electrically operated lifting door and electrical bogie-hearth drive unit
- Heated by 26 high-speed burners
- Fully automatic furnace regulation across eight regulated zones
- The furnace system is also suitable for operation under a reducing atmosphere.





Gas-fired high-temperature furnaces

T max. up to 1600 °C

In the production of technical ceramics and refractory materials, gas-fired high-temperature furnaces are often used for sintering the components. THERMCONCEPT supplies different furnace concepts that allow precise adaptation to the respectively required process.

- Furnace systems for temperatures up to 1600 °C
- Various furnaces types (chamber furnaces, bogie hearth furnaces, hood furnaces, driving hood furnaces)
- Superb firing results
- Low power consumption due to special multilayer refractory lining with best insulation properties
- Burner systems with large performance range, specially designed to match the furnace
- Automatic control of burner atmosphere
- Start-up of furnace at low temperature with high temperature uniformity and without sudden temperature changes
- Optimal temperature distribution by means of multi-zone control and special flue gas routing system
- Cutting-edge control and regulation system with optimal process management for fully-automatic operation, perfectly matching the needs of users
- Minimal maintenance required

Driving hood furnace system 1600 °C

Driving hood furnace system for firing SiC crucibles up to T max. 1600 °C.

Useable space: 2800 x 8300 x 2500 mm (wxdxh).

The heated furnace hood is moved alternately between two positions. Electrical drive. Space for an additional furnace system is already prepared.

Gas-fired high-temperature furnaces

T max. up to 1600 °C

Chamber furnace 1600 °C

Gas-fired chamber furnaces for sintering pigments with nine burners. Short cycle times due to automatically controlled cooling fan



Bogie-hearth furnace 1600 °C

Bogie-hearth furnace for sintering pigments in capsules, with transverse shunting device. The bogie hearths are rail-bound and are moved into the parking rails by electrical drives.



Bogie-hearth furnace 1600 °C

Gas-fired bogie-hearth furnace with transverse shunting device for sintering grinding discs. While one bogie is in the furnace, two additional bogies can be loaded.

All bogie hearths are rail-bound and can be pushed into the parking rails via the transverse shunting device either manually or by an electric drive.



Hood furnace 1600 °C

This gas-fired furnace system is designed as a hood furnace and is used for sintering insulators.





Catalytic and thermal purification of exhaust air

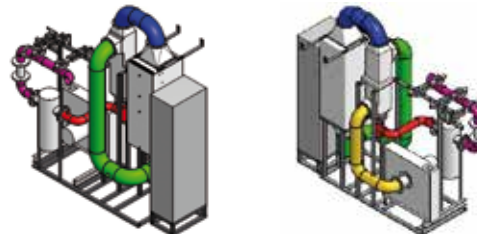
Many thermal processes in technical ceramics, dental ceramics and other fields result in the release of volatile organic compounds. Compliance with emission limits requires the use of downstream exhaust air purification systems. THERMCONCEPT supplies catalytic and thermal exhaust air purification systems that are customised for the specific process.

Catalytic exhaust air purification system

THERMCONCEPT catalytic converters work with honeycomb ceramics that are coated with needle-shaped Perovskite crystals and which have a high resistance against most catalyst poisons.

Catalytic exhaust air purification systems are designed according to the volumetric flow of exhaust gas and the composition and concentration of the organic compounds. Depending on the specifically intended use, these compounds are catalytically oxidised at temperatures between 280 °C and 500 °C and are entirely converted into carbon dioxide and water.

THERMCONCEPT supplies integrated plants consisting of the furnace system, the catalytic exhaust air purification unit and a PLC controller for the entire process. The plant also includes the required safety equipment in accordance with the EN 1539 standard and also can be supplied, on request, with a matching exhaust pipe.



Thermal exhaust air purification systems

THERMCONCEPT designs, builds and supplies thermal post-combustion systems for different applications. This robust and versatile type of exhaust air purification is generally deployed when an undefined crude gas is used, or when catalyst poisons exclude the use of a catalytic purifier. Organic components in the exhaust air are burned completely at temperatures of approx. 750 °C.

- Standing, lying or suspended design
- With noise control measures (installation of silencers, noise control booths)
- Insulation with high-quality ceramic fibres for combustion temperatures up to 1200 °C
- Heating by means of gas or oil burners; electrical heating also possible
- Volumetric flow rates of 50 nm³ /hr to 15000 nm³ /hr
- Optionally fitted with heat exchangers for heat recovery
- Exhaust gas chimney and pipes available on request
- System fitted with the required safety equipment

The THERMCONCEPT service range:

- Planning and design of exhaust air purification systems in new and old systems
- Support with official approval procedures and emission measurements
- Integration with upstream and downstream processes
- Integration in existing conveyor and handling solutions
- Tests in our high-temperature pilot plant

THERMCONCEPT deploys thermal post-combustion in furnace systems heated electrically or with gas. The priority is always to supply a customised turnkey solution for the user's specific process, comprising the furnace, thermal post-combustion unit, safety equipment and process control.



The photo shows a gas-fired furnace for dewaxing with thermal post-combustion, program flow control and temperature regulation using a Siemens-PLC S7 313 with TP 170 touch panel.





Process control and documentation

State-of-the-art control technology is fitted as standard in THERMCONCEPT furnaces. Microprocessor controllers ensure precise furnace regulation of both simple and complex processes. The program controllers are extremely user-friendly. The wide range of standard controllers matches the various types of furnaces and covers most customer requirements.

Eurotherm 3208/3204 temperature controller:

- 8 segments (4 ramps, 4 holding times)
- 1 program
- 1 programmable function
- Optional RS 232/485 and iTools
- Multi-zone control as option

Eurotherm 3508/3504 temperature controller:

- Total of 500 segments, freely editable
- 10 programs
- 7-day preselect clock for delay program start
- Optional RS 232/485 and iTools
- Multi-zone control as option
- Several programmable functions (optional)
- Cascade control system (optional)

Eurotherm 3216i/32h8i over-temperature controller:

- Alarm message in clear text
- Can be deployed as a temperature limiter or as a temperature selection limiter
- Alarms in accordance with FM/DIN 3440

Bentrup TC 505 temperature controller:

- 5 segments per program (2 ramps, 2 holding times, 1 cooling ramp)
- 30 programs (6 fixed, 24 modifiable)
- Programmable lead time (00.00-99.59 hrs)
- Optional RS 232/485 and software
- Multi-zone control (max. 3 zones) as option
- Several programmable functions

Bentrup TC 507 temperature controller:

- Up to 99 segments (ramp and holding time)
- Up to 99 programs can be stored
- Programmable lead time (00.00-99.59 hrs)
- Optional RS 232/485 and software
- Multi-zone control (max. 3 zones) as option
- Several programmable functions

Process control and documentation

The control system can be extended as required. Software packages for managing the controller and for evaluating the processes are available, as is visualisation software. On request, we can install Siemens S7 control systems featuring Siemens touch panels as user interface.

In addition to our proven standard systems, we also design switching and control systems according to customer wishes, in compliance with special plant standards and equipment regulations.

Siemens S7 controllers, Simatic Panel with remote maintenance:

PLC controllers based on the Siemens S7 controller, with remote maintenance option, are used to meet challenging requirements in respect of process control and documentation.

THERMCONCEPT user interfaces:

THERMCONCEPT designs its own user interfaces that meet most requirements for simple operation and monitoring even in the standard version. In more advanced versions, all functions and the entire process can be graphically displayed, stored and read out via various interfaces.

THERMCONCEPT software for control and analysis:

THERMCONCEPT supplies a range of software packages for programming, controlling, visualising and documenting temperature-related processes:

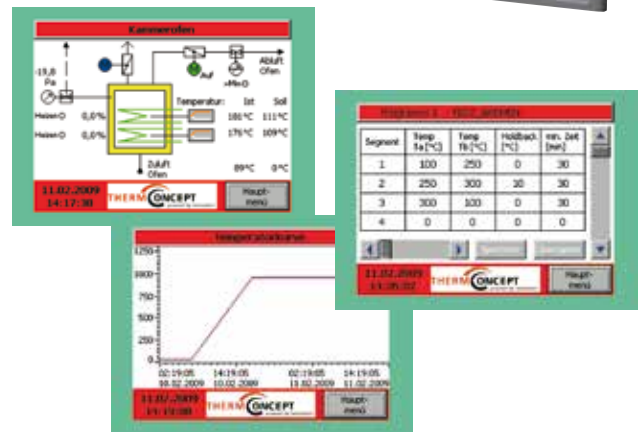
- Management of several furnaces simultaneously
- Furnace regulation from a central PC
- Detecting the temperature-time profile in accordance with DIN ISO 9000 ff.
- Documentation of batch data

Process documentation:

Various graphics, line or dot recorders are available.

Switching technology:

- From contactor control systems to thyristor control units
- Multi-zone control
- Cascade control system
- Remote maintenance systems
- Heating control using DC power packs
- Frequency-regulated drive controller
- Drive controllers for linear drives
- Control panel according to customer-specific plant standards and guidelines
- Air-conditioning for control panels



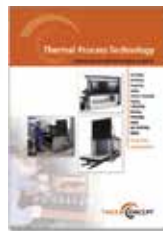
The product range at a glance



Brochure:
Kilns and Furnaces for
Ceramic and Glass



Brochure:
Laboratory Chamber &
Tube Furnaces



Brochure:
Thermal Process
Technology



Brochure:
Hardening, Tempering,
Quenching



Brochure:
Heat treatment
Accessories



Brochure:
Heat treatment
systems



Brochure:
Melting and Holding of
Non-Ferrous Metals

Ceramics and glass

THERMCONCEPT kilns and furnaces are used for many applications in the fields of ceramics and for processing glass in the craft trades and industry. Our chamber furnaces, bogie-hearth furnaces and hood furnaces are designed with electrical or gas heating. In addition to our wide range of proven standard models, we also supply customised furnace systems specially designed for your specific application.

Research and laboratory

Furnaces for research and laboratory applications can be supplied for temperatures between 200 °C and 1800 °C. Our range includes muffle furnaces, tube furnaces, drying cabinets, elevator furnaces and high-temperature furnaces.

Heat treatment of metals and plastics

We supply electrically heated and gas-heated industrial furnaces and systems for many different types of heat treatment. Our furnaces and systems are used for annealing, hardening, tempering, heat treatment, ageing, preheating, drying and age hardening of metals and plastics.

Annealing, hardening, tempering

Here you will find furnaces, systems and accessories for a wide range of heat treatment applications in the metalworking industry, for example in toolmaking. Virtually all the key requirements for heat treatment can be met with our proven range of products.

Foundry

The foundry range includes electrically heated and fuel-fired melting and holding furnaces for light and heavy metals, designed as bale-out furnaces or as tilting furnaces. We also supply furnaces for many different types of heat treatment in foundries.



THERMCONCEPT Dr. Fischer GmbH & Co. KG
Friedrich-List-Strasse 17 · D-28309 Bremen · Germany
Phone: +49 (0)421 - 4 09 70-0 · Fax: +49 (0)421 - 4 09 70-29
eMail: info@thermconcept.com · www.thermconcept.com