

## Thermal Processing Equipment for the manufacture of high quality components



### **CAF 2.0 (Changeable Atmosphere Furnace)**

Sinter furnaces for the production of products, made from:

- high purity metals and metal alloys
- PIM, MIM & CIM
- silicate ceramics
- oxide ceramics
- non-oxide ceramics
- cermets
- rare earths
- fine chemicals
- carbon chemistry
- heat treatment refining





## CAF 2.0 Laboratory furnaces, user-friendly - modular - flexible

MUT's CAF furnace series is on the market since 1997. Since that time there have been two major revisions. The second revision has now been successfully launched. Experiences from research, laboratory and industry have been incorporated.

The special design features of the new series are:

- The way of introducing the process heat is realized in the same way as with industrial plants
- Scaling up processes to larger batch volumes is easy and without any risk to realize
- The modular system covers furnace sizes from laboratory to pilot production
- Design for mass production in industrial applications is available too

## CAF 2.0 advantages at a glance:




- Modular system; compact and flexible
- Simple and user friendly operation via touch panel
- High reliability, thus little need for repair
- Minimal footprint, due to a steel frame with integrated peripherals, such as: gas supply, cooling water distribution and transformer
- Decentral control components
- Double-walled water-cooled stainless steel jacket with two major openings (bottom-flange for loading and unloading; top-flange for service)
- Different hot-zone types with single zone controlled circumferentially oriented heaters (graphite, molybdenum, tungsten, MoSi<sub>2</sub> with ceramic fibre insulation – depending on type of process atmosphere)
- Mechanically unencumbered freely suspended heating elements for a long service life
- Cylindrical working chamber circumferentially heated (Ø x H) to achieve excellent temperature uniformity; temperature uniformity ≤ 5 K according to DIN 17052-1 and AMS 2750 E
- Horizontal design for loading and unloading from the front on request
- Elevator for loading and unloading (electrically driven bottom-flange „bottom loader“) for easy and fatigue-free load preparation
- Two independent temperature measurement points (furnace control / maximum temperature monitoring)
- Easiest transport in two packages (furnace and control cabinet), hence

Type	Usable hot zone dimensions [mm] Ø x H	Usable hot zone volume [dm <sup>3</sup> ]	Outside dimensions of the furnace [mm] L x W x H	Outside dimensions of the elec. cabinet [mm] L x W x H	Heating power [kW]	Electrical connection [A] 3~	Total weight [kg]
CAF 140/140	140 x 140	2,10	1020 x 1020 x 1980	600 x 400 x 1900	7	25	750
CAF 140/280	140 x 280	4,30	1020 x 1020 x 2230	600 x 400 x 1900	14	35	900
CAF 200/200	200 x 200	6,20	1280 x 1040 x 2180	600 x 400 x 1900	18	35	1000
CAF 200/400	200 x 400	12,50	1280 x 1040 x 2480	600 x 400 x 1900	32	50	1150
CAF 300/300	300 x 300	21,20	1990 x 1060 x 2230	800 x 400 x 1900	38	63	1450
CAF 300/600	300 x 600	42,40	1990 x 1060 x 2580	800 x 400 x 2100	65	125	1750
CAF 370/370	370 x 370	39,70	2010 x 1190 x 2580	800 x 400 x 2100	65	125	1650
CAF 370/750	370 x 750	80,60	2010 x 1190 x 2980	1000 x 400 x 2100	120	200	2000

## Configure your furnace to match the needs of your application:

The well structured Configurator shows the available options.

Our specialists will support you in the selection of the furnace and furnace features, which will be required (or recommended) for the manufacture process of your product:

	Basic configuration
	Option
	Accessory

6	2
4	
<b>C</b>	
Carbon	
12.0107	

42	2
8	
18	
13	
1	
<b>Mo</b>	
Molybdenum	
95.98	

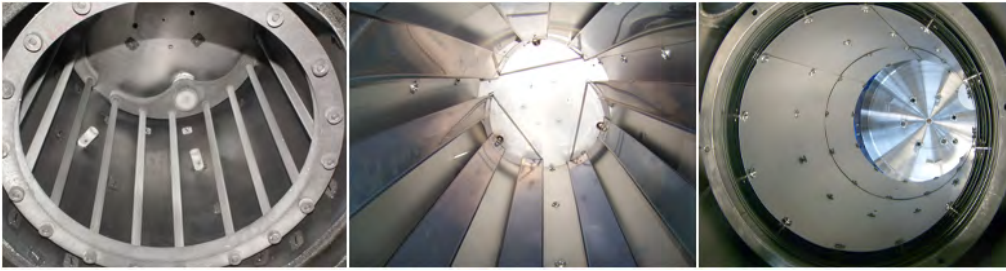
74	2
8	
18	
32	
12	
2	
<b>W</b>	
Tungsten	
183.84	

## CAF Configurator

Features	Graphite-furnace	Moly-furnace	Tungsten-furnace
Steel frame with integrated peripherals, such as: gas system, cooling water distribution, ...			
Double-walled water-cooled stainless steel jacket with cooling cycles and feed throughs			
Hot-zone, consisting of: casing, thermal insulation and heating			
Furnace door = bottom-flange with electrically driven elevator (bottom loader)			
Gas inlet for 1x inert-gas (purge-gas and process-gas), process gas line with Rotameter			
Transformer, sensors und actuators completely wired			
Separate electrical cabinet with fuse-, switching- and power-electronic components			
SIEMENS S7 controls including the possibility of remote maintenance			
SIEMENS operator-panel with graphic visualization			
Single stage rotary-vane pump for a fast change of process atmosphere			
Mass Flow Controller (MFC) for gas flow adjustment via the heat treatment program			
Load thermocouples			
Fine vacuum up to $5 \cdot 10^{-2}$ mbar (cold, dry and empty furnace)			
High vacuum up to $5 \cdot 10^{-6}$ mbar (cold, dry and empty furnace)			
Operation with flammable process gases (safety analysis, redundancy, emergency purging)			
Debinding function		<b>ISO*</b>	<b>ISO*</b>
Fail safe PLC-control to rescue the product (batch) or in connection with hydrogen operation			
Dew point measurement, gas humidifier			
Fast cooling (inert-gas circulation through the hot-zone and an external heat exchanger)			
Cold trap, binder trap			
Torch, thermal post-combustion, catalytic post-combustion			
Gas purification, waste-gas filtration			
Design for corrosive media			
SIEMENS process visualization, data recording & program library on customer's PC			
AMS 2750 E compliance			
Cooling module (closed-loop furnace-cycle with heat exchanger and pump station)			
Product carriers, jigs, fixtures, baskets, ... (consultancy, design and manufacture)			
Charging cart and load preparation place for fast and easy loading and unloading			



\* More information about ISO furnace is available in a separate brochure



6	2	42	2	74	2
	4		8		8
<b>C</b>		<b>Mo</b>	18	<b>W</b>	18
Carbon		Molybdenum	13	Tungsten	32
12.0107		95.98	1	183.84	12
					2

## Furnace atmospheres and temperatures

	Graphite-furnace	Moly-furnace	Tungsten-furnace
Vacuum	≤ 1800 °C	≤ 1700 °C	≤ 2200 °C
Nitrogen <span style="color: green;">N</span>	≤ 1800 °C	≤ 1550 °C	≤ 1700 °C
Argon <span style="color: blue;">Ar</span>	≤ 2400 °C	≤ 1700 °C	≤ 2200 °C
Hydrogen <span style="color: red;">H</span>	≤ 1600 °C	≤ 1700 °C	≤ 2200 °C
Forming gas 95% N <sub>2</sub> / 5% H <sub>2</sub>	≤ 1600 °C	≤ 1550 °C	≤ 1700 °C
Forming gas 95% Ar / 5% H <sub>2</sub>	≤ 1600 °C	≤ 1700 °C	≤ 2200 °C
Humidified process gas with H <sub>2</sub> O dew point ≤ 40 °C	≤ 400 °C	≤ 300 °C	≤ 450 °C

### Our Product Portfolio:

- CAF Laboratory furnaces
- Industrial vacuum furnaces
  - Graphite furnaces
  - Molybdenum and Tungsten furnaces
- ISO furnaces: Integral designed sintering and debinding furnaces
- Waste gas purification: thermal post combustion, catalytic post combustion, hot gas filter
- Hood furnaces
- High pressure furnaces
- Rotary tube furnaces
- Retort furnaces
- Conveyor belt furnaces
- Customized solutions

**MUT Advanced Heating GmbH** designs and manufactures customized thermal processing equipment and systems since 1994 for industries, such as: glass and ceramics, metal processing, powder metallurgy, carbon and chemical processing industries. We design systems for state of the art processes, such as: sintering, debinding, joining techniques, heat treatment of aggressive substances as well as for high-pressure hot gas treatment.

With inhouse competence in mechanical design, process and safety techniques, electrical design and software development we are a skilled and reliable partner to our customers. MUT is distinguished in its industry by a high level of vertical integration, for instance:

- Prefabrication including machining, welding, sheet metal workshop, thermal insulation processing, control and switch gear production
- Separate assembly shops to maintain cleanest possible ambient condition also in the assembly stage
- Certified manufacturer of pressure vessels

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