



## ANNEALING FURNACE - GLO

**The GLO annealing furnace features a vacuum tight retort with highly symmetric positioning of the heating elements. The heating elements are CrFeAl, also known as APM, and are embedded in the ceramic fibre insulation.**

The GLO is often equipped with a vacuum pumping system to reduce the Oxygen levels prior to heat treatment. To ensure the lowest possible contamination levels, several cycles of vacuum and Nitrogen purging occur to create a pure atmosphere in the retort. Vacuum assisted cycling is far superior compared to simply flowing Nitrogen through the retort as the process creates a pure atmosphere faster and requires less Nitrogen. After Oxygen levels have been reduced, heat treatment begins under an inert atmosphere with a slight overpressure.

The highest possible temperature of the GLO annealing furnace is 1100°C for heat treatment with an atmosphere. The front door of the cylindrical retort can be heated if required. At the water cooled front door, the gas is purged inside the GLO. It is preheated by the radiation shields, which are inserted at the front. The GLO is provided with a rear port for the expulsion of any gaseous by-products generated during the process.

The GLO can be operated manually or with the use of an automated system. The furnace is available in sizes of 5, 10 (mobile version), 40, 75, 120, 260, 400, 550, 600, 850, 950 and 1300 litres. The retort is manufactured with temperature resistant steel alloy (1.4841). Other materials are available on request.

The annealing furnace may be operated with reactive gases such as Hydrogen, which requires appropriate safety technology. The Hydrogen safety system includes an automatic operating system with a Nitrogen flooding tank to detect and purge the system should any malfunctions be detected. All devices are SIL2 certified.

The furnaces have a compact, space saving design. The debinding package allows for debinding or pyrolysis processes to be carried out. Virtually no condensation occurs as the unit is equipped with an afterburner and heated gas outlet for strong outgassing applications.

The GLO can be equipped with a fast cooling system. The retort can be air cooled from the outside or purged with cold, inert gas.

**The GLO furnace is also available in two alternative versions:**

1. The **vertical VGLO** is loaded vertically and therefore provides a compact, space saving design.
2. The **mobile GLO** is a transportable, space-saving version for flexible use in different applications.

## APPLICATION EXAMPLES

annealing, degassing, drying, glowing, hardening, pyrolysis, tempering, thermal debinding prior to sintering

## STANDARD FEATURES

- | Manual control
- | Gas tight retort made of 1.4841 (equals grade 314) stainless steel
- | Water cooled door with gas tight rubber sealing (water cooling must be provided at customer site)
- | Radiation shields
- | Gas control with manual control for a single inert gas, air or formation gas
- | Precisely controlled atmosphere with highest possible purity
- | Over-temperature protection (recommended to protect valuable contents & for unattended operation)

## OPTIONS (*SPECIFY THESE AT TIME OF ORDER*)

- | Vacuum System: pre-vacuum pump, roots pump, or turbomolecular pump
- | A range of sophisticated digital controllers, multisegment programmers and data loggers with digital communication options is available - more information about controllers
- | Reaction gas equipment for hydrogen concentrations larger than 4%
- | Chiller in case no water cooling is available on-site

## ANNEALING FURNACE - GLO TECHNICAL DETAILS

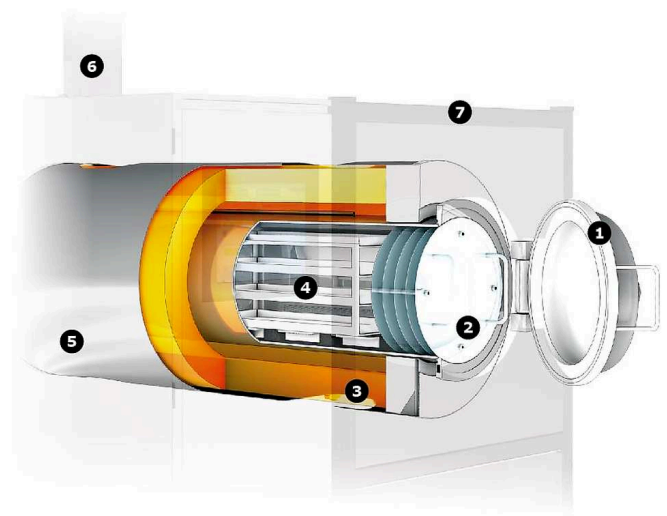
### View inside of the annealing furnace:

1. opened door
2. radiation shields
3. ceramic fiber insulation and heating elements
4. charging rack
5. thin metallic surrounding
6. afterburner
7. frame

The maximum temperature of the GLO annealing furnace is 1100°C. In this temperature range, heat is transmitted via a high amount of heat convection and conduction.

To ensure excellent temperature uniformity, the furnace is equipped with a gas circulation system by means of a ventilator located at the rear of the furnace, which ensures that the sample is surrounded by uniform inert gas at all times.

The sample specimen is placed on an engineered,



View inside of the GLO

ANNEALING FURNACE - GLO  
**EXAMPLES**



GLO 40/11



GLO 10/11-1G: Compact hot wall furnace with stainless steel retort and optional iniconel retort (vacuum up to 750 °C and under normal pressure up to 1100 °C)



GLO 120/11-1G automatic up to 1100°C with optional hydrogen package and drawer door



GLO 40/11-1G semi-automatic up to 1100°C



VGLO Top Loader 10/11-1G manual up to 1100°C with optional vacuum pump (750°C max.)



VGLO - vertically mounted version of the GLO

## TECHNICAL DETAILS (MODELS)

	<b>GLO 10/11-1G</b>	<b>VGLO-TL 10/11-1G</b>	<b>GLO 40/11-1G</b>
<b>Dimensions:</b>			
<b>External H x W x D (mm)</b>	1800 x 850 x 1600	1600 (open) x 1400 x 850	1900 x 1400 x 1800
<b>Transport weight</b>			
<b>Complete system (kg)</b>	500	500	1200
<b>Usable space</b>			
<b>Volume (l)</b>	10	10	40
<b>Ø x D (mm)</b>	250 x 600	250 x 250	310 x 600
<b>Thermal values</b>			
<b>Tmax vacuum (°C)</b>	900 (1.4841) / 1000 (Inconel)	600	900 (1.4841) / 1000 (Inconel)
<b>Tmax atmospheric pressure (°C)</b>	900 / 1100	900 / 1100	900 / 1100
<b>-Delta-T between 300 and 1100°C (K) according to DIN 17052</b>	± 5	± 5	± 5
<b>Max. heat-up rate (K/min)</b>	10	10	10
<b>Cooling time from 1100 - 100 °C (h)</b>	18 (natural) / 2.5 (forced)		
<b>Connecting values</b>			
<b>Power (kW)</b>	14	14	25
<b>Voltage (V)</b>	400 (3P)	400 (3P)	400 (3P)
<b>Current (A)</b>	3 x 25	3 x 25	3 x 63
<b>Series fuse (A)</b>	3 x 32	3 x 32	3 x 80
<b>Vacuum (option)</b>			
<b>Leakage rate - clean, cold and empty (mbar l/s)</b>	< 5x10 <sup>-3</sup>	< 5x10 <sup>-3</sup>	< 5x10 <sup>-3</sup>
<b>Vacuum range depending on the pumping unit</b>	rough, fine or high vacuum	rough, fine or high vacuum	rough, fine or high vacuum
<b>Cooling water required</b>			
<b>Flow (l/min)</b>	1-3	1-3	1-3

	<b>GLO 10/11-1G</b>	<b>VGLO-TL 10/11-1G</b>	<b>GLO 40/11-1G</b>
<b>Max. inlet temperature (°C)</b>	23	23	23
<b>Gas supply</b>			
<b>Nitrogen or Argon flow, others on request (l/h)</b>	200-2000	200-2000	200-2000
<b>Controller</b>			
<b>Manual operation</b>	Eurotherm	Eurotherm	Eurotherm with KP 300 panel
<b>Automatic operation</b>	Siemens	Siemens	Siemens
<b>Cooling time (h)</b>		4 - 5	
<b>Cooling time from 800 - 100 °C (h)</b>			13 (natural) / 2 (forced)
<b>Cooling time from 900 - 100 °C (h)</b>			

	GLO 75/11-IG	GLO 120/11-IG	GLO 260/11-IG
<b>Dimensions:</b>			
<b>External H x W x D (mm)</b>	2000 x 1600 x 1800	2100 x 1800 x 2000	2300 x 2000 x 2800
<b>Transport weight</b>			
<b>Complete system (kg)</b>	1500	2000	2500
<b>Usable space</b>			
<b>Volume (l)</b>	75	120	260
<b>Ø x D (mm)</b>	400 x 800	500 x 940	640 x 1100
<b>Thermal values</b>			
<b>Tmax vacuum (°C)</b>	800 (1.4841) / 900 (Inconel)	700 (1.4841) / 800 (Inconel)	600 (1.4841) / 750 (Inconel)
<b>Tmax atmospheric pressure (°C)</b>	900 / 1100	900 / 1100	900 / 1100
<b>-Delta-T between 300 and 1100°C (K) according to DIN 17052</b>	± 5	± 5	± 5
<b>Max. heat-up rate (K/min)</b>	10	10	10
<b>Cooling time from 1100 - 100 °C (h)</b>			
<b>Connecting values</b>			
<b>Power (kW)</b>	40	60	70
<b>Voltage (V)</b>	400 (3P)	400 (3P)	400 (3P)
<b>Current (A)</b>	3 x 110	3 x 67	3 x 110
<b>Series fuse (A)</b>	3 x 160	3 x 80	3 x 125
<b>Vacuum (option)</b>			
<b>Leakage rate - clean, cold and empty (mbar l/s)</b>	< 5x10 <sup>-3</sup>	< 5x10 <sup>-3</sup>	< 5x10 <sup>-3</sup>
<b>Vacuum range depending on the pumping unit</b>	rough, fine or high vacuum	rough, fine or high vacuum	rough, fine or high vacuum
<b>Cooling water required</b>			
<b>Flow (l/min)</b>	1-3	5-10	10-15
<b>Max. inlet temperature (°C)</b>		23	23

	GLO 75/11-IG	GLO 120/11-IG	GLO 260/11-IG
<b>Gas supply</b>			
<b>Nitrogen or Argon flow, others on request (l/h)</b>	200-2000	200-3000	300-3000
<b>Controller</b>			
<b>Manual operation</b>	Eurotherm with KP 300 panel	Eurotherm with KP 300 panel	Eurotherm Mini 8
<b>Automatic operation</b>	Siemens	Siemens	Siemens
<b>Cooling time (h)</b>	7 - 9		10 - 12
<b>Cooling time from 800 - 100 °C (h)</b>			
<b>Cooling time from 900 - 100 °C (h)</b>		17 (natural) / 4 (forced)	

	GLO 400/11-1G	GLO 550/11-1G	GLO 600/11-1G
<b>Dimensions:</b>			
<b>External H x W x D (mm)</b>	2300 x 2000 x 3500	2300 x 2000 x 4000	2500 x 2300 x 3500
<b>Transport weight</b>			
<b>Complete system (kg)</b>	3000	3300	3800
<b>Usable space</b>			
<b>Volume (l)</b>	400	550	600
<b>Ø x D (mm)</b>	640 x 1500	640 x 2200	800 x 1800
<b>Thermal values</b>			
<b>Tmax vacuum (°C)</b>	600 (1.4841) / 750 (Inconel)	600 (1.4841) / 750 (Inconel)	500 (1.4841)
<b>Tmax atmospheric pressure (°C)</b>	900 / 1100	900 / 1100	900 / 1100
<b>-Delta-T between 300 and 1100°C (K) according to DIN 17052</b>			
<b>Max. heat-up rate (K/min)</b>			
<b>Cooling time from 1100 - 100 °C (h)</b>			
<b>Connecting values</b>			
<b>Power (kW)</b>	80	90	95
<b>Voltage (V)</b>			
<b>Current (A)</b>			
<b>Series fuse (A)</b>			
<b>Vacuum (option)</b>			
<b>Leakage rate - clean, cold and empty (mbar l/s)</b>	< 5x10 <sup>-3</sup>	< 5x10 <sup>-3</sup>	< 5x10 <sup>-3</sup>
<b>Vacuum range depending on the pumping unit</b>	rough, fine or high vacuum	rough, fine or high vacuum	rough, fine or high vacuum
<b>Cooling water required</b>			
<b>Flow (l/min)</b>			
<b>Max. inlet temperature (°C)</b>			

	GLO 400/11-1G	GLO 550/11-1G	GLO 600/11-1G
<b>Gas supply</b>			
<b>Nitrogen or Argon flow, others on request (l/h)</b>			
<b>Controller</b>			
<b>Manual operation</b>	Eurotherm Mini 8	Eurotherm Mini 8	Eurotherm Mini 8
<b>Automatic operation</b>	Siemens	Siemens	Siemens
<b>Cooling time (h)</b>			
<b>Cooling time from 800 - 100 °C (h)</b>			
<b>Cooling time from 900 - 100 °C (h)</b>			

	GLO 850/11-1G	GLO 950/11-1G	GLO 1300/11-1G
<b>Dimensions:</b>			
<b>External H x W x D (mm)</b>	2500 x 2300 x 4000	2600 x 2400 x 3500	2600 x 2400 x 4000
<b>Transport weight</b>			
<b>Complete system (kg)</b>	4300	4500	5000
<b>Usable space</b>			
<b>Volume (l)</b>	850	950	1300
<b>Ø x D (mm)</b>	800 x 2300	1000 x 1700	1000 x 2400
<b>Thermal values</b>			
<b>Tmax vacuum (°C)</b>	500 (1.4841)	400 (1.4841)	400 (1.4841)
<b>Tmax atmospheric pressure (°C)</b>	900 / 1100	900 / 1100	900 / 1100
<b>-Delta-T between 300 and 1100°C (K) according to DIN 17052</b>			
<b>Max. heat-up rate (K/min)</b>			
<b>Cooling time from 1100 - 100 °C (h)</b>			
<b>Connecting values</b>			
<b>Power (kW)</b>	100	110	120
<b>Voltage (V)</b>			
<b>Current (A)</b>			
<b>Series fuse (A)</b>			
<b>Vacuum (option)</b>			
<b>Leakage rate - clean, cold and empty (mbar l/s)</b>	< 5x10 <sup>-3</sup>	< 5x10 <sup>-3</sup>	< 5x10 <sup>-3</sup>
<b>Vacuum range depending on the pumping unit</b>	rough, fine or high vacuum	rough, fine or high vacuum	rough, fine or high vacuum
<b>Cooling water required</b>			
<b>Flow (l/min)</b>			
<b>Max. inlet temperature (°C)</b>			
<b>Gas supply</b>			

	GLO 850/11-1G	GLO 950/11-1G	GLO 1300/11-1G
<b>Nitrogen or Argon flow, others on request (l/h)</b>			
<b>Controller</b>			
<b>Manual operation</b>	Eurotherm Mini 8	Eurotherm Mini 8	Eurotherm Mini 8
<b>Automatic operation</b>	Siemens	Siemens	Siemens
<b>Cooling time (h)</b>			
<b>Cooling time from 800 - 100 °C (h)</b>			
<b>Cooling time from 900 - 100 °C (h)</b>			

[www.carbolite.com/glo](http://www.carbolite.com/glo)