

SERIES LF-2000 Refractory Metal SERIES LF-3000 Graphite Laboratory Vacuum Furnace

Description

Centorr Vacuum Industries' LF line of furnaces was first released in 2012 and has been one of its most versatile and best-selling furnaces for lab scale use and research and development at companies, Universities, and National Laboratories. Built with robust features for everyday use with a water-cooled chamber and 208V power, the LF furnace is a capable piece of processing equipment.

The versatile chamber and hot zone size is designed to conduct important vacuum metallurgical processes as well as ceramic sintering at temperatures to 3000°C. It is designed to let you melt, sinter, braze, weld, outgas, anneal, heat treat or quench as desired.

Starting with the multipurpose vacuum chamber mounted in a portable console on wheels, various options are available for vacuum and even debinding.

Leading Universities and National Laboratories throughout the world have selected Centorr/Vacuum Industries LF furnaces for the following major benefits:

Efficiency - One multi-purpose system for all major vacuum metallurgical and Ceramic or Carbon/Graphite/Composites capabilities.

Economy - Save valuable floor space while avoiding expensive equipment duplication. Meet current requirements while providing the basics for tomorrow's needs.

Convenience – hot zone access for loading is easy. Quick access to pumping components and instrumentation makes maintenance quick and easy with common hand tools.



Key Features

- Cold Wall Vacuum furnace design with stainless steel inner and outer jackets with water cooling.
- Refractory metal unit rated at 2000°C and Graphite hot zone unit rated for 3000°C.
- Complete manual controls consisting of Yokogawa Programmable Controller for temperature and Vacuum Instrumentation on the cabinet face.
- Available in High-vacuum or rough-vacuum and slight positive pressures of Argon and Nitrogen with *optional* partial pressure capability from 1-1000 microns
- Low and high vacuum pumping systems include mechanical pumps, diffusion, turbomolecular high vacuum systems with a graphic control panel.
- System protection is provided by water flow interlock. Components are readily accessible for inspection and maintenance.



Series LF-2000 Refractory Metal - Top Loading Multi-Purpose Furnace

EQUIPMENT SPECIFICATIONS

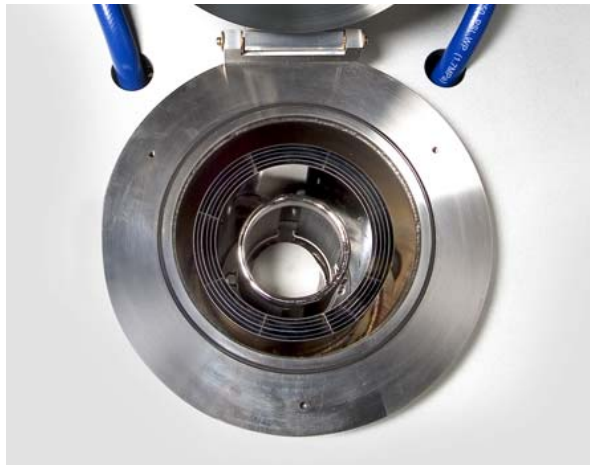
<u>Max Temp:</u>	2000°C (3632°F) in rough (10^{-3} torr/mbar, high vacuum (10^{-5} - 10^{-6} torr/mbar), and inert gas to 2 psig (1150mbar)
<u>Chamber:</u>	Double-walled, water-cooled 304L stainless steel chamber with water-cooled, hinged lid.
<u>Hot Zone:</u>	Useable 2.25" (57mm) ID x 3.5" (89mm) H tungsten mesh element with tungsten and molybdenum sheet heat shields. Molybdenum hearth plate and pins. Inside element dimensions 2.9" (74mm) ID x 4" (100mm) H.
<u>Power Supply:</u>	12 KVA (MP) / 16KVA (HV) 220/1/50-60 SCR controlled with current limiting and soft start features fully interlocked for failsafe operation.
<u>Temp Sensor:</u>	(2) Type "C" molybdenum sheathed thermocouples
<u>Controller:</u>	Eurotherm 2416 temperature controller/programmer. 1/16 DIN temperature controller, 4 programs of 16 segments, auto-tune, RS-485 Modbus RTU communications.
<u>O/T Control:</u>	Eurotherm 2216i overtemperature controller. 1/16 DIN temperature controller & hot zone interlock. RS-485 Modbus RTU communications.

PUMPING SYSTEMS AVAILABLE:

Roughing Pump Vacuum System: Manual vacuum system with Vacuum Research Corp. 902111, Vacuum Research Corp Model 200-7, 200 L/Min. @ 60 Hz (7.0 CFM) direct drive mechanical pump or equal and all necessary plumbing and manifolding.

Diffusion Pump Vacuum System: 2" (50.8) manual high vacuum system with Granville 330/ B-RAX-3000 vacuum instrument vacuum instrument, Vacuum Research Corp. Model 200-7, 200 L/min. (7.0 CFM) direct drive mechanical pump (or equal) , Varian HS-2 diffusion pump, 200 L/S Helium, water baffle, high vacuum valve, and all necessary plumbing and manifolding.

Turbo Molecular Pump Vacuum System: 2" (50.8 mm) manual high vacuum system with Granville 330 vacuum instrument, high vacuum valve, Varian TMP V81, rated 77 L/S N₂, Varian SH-110 dry scroll pump rated 110 L/M, and all necessary plumbing and manifolding.



Series LF-3000 Graphite - Top Loading Multi-Purpose Furnace

EQUIPMENT SPECIFICATIONS

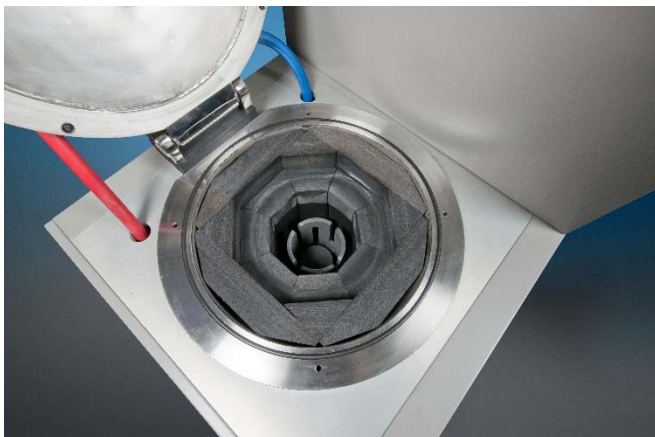
<u>Max Temp:</u>	3000°C (54322°F) in rough vacuum (10^{-2} torr/mbar), and inert gas to 2 psig (1150mbar)
<u>Chamber:</u>	Double-walled, water-cooled 304L stainless steel chamber with water-cooled, hinged lid.
<u>Hot Zone:</u>	3.0" (76.2mm) ID x 4" (100mm) H Graphite element with rigid graphite board / felt insulation. Graphite hearth plate. Inside element dimensions 3.8" (96mm) ID x 5" (127mm) H.
<u>Power Supply:</u>	18 KVA 220/1/50-60 SCR controlled with current limiting and soft start features fully interlocked for failsafe operation.
<u>Temp Sensor:</u>	(1) Two-color Optical Pyrometer.
<u>Controller:</u>	Eurotherm 2416 temperature controller/programmer. 1/16 DIN temperature controller, 4 programs of 16 segments, auto-tune, RS-485 Modbus RTU communications.
<u>O/T Controller:</u>	Eurotherm 2216i overtemperature controller. 1/16 DIN temperature controller & hot zone interlock. RS-485 Modbus RTU communications.

PUMPING SYSTEMS AVAILABLE:

Roughing Pump Vacuum System: Manual vacuum system with Vacuum Research Corp. 902111 vacuum instrument, Vacuum Research Corp Model 200-7, 200 L/Min. @ 60 Hz (7.0 CFM) direct drive mechanical pump or equal and all necessary plumbing and manifolding.

APPLICATIONS:

This vertical table-top furnace is used for vacuum and controlled atmosphere heat treatment and sintering studies of ceramics, carbon, graphite powders and carbon fiber composites, reactivity studies, and small scale UHTC sintering trials.



MISC. / OPTIONAL FEATURES

- 2500°C refractory metal hot zone upgrade.
- UL / CE / CSA approvals and other non-U.S. standards for compliance.
- Choice of rough vacuum or high-vacuum systems using either Diffusion or Turbomolecular pumps.
- Easy to Install. All Items Cabinet Mounted.
- UTILITIES CONNECTIONS:
 - One Piece Furnace
 - Control Cabinet, Power Suppl,
 - Single Point Electrical Connection
 - 220 Volt Single Phase
 - Single Inert Gas Connection 1/4" NPTF
 - Water Connections: 1" NPTF Supply, 1 1/4" NPTF Drain
 - Single Air Supply Connection 1/4" NPTF
 - Pump Exhaust 3/4" ID Hose Connection



- LF-3000 Graphite systems have *Optional* binder removal systems including our proprietary Sweepgas™ Binder Removal System with flowmeter for precise repeatable gas flow rates.
- Water cooled binder particulate trap
- Robust exhaust tower with air-operated valve.
- Water-cooled chamber exhaust manifold.
- 1-1000 microns partial pressure gas system.

MATERIALS PROCESSED

Stainless Steels Titanium
Tungsten Carbide Inconels

Advanced Ceramics including: AlN, BN, SiC, Si₃N₄, B₄C, ZrB₂. UHTC's and all Carbon, Graphite, and CFC materials.

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INSTRUMENTATION & CONTROLS PACKAGE

- Can be mastered in hours.
- Ramp/Soak Temperature programmer
- Dedicated Overtemp controller
- Vacuum instrumentation
- Emergency Stop button
- Alarm indicator lights.
- Lights and switches for manual operation.