

SERIES 3540 – WORKHORSE AM™

High Vacuum Furnace for 3D/AM Materials



Description

The Workhorse AM™ is Centorr Vacuum Industries production-oriented offering specifically designed for the secondary heat treating, annealing, stress-relieving, de-gassing, and quench cooling of 3D printed and Additive Manufactured parts. Because DLS (direct laser sintering) and SLM (selective laser melting) processes involve localized high-temperature melting of small spots within the overall part, micro-stresses can build up in the parts that must be eliminated in order to achieve enhanced physical properties such as fatigue strength, hardness, durability, and ductility. Annealing and stress-relieving in a vacuum or controlled atmosphere of inert gas provides that necessary reduction in stresses. The ultra-clean vacuum environment also assures no oxidation or decarburization, and a shiny part surface when compared to heat treatment in common atmosphere box furnaces.

The Workhorse AM™ has a long list of optional equipment that makes this one of the most versatile custom-designed furnaces available today. The basic design comprises of the standard hot zone rated for 1315°C with an *optional* upgrade to 1650°C for processing higher melting materials such as superalloys and Titanium. The Workhorse AM™ even has an option for operation in positive pressure for processing specific alloys in a controlled atmosphere of pure inert gas. For quick-quench gas cooling requirements, the furnace can be outfitted with a 2BAR gas quench cooling system consisting of a large rotary fan and water-cooled heat exchanger. The furnace chamber is mounted on legs for a compact and highly efficient design and is a "front-loading" orientation which offers better ergonomics and temperature uniformity compared with vertical top/bottom loaders or cylindrical hot zones.

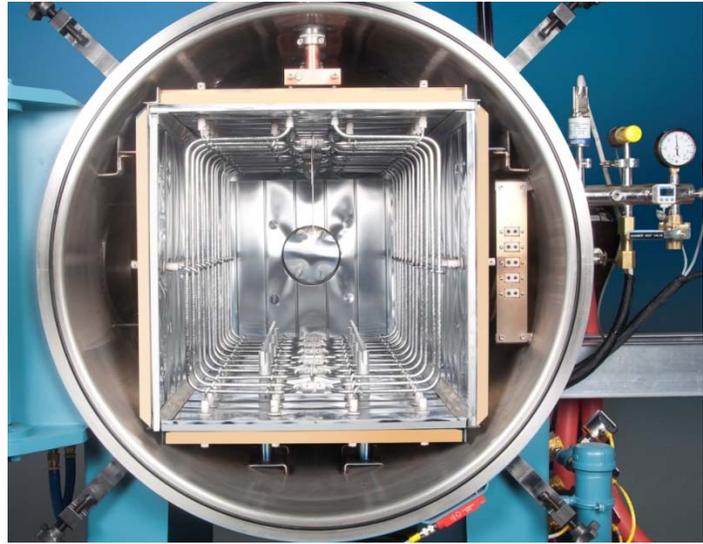
Unlike laboratory or smaller research furnaces, the Workhorse® contains features only found on high-end heat treat furnaces, such as a stainless steel interior vacuum chamber with manual door clamps; heavy duty Molybdenum or Tungsten rod heating elements; and all-metal Tungsten, Molybdenum/SS radiation shield hot zone for fast heating and cooling, and excellent process cleanliness. You won't find any refractory ceramic insulation or graphite felt/board in this hot zone.

Standard Furnace instrumentation includes a programmable controller with PLC and PC/HMI for process control. Name brand vacuum sensors and gauges are available on all systems. CVI's "one-button start" control system initiates a complete cycle including pumping, heating, and cooling modes. A full complement of program interlocks and safeties ensures safe and efficient furnace operation and reduces the chance of operator vacuum pumping errors, with our unique "keylock" override design.

The Workhorse® furnace line is available with high-vacuum or low vacuum pumping systems and can include Diffusion pumps, Turbomolecular pumps, or Cryogenic pumping systems, with or without cold traps and refrigerated baffles. A variety of processing environments are available including high/low vacuum and partial and/or positive pressures of Ar, He, and N₂ gases, or Hydrogen process gas with our optional G-10503A gas system.

Key Features

- Cold Wall Vacuum furnace design with stainless steel inner jacket and outer jackets with baffled water cooling.
- No epoxy coated surfaces on chamber interiors results in higher vacuum integrity.
- High and low vacuum pumping systems including diffusion, cryogenic, and turbomolecular.
- *Optional* 2 BAR gas quench cooling system with 10HP fan and water cooled heat exchanger.
- Heavy duty rod elements used instead of thin strip or foil elements which can be easily damaged. Hot zones use a 30° rule to ensure proper radiation on all sides.
- Operation to 1315°C or *optionally* 1650°C with four-sided heating elements in partial pressures from 10⁻³ torr up to 1-3 psig positive pressures of Argon, Nitrogen, Helium, and Hydrogen.
- PLC with Industrial Programmable Controller or PC system using Specview® HMI software customized by CVI for vacuum furnaces, with extensive data acquisition; and remote monitoring capabilities.
- G-10504A Partial Pressure control system (1-1000 microns) available for suppression of low vapor pressure braze compounds, and *optional* G-10505A positive pressure inert gas, or G-10503A positive pressure Hydrogen gas system built to NFPA 86 standards.
- Graphic control panel shows location of vacuum pumps and system status using indicator lamps, and provides for manual operation of the furnace.



STD MODEL*	USABLE SIZE cu. ft (liters).	EFFECT HOT ZONE WxHxD in (mm)
I - 3024	1 (28)	12 x 12 x 12 (300 x 300 x 300)
II - 3040	2 (57)	12 x 12 x 24 (300 x 300 x 610)
4060	4.5 (127)	18 x 18 x 24 (457 x 457 x 610)
4873	12 (340)	24 x 18 x 48 (610 x 457 x 1220)
5273	16 (453)	24 x 24 x 48 (610 x 610 x 1220)

* Custom sizes available upon request

FURNACE APPROVALS

Centorr/Vacuum Industries furnaces are designed to our own internal quality standards developed over our 60+ year history, and are built to the following industry standards:
ASTM NFPA 86 NEC (NFPA70)

ALLOYS PROCESSED

Stainless Steels
Ferrous and Non-Ferrous
Alloys

Tool Steels
High Speed Steels
Ti, Ni, and Superalloys