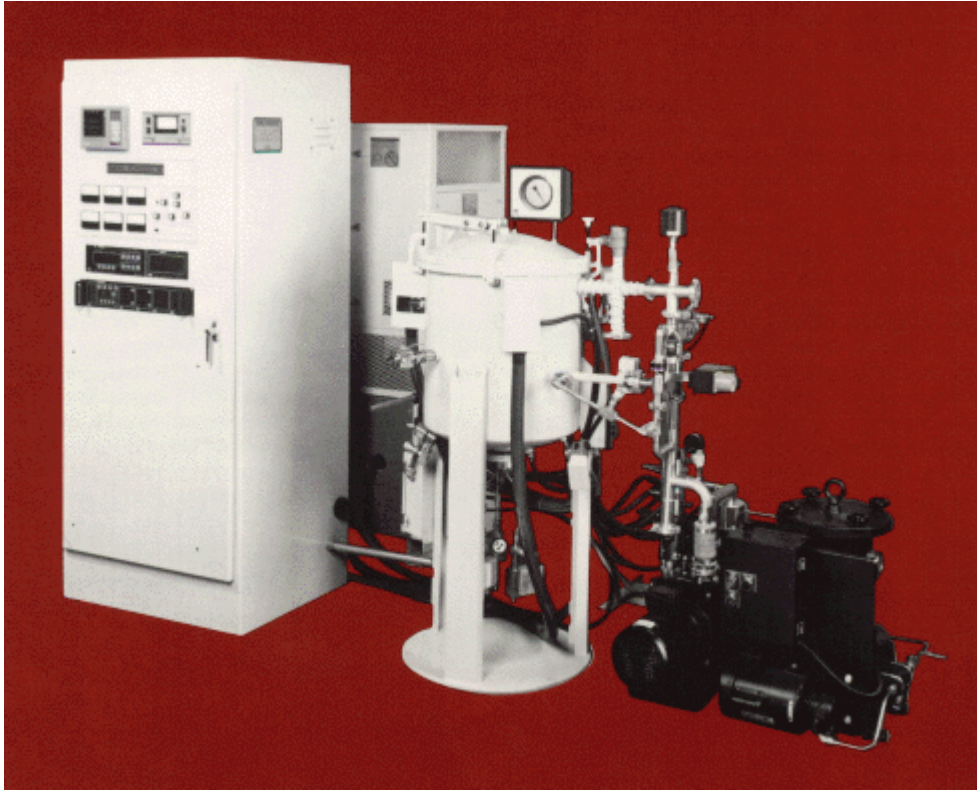


COATINGMASTER

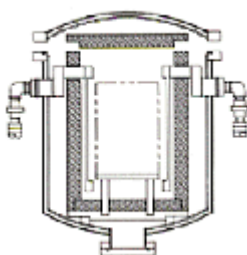
VACUUM/CONTROLLED ATMOSPHERE FURNACES FOR
CHEMICAL VAPOR DEPOSITION (CVD) AND
CHEMICAL VAPOR INFILTRATION (CVI)



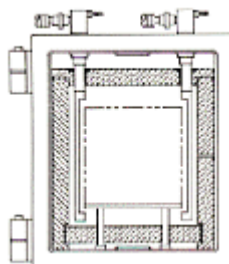
GENERAL DESCRIPTION

Coatingmaster furnaces are designed for chemical vapor deposition (CVD) and chemical vapor infiltration (CVI) of refractory ceramic and metallic coatings. Standard furnaces are rated for use to 1600°C, with an optional upgrade to 2200°C for pyrolytic graphite and other high temperature deposition processes.

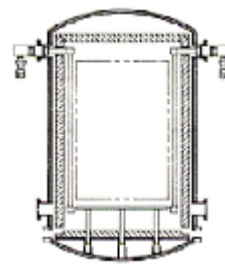
Each furnace is supplied as a complete system including: vacuum chamber; heat zone; power supply; vacuum pump; and a programmable control system. Manual process controls are provided for two reactant gases and one inert blanket gas. Additional flow channels are optionally available, as well as fully automatic process and blanket gas control systems.



Top Loader



Front Loader



Bottom Loader

(Model 612)

(Model 121212)

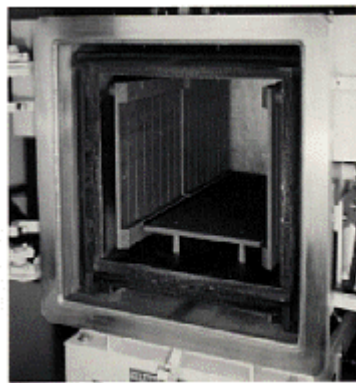
(Model 1624)

CHAMBER AND HEAT ZONE

Coatingmaster vacuum vessels are made completely with stainless steel, including the chamber, water jacket, and all flanges. Process gas and vacuum pump manifolds are also made with stainless steel, as well as any additional piping which may come in contact with chlorinated or fluorinated gases. Nickel gaskets are used as vacuum seals on small diameter piping where practical, and Viton O-rings on larger diameter flanges such as the main door and vacuum pumping system ports.

Graphite heat zones are used on all furnaces, including graphite resistance heating elements and low density fibrous graphite insulation. Internal graphite retorts are also supplied to provide a barrier between blanket and process gases, thereby containing reactive gases and effluents. A graphite exhaust tube directs effluent gases to the pumping system while a gas supply manifold brings reactants into the retort. Internal gas distribution manifolds are normally provided by the user, or custom designed to meet a specific application.

Top Loading
Heat Zone



Front Loading
Heat Zone

VERTICAL CVD/CVI FURNACES*

Model Number	Work zone (inches)	Work volume (cubic feet)	Hearth capacity (lbs)	Power ** supply (KVA)	Relative price
510	5 ϕ x 10	0.1	10	40	0.5
1014	10 ϕ x 14	0.6	50	60	0.6
1318	13 ϕ x 18	1.4	150	110	0.8
1824	18 ϕ x 24	3.5	350	175	1.0
2436	24 ϕ x 36	9.4	1000	300	1.4
3648	36 ϕ x 48	28.3	3000	500	2.1
4860	48 ϕ x 60	62.8	6000	800	2.7

* Top loading design. Bottom loading optional.

** 2200 °C maximum operating temperature.

GAS CONTROLS

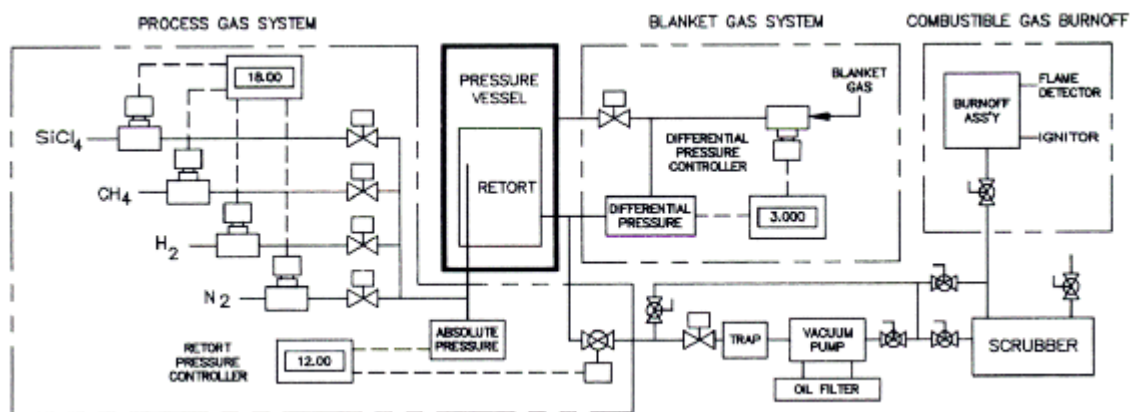
Coatingmaster furnaces include a basic gas supply system that can be upgraded to meet individual requirements. The basic system includes two corrosion resistant rotometers with manual needle valve controls; a laser welded stainless steel diaphragm pressure gauge, and manual blanket gas controls. The blanket gas controls include a shut-off valve, rotometer flow indicator, and a needle valve to adjust the flow of protective inert gases which surround the retort.

Optional enhancements include mass flow controllers, automatic retort pressure control systems, and automatic blanket gas pressure control systems. See schematic drawing below.

The automatic retort downstream pressure control system includes an absolute pressure capacitance manometer, a proportional control valve on the retort exhaust manifold, and a pressure control panel for maintaining process gas pressure at a constant level.

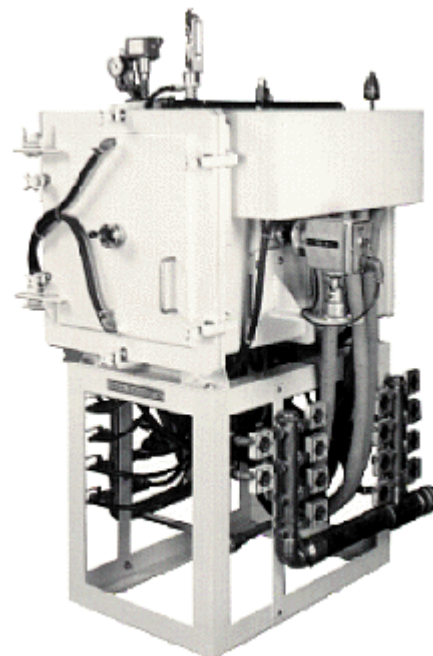
The automatic blanket gas upstream pressure control system uses a differential pressure capacitance manometer to monitor the pressure difference between the inside and outside of the retort. A set-point control panel maintains a constant positive pressure differential outside the retort by adjusting a proportional valve which controls inert blanket gas flow.

Coatingmaster furnaces must be furnished with a combustible gas safety system if explosive concentrations of combustible gases will be present. This optional system includes a blow-off port, burn-off tower, and extensive safety interlocks. Blow off and pressure relief ports must be properly vented by the user.



SPECIAL FEATURES

- Corrosion resistant vacuum pump, gauges, and fittings
- Complete stainless steel chamber construction
- High temperature capability to 2200°C
- Choice of manual or fully automatic gas controls
- Optional top and bottom heaters for improved uniformity
- Large power supply for rapid heating
- Including graphite retort for vapor containment
- Complete instrumentation package including temperature sensor, programmable microprocessor, and gas controls



VACUUM PUMPS

Coatingmaster furnaces are supplied with corrosion resistant two stage mechanical vacuum pumps designed for operation with chlorinated and fluorinated gases. Standard pumps are sized for rapid chamber evacuation to less than 0.1 torr in

ADDITIONAL INSTRUMENTATION

Microprocessor based programmable controllers are provided for all furnaces. The standard controller is capable of storing ten ramp and ten soak segments as well as two process events such as pump-down or backfill. Controllers with more extensive

approximately five minutes.

The chamber can then be backfilled for deposition near atmospheric pressure, or operated above one torr with moderate gas flows. Deposition at lower pressures or with high gas flows will require a larger pump or the addition of a mechanical booster pump.

All pumps are normally provided with high-grade hydrocarbon oil. Synthetic inert fluids can be optionally provided, as well as oil filtration systems, inlet traps, and mist eliminators.

POWER SUPPLY

Two different power supplies are available for each Coatingmaster, depending on whether the furnace will be used to 1600°C or 2200°C. Each supply is generously sized with ample reserves for load heatup and compensation for heat zone aging. Furnace heatup time to full temperature is typically one to two hours or less.

INSTALLATION

Thermal Technology can provide assistance in selecting and installing scrubbers, gas bubblers, gas cabinets, mass spectrometers, exhaust hoods, and related equipment. Changes will be based on actual engineering time involved, field personnel time and travel expenses, subcontractor payments, and equipment costs.



capabilities are optionally available, as well as custom designed control systems to meet any requirement.

Temperature sensing is done with a tungsten-rhenium thermocouple, or optionally with an infrared pyrometer. Independent over-temperature control systems using either a thermocouple or power transducer are also available. Two thermocouple gauges measure vacuum and a PLC coordinates system functions and provides safety interlocks.



Typical Control Cabinet

- microprocessor
- pyrometer or TC
- ionization gauge
- TC gauges
- programmable logic controller
- voltmeters
- ammeters

CUSTOM FURNACE DESIGN

Our engineering team can design a custom furnace system to meet your exact requirements. When your needs exceed the capabilities of our standard models, you can count on receiving the same quality and reliability in a customized system. Typical reasons for needing a customized system include larger work loads, specialized control requirements, and proprietary gas handling systems.

Extensive design, fabrication, and testing skills are available for use in developing furnaces built for a specific application. Our custom designed furnaces are located at national laboratories and major corporations around the world. When

you need the best—call Thermal Technology.

COATINGMASTER INSTALLATION DATA

Model Number	Layout 1 WxDxH (feet)	Electrical 2 480V, 3 ϕ , 60Hz (KVA)	Water 2,3 (gpm)	Air (psig)	Backfill gas (ft 3)
510	6x6x6	50	8	75-100	4
1014	6x6x6	75	12	75-100	8
1318	7x7x8	130	22	75-100	15
1824	8x8x9	200	35	75-100	50
2436	9x9x12	340	60	75-100	100
3648	10x10x15	575	100	75-100	150
4860	11x11x18	900	160	75-100	250

- Notes:
1. Includes furnace, power supply, control cabinet, and pumping system. Exact dimensions depend on choice of accessories. Components can be re-arranged to suit individual requirements.
 2. Alternate power supplies, pumps, and fans may require different inputs.
 3. Water must be clean and free of contamination and minerals, regulated to 50 psig, and 70°C maximum temperature.

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