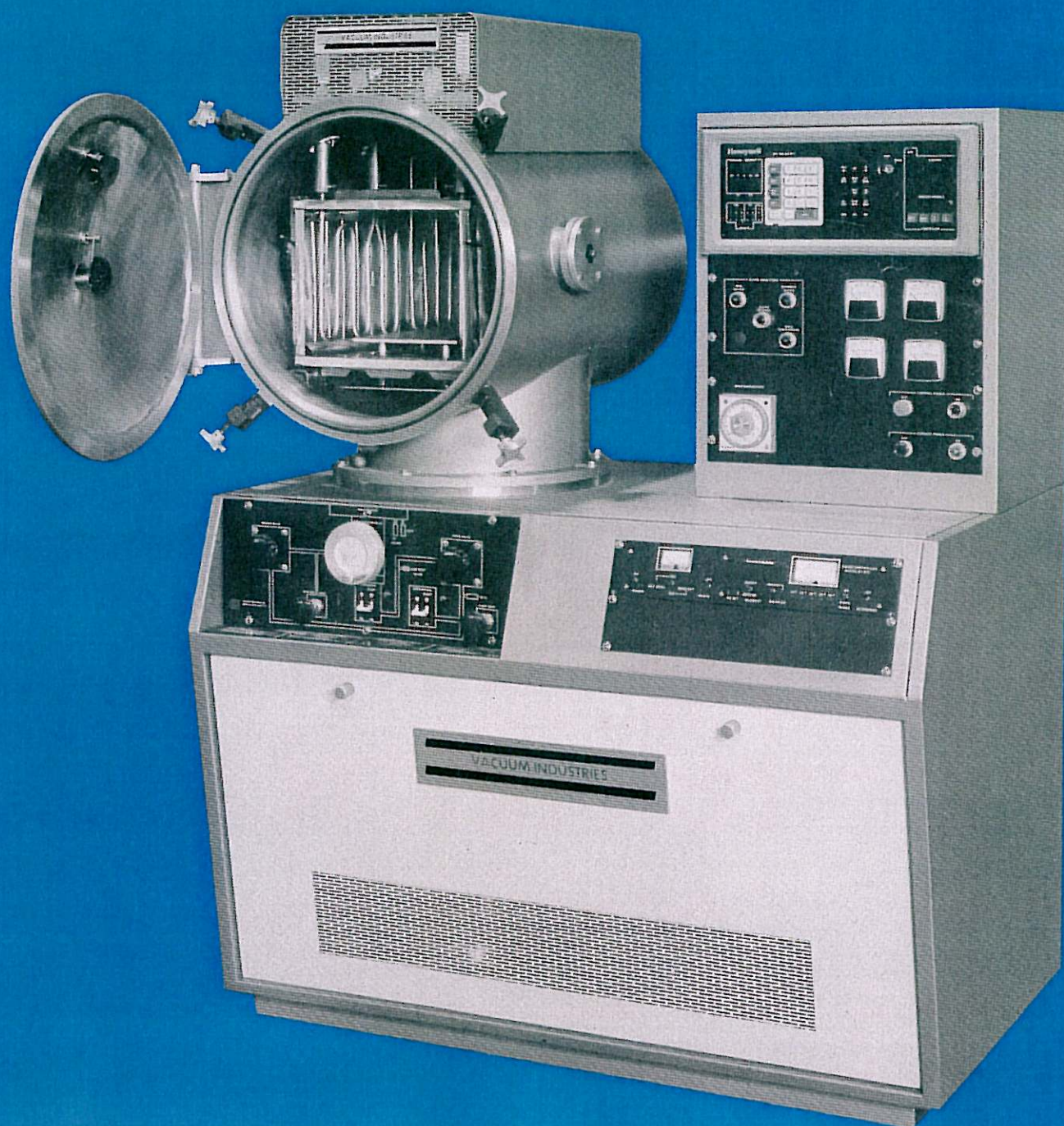


Vacuum Industries

SYSTEM VII/SUPER VII

Multipurpose Vacuum Metallurgical Systems



System VII/Super VII — Advantages and Uses

Expands Metallurgical Capabilities

System VII and Super VII broaden the capabilities for vacuum and inert atmosphere metallurgical processes with a basic chamber concept that avoids equipment duplication and minimizes cost.

The versatile chamber accommodates accessories carefully designed to conduct all important vacuum metallurgical processes. Equipment can be chosen to meet one specific need. Should requirements change in the future, the basic system can be converted for a different process by merely substituting accessories.

Starting with the multipurpose vacuum chamber, mounted on a standard pumping system, the interchangeable accessories are easily installed to let you melt, sinter, braze, weld or heat treat as desired.

Leading materials engineers and metallurgists throughout the world have selected Vacuum Industries System VII and Super VII for these major benefits:

Efficiency

One multi-purpose system for all major vacuum metallurgical capabilities. Components can be added to convert from one process to another as programs and needs change.

Economy

Save valuable floor space while avoiding expensive equipment duplication. Meet current requirements while providing the basics for tomorrow's needs. Obsolescence is designed out.

Convenience

Accessory change-over is fast and easy using ordinary hand tools. Easily removable front and rear panels allow full service access to the pumping components.

Reliability

Vacuum Industries equipment is built to the high quality standards required for industrial vacuum systems. All components are designed for years of dependable service.

Versatility

The various System VII accessories listed in this brochure are only a few of the possible uses. Imagination and experimenting will commit the researcher to further expand the possible uses. Some of the current users have looked at carburization, ion nitriding, electron beam welding, centrifugal casting, laser and plasma operations in the System VII.

One System, Many Applications

Multi-purpose System VII (or Super VII) can be used for many applications. Start with a basic vacuum chamber, add a pumping system and select the accessories you need.

Typical Applications

Brazing, Sintering,
Heat Treating, Annealing,
Stress Relieving,
Degassing

Hardening

Alloy Development,
Metal Casting

Pure Metal Preparation,
Alloy Development

Test Sample Preparation

Handling Atmosphere
Sensitive Materials

Inert Gas Welding

Typical System Accessories

Horizontal or Vertical
Resistance Furnaces

Gas or Liquid Quench
Accessory

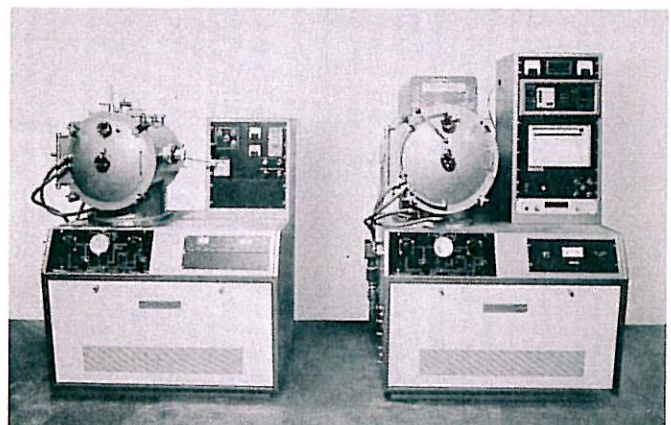
Induction Melting Furnace

Arc Melting Furnace

Arc Button/Bar Furnace

Dry Box Assembly

Dry Box with Welding
Accessories



System VII (left) and Super VII multipurpose vacuum furnaces meet practically all metallurgical process requirements.

Starting with these basic components

Vacuum Chamber

Excellent vacuum integrity plus multi-port versatility are the major ingredients of every System VII chamber. One chamber becomes the foundation of a versatile metallurgical process laboratory.

Vacuum Pumping System

The compact, cabinet enclosed vacuum pumping systems, designed for the System VII chamber, are capable of repeated pumpdown to the high vacuum range.

. add any or all of these accessories

1 Resistance Furnaces

To heat treat, braze or sinter, the basic chamber quickly and easily becomes a resistance heating furnace that can operate in vacuum or inert atmosphere.

5 Inert Gas Welding System

To join reactive, refractory and other special metals and alloys, the basic chamber quickly and easily becomes a vacuum/inert atmosphere welding system.

2 Induction Melting Furnace

To melt and cast advanced alloys and clean metals, the basic chamber quickly and easily becomes a five lb. (2.3 kg) vacuum induction furnace.

6 Gas Quench

When rapid load cooling is required this highly desirable factory installed option provides a high speed gas stream within the resistance furnace work zone.

3 Arc Melting Furnaces

To melt samples for alloy development, spectrographic analysis, or phase diagram work, the basic chamber quickly and easily becomes an arc melting furnace with three interchangeable hearths for button, bar or skull melting.

7 Liquid Quench

When liquid quenching is required this convenient roll-away system provides laboratory scale oil or water quench capabilities in an isolated chamber.

4 Dry Box Assembly

To handle pyrophoric or atmosphere sensitive materials, the basic chamber quickly and easily becomes a "dry box".

When complete control of process environment is vital.

Vacuum Chamber

Advantages

High vacuum design for dependable performance.
Two chamber sizes for versatile selection of resistance furnaces.
Contains all ports needed to accept wide range of high temperature accessories.
Convenient horizontal loading and work handling at bench top level.
Easy to maintain 100% stainless steel construction.
Mounts on any standard 20" (508 mm) diameter baseplate.

Features

Chamber

Stainless steel (type 304) construction throughout, including cooling jacket and all ports and flanges. O-ring seals are used throughout. Unique engineering of baffle system between inner and outer shell provides uniform water cooling of chamber. Large pumping port (20" diameter flange) provides stable support.

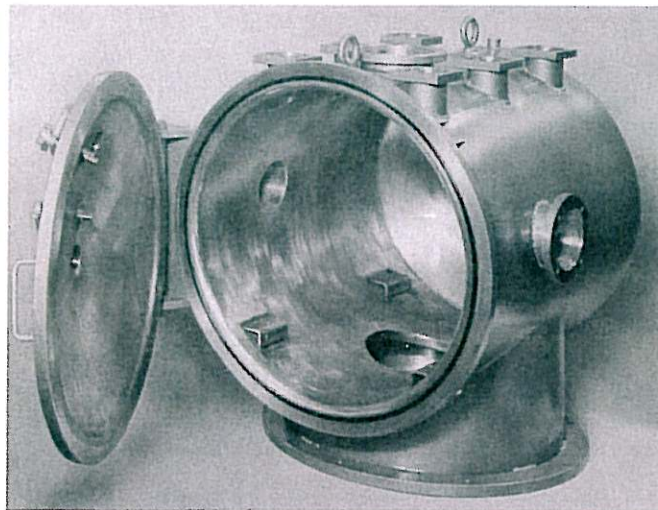
Inert gas manifold for static backfill includes 5 psig overpressure relief valve, compound Bourdon gauge 30" Hg-0-15 psig (750 mm Hg-0-1 kg/cm²) and valve for vent or static backfill.

Hinged Door

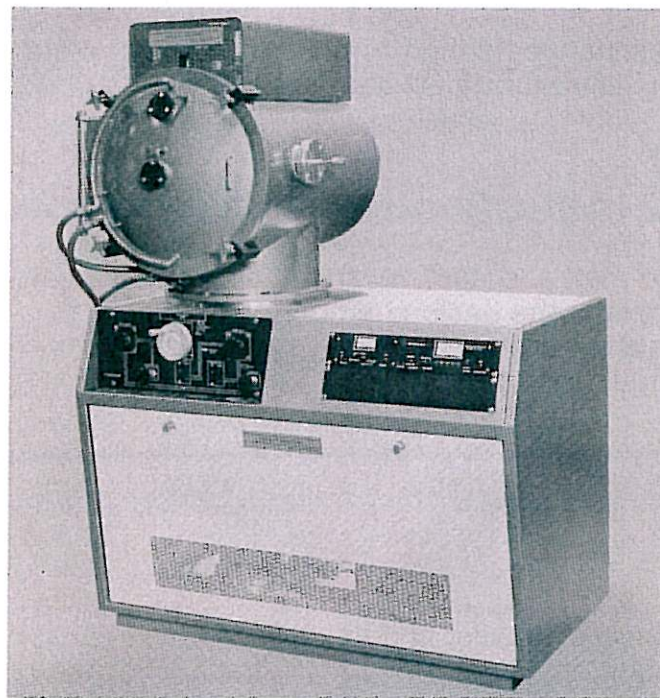
Stainless steel construction with double wall dished head for complete water cooling. Machine finished flange to insure vacuum tight closure. Securely fastening swing clamps for rapid initial pumpdown. Two pyrex sight ports with remotely-operated stainless steel shields are positioned for convenient viewing.

Attachments

Nine accessory ports (11 on Super VII) provide maximum flexibility for the wide range of accessories. Design provides for continual updating to accommodate new techniques, processes and accessories.



System VII vacuum chamber, fabricated entirely of stainless steel, has all ports needed for major arc, induction and resistance furnace accessories.



System VII chamber mounted on vacuum pumping system equipped with manual valve controls.

SELECTION GUIDE

Vacuum Chamber	Size dia. x length	Volume	Accessory Ports			
			Sight Glass 1.5" (38mm) Ø	Top 2" (51mm) Ø	Side 3" (76mm) Ø	Top 4" (102mm) Ø
System VII Chamber Series 2100 Model 1822	18" x 22" (457 x 559 mm)	3.2 cu. ft. (92 liters)	2	6	2	1
Super VII Chamber Series 2110 Model 2030	20" x 30" (508 x 762 mm)	5.5 cu. ft. (147 liters)	2	8	2	1

When high vacuum and partial pressure capabilities are required.

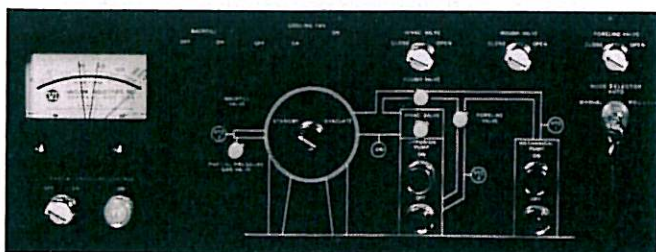
Vacuum Pumping System

Advantages

- High vacuum performance in laboratory styled compact console.
- Variety of component selection to meet your precise pumping needs.
- Front panel controls for easy operation.
- Quick installation with simple electrical and water connections.
- Simplified servicing with easy access front and rear panels.
- Automatic controls available with fail-safe vacuum valving for unattended operation.

Features

- 20" (508 mm) diameter stainless steel baseplate — industry standard for versatility.
- Rugged roughing and backing mechanical pump for initial pumpdown and foreline back-up.
- High vacuum diffusion pump — job rated for your application.
- Vacuum plumbing and valving completely interconnected and tested.
- Easy operation from graphic panel.
- Water-cooled baffle included as standard equipment to minimize diffusion pump backstreaming.
- Vacuum gauge control on sloped front of console for convenient viewing.
- Mass spectrometer connection valve on diffusion pump foreline for leak checking.



Automatic Pumping System Graphic Control Panel



Vacuum pumping system with manual vacuum valve controls and optional vacuum gauge.

SELECTION GUIDE

Standard Pumping Systems*

Model No.	405-0750	617-1500	617-2400
Diffusion Pump			
Nominal Size	4"	6"	6"
Speed, ltrs/sec.	800	1500	2400
Baffle	water-cooled chevron		
Mechanical Pump	2-stage rotary		
Speed, CFM	5.6	17.7	17.7
ltrs/min.	160	500	500
Valves	manual	manual	manual

*Cryopumped and turbo pumped systems may be quoted upon request.

Options

Vacuum Gauge	Model No.
Combination hot filament ionization gauge and two-position thermocouple gauge for digital readout	91-307
Automatic Pumping System Control	
Pressure transducer opens and closes remotely operated pneumatic and solenoid valves in proper sequence	E-7607
Diffusion Pump Baffles (in place of standard water-cooled baffle to improve ultimate vacuum)	
Refrigerated (-30°F) chevron baffle system	RCB-6177
Liquid nitrogen type, 4"	LNB-4077
Liquid nitrogen type, 6"	LNB-6077
Automatic Liquid Nitrogen Controller (requires pressurized dewar)	ALC-0100
Partial Pressure Control System (flow through of inert gases controlled between two set points on 1-1000 microns analog controller) Refer to accessory bulletin	G-10504

When high temperatures in vacuum are needed for brazing, heat treating, sintering, degassing.

Resistance Furnaces and AC Power Supplies

The System VII hot zone is ideal for laboratory and small production applications with its front loading 6" x 6" x 15" long effective work space. The 8" x 8" x 20" long Super VII hot zone is designed to handle larger loads.

Special vertical hot zone accessories for either chamber provide capability for heating to very high temperatures within a 4" diameter x 7" high cylindrical element. Temperatures up to 3000°C are attained with an all tungsten hot zone and temperatures up to 2200°C with an all tantalum hot zone.

A complete metallic hot zone accessory includes durable refractory metal elements, metal radiation shields, hearth plate and support posts. A complete graphite hot zone accessory includes thick graphite plate elements, fibrous insulation, graphite hearth plate, and support posts. All hot zones are mounted in a stainless steel support frame and are easily removable for servicing.

Water-cooled copper power feedthroughs and interconnecting busswork are included with the hot zones to make a complete accessory unit. Power supplies rated for operating the furnace hot zones in vacuum can be selected from the guide.

Features and Advantages

Rapid heating to maximum temperature — saves time, conserves energy.

Rugged heating elements — long life, reliable operation.

Low voltage operation — avoids corona and/or arcing.

Heating elements unitized — individually replaceable.

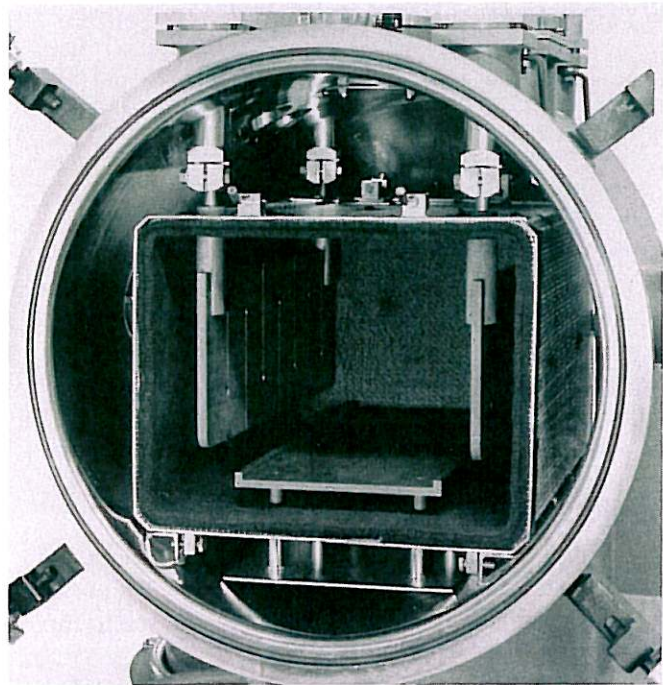
Positive shield separation (dimpling) — provides high thermal efficiency.

Modular hot zone — easily removed for changeover to another accessory or for bench-top servicing.

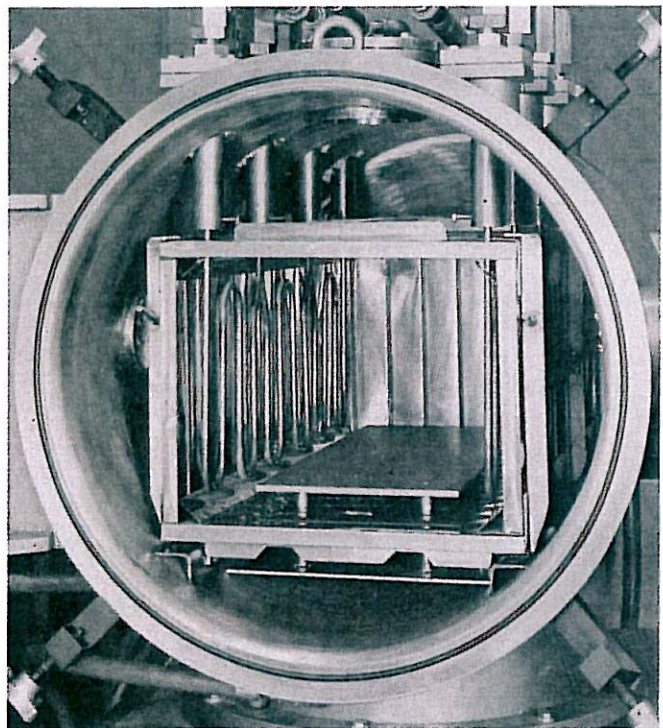
Water jacketed chamber — allows higher temperature hot zone bake-out for maximum cleanliness.

Versatile environment — choice of vacuum, inert or optional reducing atmospheres.

Copper electrode feedthroughs — externally water cooled to avoid water leaks in chamber.



2100°C (3800°F) horizontal graphite hot zone assembly for very high temperature processes in controlled environments.



Typical metal hot zone assembly for optimum vacuum performance and fastest heating and cooling.

SELECTION GUIDE

Metal or graphite horizontal hot zones are available for temperatures up to 2200°C. Vertical hot zones provide for furnace temperatures up to 3000°C. Typical assemblies include resistance heating elements, radiation or insulation shielding, stainless steel support frame, and the hearth plate. Gas cooling/quench and liquid quench accessories can expand heat treating capabilities to harden a wide range of materials. Process gas control options are available.

Horizontal Furnaces

Horizontal Furnaces				System VII	Super VII
Useable Work Space				6" x 6" x 15" lg. (150 x 150 x 380 mm)	8" x 8" x 20" lg. (200 x 200 x 500 mm)
Working Volume				0.3 ft. ³ (8.6 Ltrs.)	0.7 ft. ³ (20.0 Ltrs.)
Maximum Operating Temperature	Element	Hot Zone Materials Shields/Insulation	Hearth	Hot Zone Model No. [Power Supply Rating — Vacuum]	
1000 °C (1830 °F)	Molybdenum	Stainless Steel	Stainless Steel	6615-1000 [10 kVA]	8820-1000 [15 kVA]
1315 °C (2400 °F)	Molybdenum	Molybdenum/ Stainless Steel	Molybdenum	6615-1315 [15 kVA]	8820-1315 [20 kVA]
1650 °C (3000 °F)	Tungsten	Molybdenum	Molybdenum	6615-1650 [30 kVA]	8820-1650 [45 kVA]
2200 °C (4000 °F)	Graphite	Graphite felt	Graphite	6615-2100 [30 kVA]	8820-2100 [45 kVA]

Vertical Furnaces

				Heating Elements Dimensions	
				4" dia. x 7" high (100 x 180 mm)	4" dia. x 7" high (100 x 180 mm)
2200°C (4000°F)	Tantalum	Tantalum	Tantalum	47-2200 [20 kVA]	47-2200 [20 kVA]
3000°C (5432°F)	Tungsten mesh	Tungsten	Tungsten	47-3000 [45 kVA]	47-3000 [45 kVA]

Horizontal Furnace Options

Model No.

Operating Controls (see pg. 12) —

Gas Cooling Recirculation System (see pg. 11) **6-250**

Liquid Quench Accessory (see pg. 11) **306-1100**

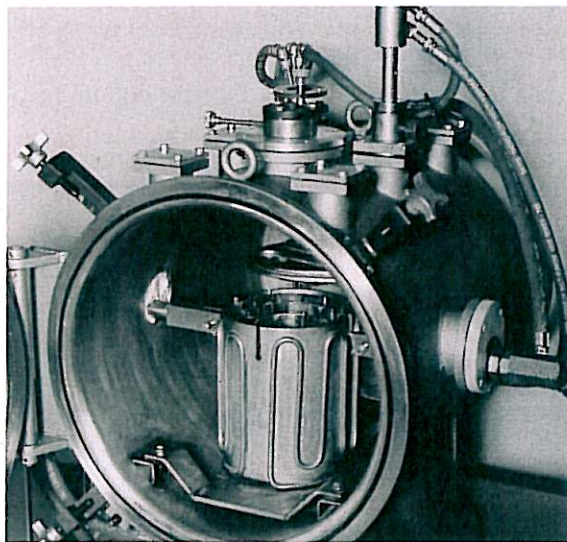
Hydrogen Flow-through Accessory***

Equips System VII/Super VII with burn-off tower, pressure relief port, automatic purge system and necessary interlocks for safe operation with a reducing gas. Furnaces require approximately twice the power supply rating for vacuum from above table to operate at maximum temperature in hydrogen. Refer to Accessory Bulletin G-10503. ... **G-10503A**

***Automatic pumping system and control required (Model E-7607)



Hydrogen Flow-through System Control Panel.



3000°C (5432°F) vertical tungsten hot zone assembly.

AC Power Supplies

Packaged system includes low voltage power transformer, saturable core reactor or Silicon Controlled Rectifier (SCR), linear power controller with current limiter, integral manual start undervoltage trip breaker and water-flow safety switch. Ammeter and voltmeter. Standard, eight foot (2.4 meters) flexible, water-cooled copper power leads are provided. Please specify voltage and frequency.

*Power supplies can be provided to match existing voltage upon request.

**Available for 208, 240, 380, or 480 volt service.

Power Supply Ratings*

kVA	Voltage	Phase	Hertz	Model No.
10	208 or 240	1	50/60	9010
15	208 or 240	1	50/60	9015
20	208 or 240	1	50/60	9020
30	**	3	50/60	9030
45	**	3	50/60	9045
60	**	3	50/60	9060
80	**	3	50/60	9080

When melting and casting
pure metals and alloys.

2 Induction Furnace

Vacuum induction furnace accessories mount in either the System VII or Super VII chamber for melting up to 5 lb. (2.3 kg) ferrous rating. A standard graphite susceptor 2 $\frac{1}{2}$ " I.D. x 5 $\frac{1}{8}$ " high (60 mm x 140 mm) is used as a crucible for a wide variety of metals. Other crucible materials can be used as liners within the graphite susceptor.

Water-cooled furnace assembly mounts on a dielectrically-insulated coaxial feedthrough equipped with an external handle for manual pouring. An optional additions bucket assembly (500 cc) permits late alloy additions.

The swing-aside crucible cover with external handle is a useful option to minimize heat loss and conserve power. Top sight port with optional wiper allows convenient viewing while pouring.

Features and Advantages

Coil designed for low voltage operation — avoids arcing and corona.

Water cooled copper coaxial feedthrough — provides high electrical efficiency.

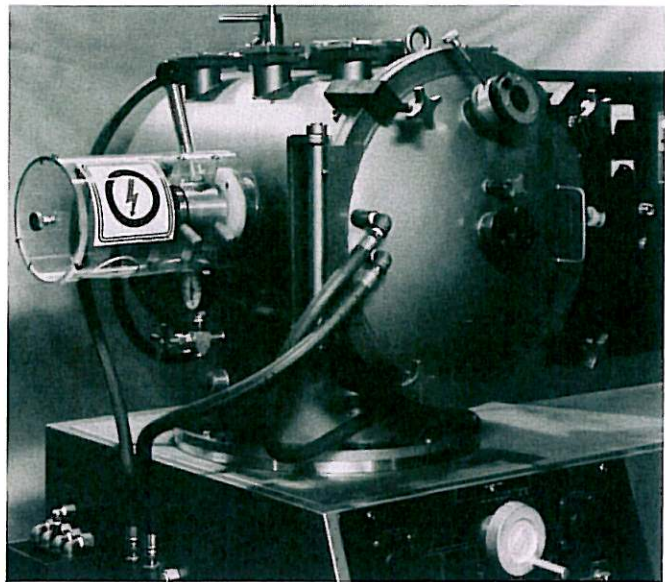
Induction coil feedthrough — connects to a simple coupling, easy operation.

Stainless steel chamber — minimizes inductive power loss.

Rotatable feedthrough — easy tilt pouring into user supplied mold.

Uses 10 kHz power supply — avoids RF interference.

Solid state power supply — tunes automatically to load and efficient design conserves space.



Induction melting furnace coax feedthrough mounts in side port of chamber with safety shield and insulated handle for accurate pouring.

SELECTION GUIDE

Vacuum Induction Melting/Casting Furnace

Model No.

High frequency induction furnace, 5 lb. (2.3 kg) rating; includes water-cooled copper induction coil assembly; tilting coaxial water and power feedthrough assembly; shuttered top Pyrex sight port assembly and stainless steel mold platform. 5-4300

Induction Furnace Options

Alloy additions bucket assembly including manipulator rod and vacuum feedthrough D-13453

Swing-aside crucible cover support including manipulator and vacuum seal B-8423

Externally actuated wiper to remove deposits from top sight glass C-8963

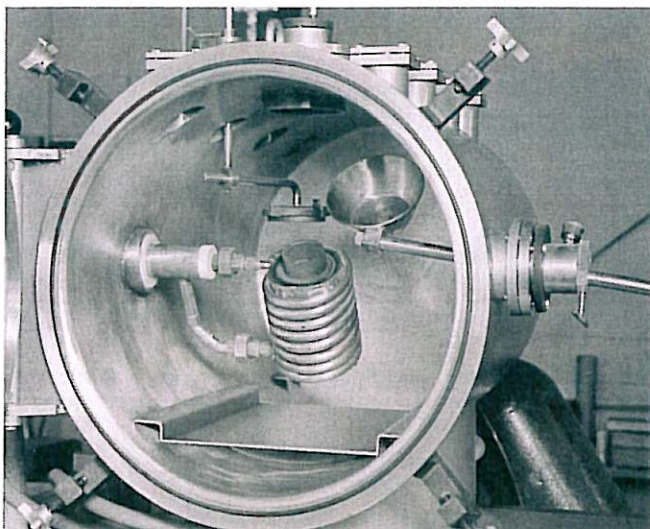
Induction Power Supplies (Vacuum-rated)

Cabinet, self-contained 10 kHz solid state frequency inverter set for 460 volt, three-phase input is supplied with matching six foot (1.8 meters) water-cooled power leads. Output is 200 volts to matching coil. Transformers are available for other voltages on request.

15 kW power supply 9-4915 SS

20 kW power supply 9-4920 SS

Specify 50 or 60 Hz supply frequency



<5 lb. induction furnace and mold platform installed in chamber with alloy additions bucket and swing-aside crucible cover options.

When pure metal castings or arc melted button or rod samples are needed.

3 Arc Melting and Casting Furnace

Arc melted refractory and reactive metal samples of various compositions can be produced under the most ideal conditions for alloy development, spectrographic analysis and phase diagram work in the System VII. The basic arc melting furnace includes a hearth mounting assembly and a non-consumable electrode assembly. Three interchangeable hearth options provide a wide choice of shapes.

The non-consumable electrode can be used with any of these hearths to melt samples in argon or helium. The optional consumable electrode feed tower is used for vacuum melting in the skull hearth.

Features and Advantages

Interchangeable button, bar or skull melting hearths — extreme versatility.

Solid copper hearths with high efficiency water-cooling — insure pure melt samples which are easily removed.

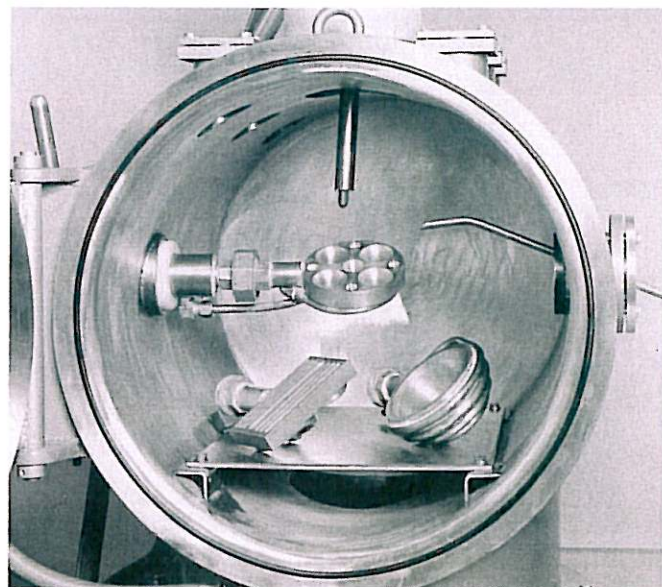
Multi-cavity button and bar hearths — several samples per load.

Skull melting hearth — eliminates graphite or ceramic crucibles and tilts for easy casting.

Thoriated tungsten tip for non-consumable electrode, conservatively rated at 1500 amperes — provides superior arc starting and improved resistance to contamination.

Non-consumable electrode — can swivel through a 30° inclusive angle and has an easily replaceable tip.

Button flipper option — lets you turn buttons over for complete melting.



SELECTION GUIDE

Arc Furnace

Model No.

Basic hearth mounting and electrode kit: includes coaxial water/power feedthrough assembly, non-consumable electrode assembly (with thoriated tungsten tip), cobalt glass filter plus pair of flexible water-cooled power leads. (Accepts any of the following hearth assemblies) 4-4100

Hearth Assemblies

A) Skull hearth 4" dia. (102 mm) hemispherical melting/casting 4-4140

B) Button hearth (nine cavity):

Four cavities $\frac{1}{2}$ " dia. x $\frac{1}{4}$ " deep
(13 mm x 6 mm)

One cavity 1" dia. x $\frac{7}{16}$ " deep
(25 mm x 11 mm)

Four cavities $1\frac{1}{2}$ " dia. x $\frac{7}{16}$ " deep
(38 mm x 11 mm) 4-4150

C) Bar Hearth

Four cavities $\frac{1}{2}$ " w x $\frac{1}{4}$ " d x $4\frac{1}{2}$ " l
(13 mm x 6 mm x 114 mm) 4-4135

Arc Furnace Options

Consumable electrode feed tower assembly (for use with skull hearth — see photo page 14) C-15060

High frequency arc stabilizer (aids starting and stability) HF-201

Manual button flipper assembly (for use with button hearth) 4105

DC Power Supplies for Arc Furnaces, Arc Welding and Resistance Furnaces

Packaged system, designed for operation on 230 or 460 volts, 3 phase, 50/60 Hz; includes control transformer, sealed rectifiers, 100% duty cycle rating, voltmeter, ammeter and variable current foot switch.

Dual voltage power supplies have a circuit specifically designed for use with both the resistance hot zone and the arc melting accessories:

15kW-40/20 volts, 375/750 amps E-9515

30kW-40/20 volts, 750/1500 amps E-9530

45kW-40/20 volts, 1125/2250 amps E-9545

Single voltage power supplies designed exclusively for use with the arc melting accessories:

21 kW-38 volts, 450 amps 901742

52 kW-40 volts, 1000 amps *900660

*Recommended for skull hearth.

◁ Button hearth is mounted to tilting coax feedthrough in vacuum chamber side port. Interchangeable bar and skull hearths can be quickly connected in its place.

When handling pyrophoric or atmosphere sensitive materials.

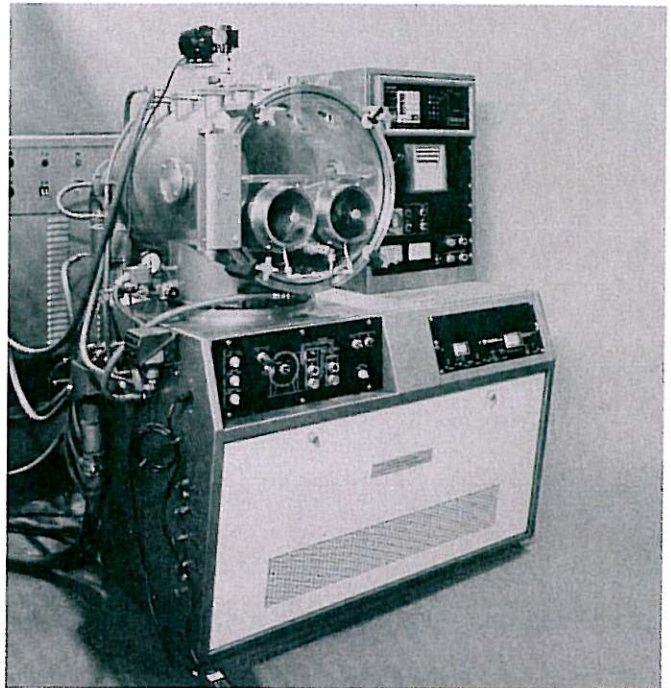
4 Dry Box Assembly

Basic chamber converts quickly and easily to an inert gas "dry box" with the glove box assembly kit. Ideally suited for handling sensitive materials and TIG welding (with welding system — see below). Convenient access for operating within the chamber is provided by two 18" (457 mm) long neoprene gloves.

Multi-access ports of System VII chamber can be used to mount various welding and feedthrough attachments (see below).

SELECTION GUIDE

Model 5100 glove box accessory includes a 1 1/4" (31.8 mm) thick acrylic door with two 6" (152 mm) diameter glove ports (including gloves), vacuum tight covers, valved pump-out line, automatic pressure regulation system, external floodlamp with special sight glass for interior illumination and a stainless steel work table.



Glove ports on transparent dry box cover are valved for pressure equalization during pumpdown prior to inert gas backfill.

When joining reactive, refractory, and special materials and alloys.

5 Inert Gas Welding System

Inert gas welding accessory and glove box accessory (above) converts the basic chamber into a TIG welding facility for joining reactive, refractory and other special metals and alloys.

Light weight TIG welding torch permits precise welding in a carefully controlled inert gas environment and accepts standard 0.020", 0.040" and 1/16" (0.5 mm, 1.0 mm and 1.5 mm) electrodes.

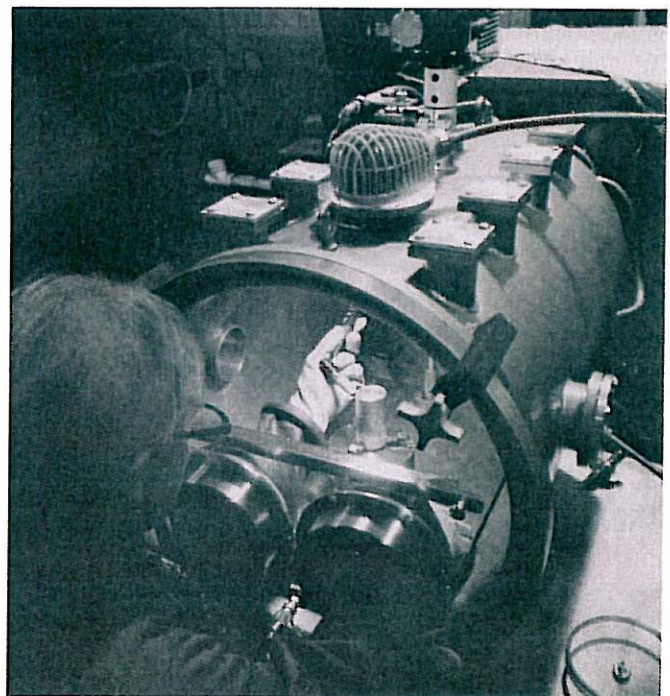
Variable speed drive with foot switch allows hands-off rotation of universal 3-jaw chuck.

A stainless steel work table supports the chuck and internal drive train.

SELECTION GUIDE

Model 5200* inert gas welding accessory includes a pencil torch, power lead/feedthrough, 5" (127 mm) universal 3-jaw chuck with DC motor rectifier supply, vacuum and rotary seals, drive train with foot switch and a low amperage DC power supply with high frequency circuit and remote foot control.

*Model 5100 Dry Box Assembly must be ordered separately.



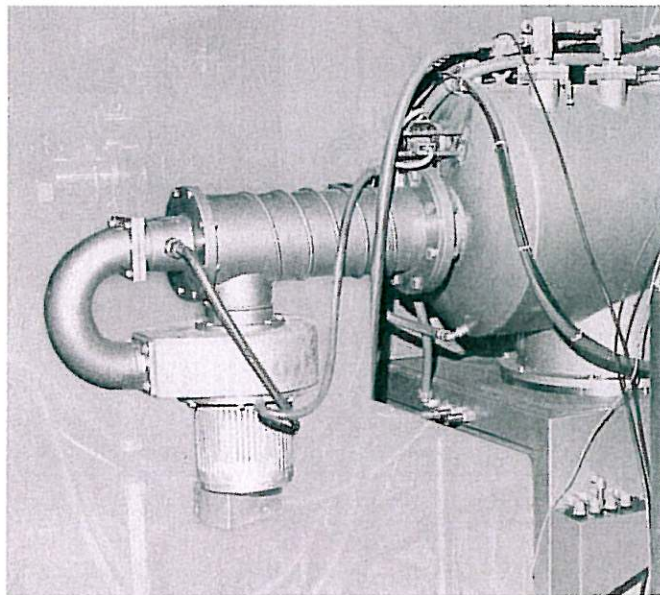
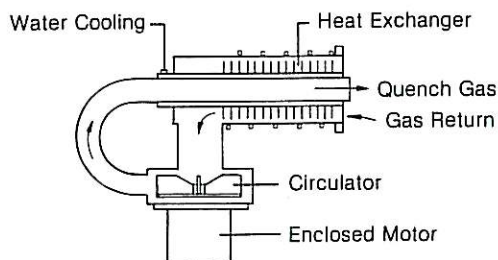
Arc welding in an inert gas atmosphere is easily performed with the welding system accessory kit.

When cycle time is critical
in a resistance furnace.

6 Gas Quench Accessory

Closed loop ducting integrates high speed blower and heat exchanger with the System VII / Super VII resistance furnaces to provide in-place load cooling capability. High speed cooling is achieved with high velocity gas flow. Accessory requires special rear port on chamber. Includes manually operated front and rear swing aside shutter shields to allow full circulation of gas through the hot zone. Refer to Product Information Bulletin on **Model 6-250**.

Gas Quench Schematic

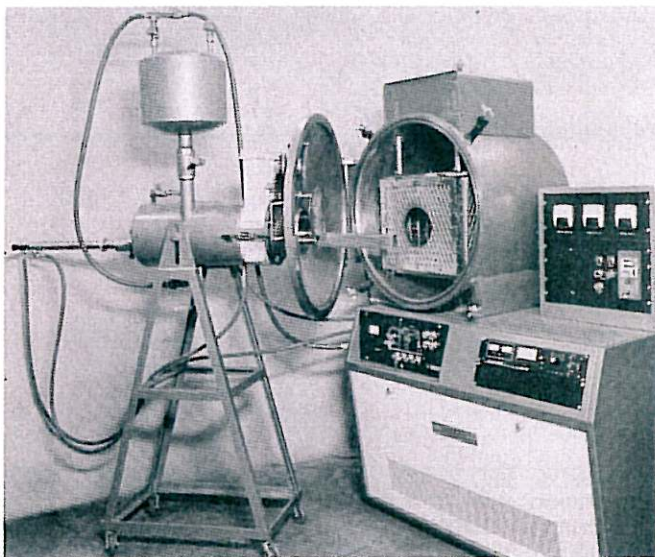


Compact gas quench accessory mounts on special 6 in. flange at rear of chamber.

When oil or
water quenching is needed.

7 Liquid Quench Accessory

Separate roll-away quench chamber with Inconel work tray, manipulator rod, and stainless steel reservoir connects to the System VII / Super VII with modified chamber door and front shields of hot zone to provide laboratory scale oil or water quench capability. Accessory requires special front door. Refer to Product Information Bulletin on **Model 306-1100**.



Roll-away quench chamber connects to basic vacuum chamber with isolation valve mounted on modified front door.

For complete temperature control,
programming and process records.

Operating Controls and Instrumentation

Cabinet-enclosed assembly mounts to the right side of the chamber and contains all instruments required to control the resistance furnace. Custom selection of temperature controllers, programmers and recorders combine with the standard instrument package to meet the specific requirements of a versatile R&D or production furnace. Legends are silk screened for permanent — long lasting readability.

SELECTION GUIDE

Select temperature controller, programmer and recorder along with appropriate thermocouples and add to standard instrument package.

Model No.

Standard Instrument PackageE-7777

Overtemperature Protector — High limit control indicates furnace temperature and protects furnace from overtemperature conditions. Digital setpoint with adjustable high-limit relay will turn off furnace power at a pre-selected temperature. Requires separate thermocouple (Honeywell UDC-2000).

Ammeter and Voltmeter — measure secondary of AC power supply.

Indicating lights and on-off buttons — for instrument power and power supply.

Alarm panel — visual and audible alarm signal for overtemperature condition and low water supply to chamber and power supply with push-button to silence alarm.

Temperature Controller*

Auto/manual three-mode microprocessor-based proportional type controller with digital read-out of temperature setpoint. Requires thermocouple.

Barber Colman 560.....	E7560
Honeywell UDC 300.....	E7300
Honeywell UDC 5000.....	E7500
L&N Electromax® V.....	E7915

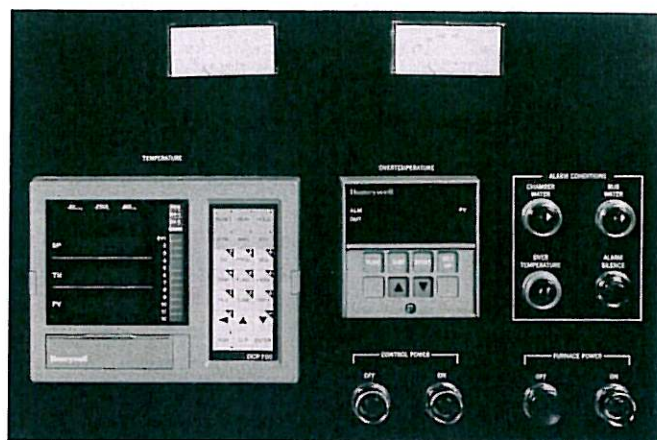
Temperature Controller/Programmer*

Microprocessor-based combination three-mode temperature controller and variable setpoint-versus-time programmer with digital display of temperature. Requires thermocouple.

Barber Colman 570	E7570
Honeywell DCP 511	E7511
Honeywell DCP 700	E700
L&N 1300	E7915/E1300
R.I. Micristar™	E7828

Optical Pyrometer

Two color, fixed position, optical sensing pyrometer, mounted to a manual valved sightport R24C05



Typical control cabinet includes E-7777 standard instrument package and E-700-1 temperature controller/programmer.

Model No.

Strip Chart Recorders*

Single pen and two pen for continuous printout or multipoint for temperature, vacuum or both.

6" chart (150mm)	— single pen (L&N).....	E-7165
	— single pen (Honeywell).....	E-7111
	— two pen (Honeywell).....	E-7211
	— multipoint (L&N).....	E-7165
10" chart (250mm)	— multipoint (L&N).....	E-7250
	— multipoint (Honeywell-programmable)	E-1500
	— multipoint (Barber Colman-programmable).....	E-7064
	— six pen (Chessell)	E-7320
11" chart (280mm)	— single pen (Honeywell).....	E-7112
	— two pen (Honeywell).....	E-7212

Thermocouples

12 in. long, 1/8" dia. metal sheathed, refractory oxide insulation; includes matching quick disconnect plug and jack connectors, lead wire and mounting.

Chromel/Alumel, type "K", with inconel sheath (up to 1050°C)..... K-12

Platinum/Platinum — 13% Rhodium, type "R", molybdenum sheath (up to 1540°C)..... R-12-M

Tungsten/5% Rhenium, Tungsten/26% Rhenium, type W5, molybdenum sheath (up to 1700°C)..... W5-12-M

Tungsten/5% Rhenium, Tungsten/26% Rhenium, type W5, tantalum sheath (up to 2100°C)..... W5-12-T

*Other manufacturers and models available upon request.

Technical Data

General Performance Data

Chamber

Pump down to 10^{-5} torr range:
 <10 min. — metal hot zone
 <15 min. — graphite hot zone

Ultimate pressure:
 10^{-6} torr range
 (10^{-7} torr range, LN_2 trap)

Rate of rise:
 <5 millitorr/hr.

Utility Requirements

System VII conserves energy; furnace power used only during heating and soak; no standby consumption required.

Electrical

Varies from 10 to 45 kW depending upon power supply selected. Entrance current rating will also depend on voltage available.

Cooling Water

From 2 to 11 gpm (7.6-42 l/min) depending on system components.
 Inlet pressure: 30-50 psig (2-3.5 bar)
 Inlet temperature: 70°F (21°C)

Compressed Air

(required for automatic valve sequencer E-7607)
 ~2 CFH (~54 l/hr) at 80-90 psig (5.5-6.4 bar), intermittent use.

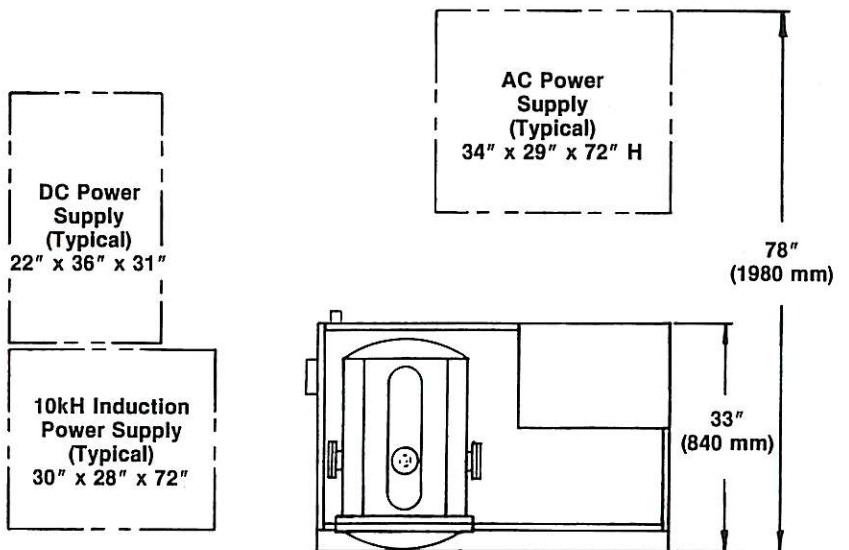
Inert Gas

For backfill and cooling: one chamber volume.
 For partial pressure flow-through: varies; consult factory.

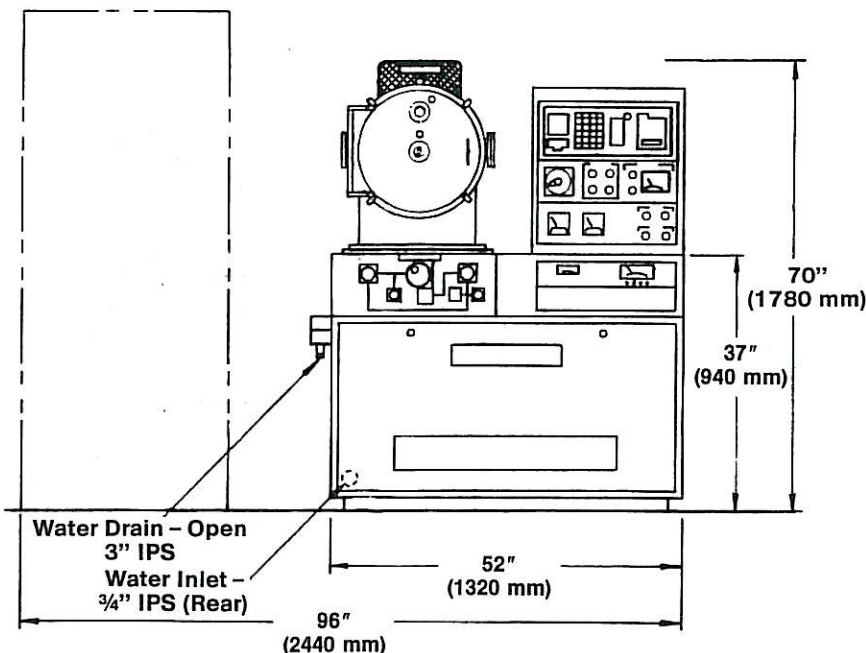
Shipping Weight

Typical system: 4000-5000 lbs (1800-2300 kg)

Space Requirements



TOP VIEW



FRONT VIEW

Safety Features

The following safety features ensure maximum operating convenience and minimize possibilities of inadvertent misoperation.

Chamber

- Overpressure relief valve on chamber.
- Sight glass positioned to view element feedthroughs.
- Designed to meet or exceed ASME Section VIII requirements.
- Cold wall protects operator.

Pumping System

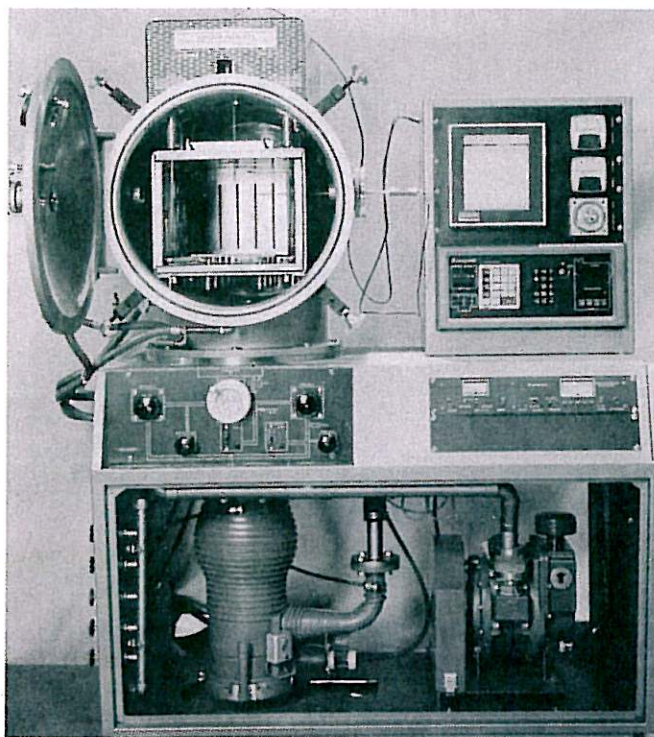
- Open sight drain.
- Diffusion pump has thermostat shut-off protection.
- Visible oil gauge on mechanical pump.
- Optional Model E-7607 automatic valve sequencer includes:
 - Normally closed vacuum valves.
 - Visual indications of pump and valve operation.
 - Automatic vent which protects hot zone when properly plumbed to an inert gas line.
 - Keylock protection with manual override.

Instruments

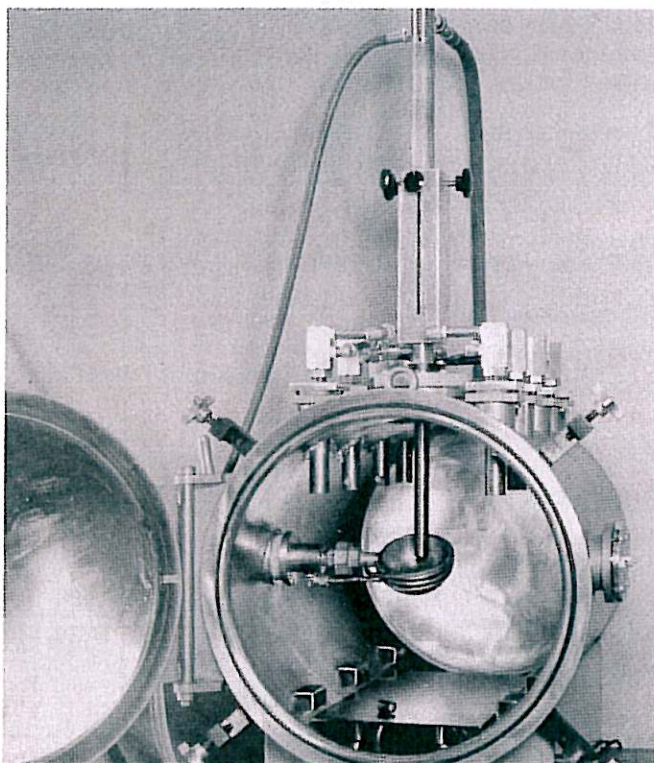
- Loud, audible alarm.
- Overtemperature shut-off to prevent catastrophic melt down of resistance hot zone.
- Upscale burn out protection on all recorders.
- Electrical design and construction to meet NEC requirements.
- Separate control power ON-OFF button.

Furnace Hot Zone

- Element and chamber water circuits include a flow switch to prevent system from being turned on without sufficient water flow.
- Element designed for low voltage operation.
- AC power supplies have undervoltage trip circuit breakers.
- Vacuum interlock to prevent system from being turned on at atmospheric pressure.



Vacuum pumping system is totally enclosed for safety; quick access cover provided for maintenance convenience.



Optional consumable electrode feedtower assembly for arc melting furnace.

Conversion Factors Vacuum Technology

Pressure Units

pascal (Pa) —

The derived unit for pressure in the International System of units (SI), newton per square meter (N/m²), has been named pascal (Pa).

torr (Torr) —

A unit of pressure defined as 1/760 of a standard atmosphere. It replaced the term millimeter of mercury (mm Hg).

micron (μHg) —

A pressure unit still referred to because of its widespread use in the past, the micron is equivalent to one millitorr (formerly 10⁻³ mm Hg).

Pressure Units Conversion

To convert From ▽ To▷	pascal (Pa)	torr or mm Hg	millibar	atm	psi	in. Hg
	multiply by:					
pascal (N/m ²)	1	7.5 x 10 ⁻³	10 ⁻⁵	9.87 x 10 ⁻⁶	1.45 x 10 ⁻⁴	2.95 x 10 ⁻²
torr (≅ mm of mercury)	133	1	1.33 x 10 ⁻³	1.32 x 10 ⁻³	1.93 x 10 ⁻²	3.94 x 10 ⁻²
millibar	100	0.75	1	9.87 x 10 ⁻⁴	14.5 x 10 ⁻²	29.5 x 10 ⁻³
atm (normal atmosphere)	1.01 x 10 ⁵	760	1.01	1	14.69	29.9
psi (lbs/in ²)	6.89 x 10 ³	51.74	68.97 x 10 ⁻³	6.80 x 10 ⁻²	1	2.04
in. Hg (inches of mercury @ 0°C)	3.39 x 10 ³	25.4	3.39 x 10 ⁻²	3.34 x 10 ⁻²	0.491	1

Conversion Reference

torr	10 ⁻⁶	10 ⁻⁵	10 ⁻⁴	10 ⁻³	10 ⁻²	10 ⁻¹	10 ⁰	10 ¹	10 ²	atm
mm Hg	0.000001	0.00001	0.0001	0.001	0.01	0.1	1	10	100	760
micron	0.001	0.01	0.1	1	10	100	1000	10,000	100,000	760,000
pascal	0.000133	0.00133	0.0133	0.133	1.33	13.3	133	1330	13,300	101,000

Leak Rate and Mass Throughput Units

Leak rates are expressed as mass flow per unit time. Examples of common units are defined below.

1 atm-cm³/sec = 1 cm³/sec. at atmospheric pressure

1 torr-liter/sec = 1 liter/sec. at 1 torr pressure.

The table can be used to convert from one set of units to another.

Throughput Units Conversion

To convert From ▽ To▷	Pa - m ³ /s	Torr — l/s	atm - cm ³ /s	μl/s	μft ³ /hr.
	multiply by:				
pascal-meter ³ /second (Pa-m ³ /s)	1	7.5	9.87	7.50 x 10 ³	9.53 x 10 ⁵
torr-liter/second (Torr-l/s)	1.33 x 10 ⁻³	1	1.32	1000	127 x 10 ³
atmosphere-cc/second or standard-cc/second (atm-cm ³ /s)	101 x 10 ⁻³	760 x 10 ⁻³	1	760	95.8 x 10 ³
micron-liter/second (μl/s)	1.33 x 10 ⁻⁶	1 x 10 ⁻³	1.32 x 10 ⁻³	1	127
micron-cubic foot/hour (@ STP) (μ ft ³ /hr.)	1.05 x 10 ⁻⁶	7.87 x 10 ⁻⁶	10.3 x 10 ⁻⁶	7.87 x 10 ⁻³	1

Pumping Speed Conversion — Gas

To convert From ▽ To▷	liters/sec.	ft. ³ /min.	m ³ /h
	multiply by:		
liters/sec. (l/s)	1	2.12	3.60
cubic feet/min. (ft. ³ /min.)	0.472	1	1.698
cubic meters/hr. (m ³ /h)	0.278	0.589	1

Flow Conversion — Liquid

To convert From ▽ To▷	SCFM	liters/min.	GPM
	multiply by:		
cubic ft./min. (SCFM)	1	28.3	7.48
liters/min. (l/min.)	0.035	1	0.264
gallons (US)/min. (GPM)	0.134	3.785	1

Quality Assurance

Over a quarter century of experience in designing, manufacturing and testing vacuum furnaces of all types is the technical advantage gained when you select Vacuum Industries equipment. Broad manufacturing capabilities permit maximum control over product integrity.

Vacuum chamber assemblies and related components are fabricated and mass spectrometer leak-checked at the plant. Instrumentation and electrical control cabinets are fabricated, assembled, wired and checked by expert craftsmen.

Factory Test

Final furnace functional tests take place before shipment. Customers are invited to witness final performance checks at the plant, taking advantage of the opportunity to review installation and operating procedures with the service group.

Service and Spares

Instructions and drawings needed for installation, operation and maintenance are supplied with the equipment. The systems are simple to install with easily-made electrical, water supply, and water drain connections.

Field servicemen are available, if desired, to inspect the original installation and to supervise start-up operations. Maintenance parts and technical service are readily available.

Other Vacuum Industries Products

Workhorse® Horizontal Vacuum Furnaces & FGQ Quench Systems

Sintervac® Vacuum Sintering Furnaces

Vacuum Hot Press Sintering Furnaces

High Vacuum Heat Treating/Brazing Furnaces

High Vacuum Annealing Furnaces

V-I-Melt Vacuum Induction Melting Furnaces

Batch, Semicontinuous; Equiax, Directional Solidification

Vacuum Arc Melting Furnaces
Batch, Semicontinuous

Diffusion Bonding Hot Press Furnaces

Vacuum-Inert Gas Manual and Semi-Automatic Welding Systems



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