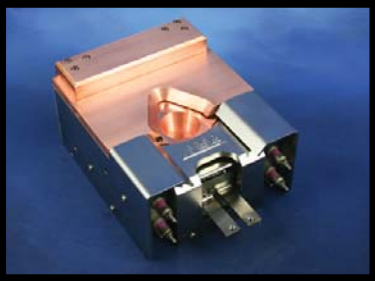
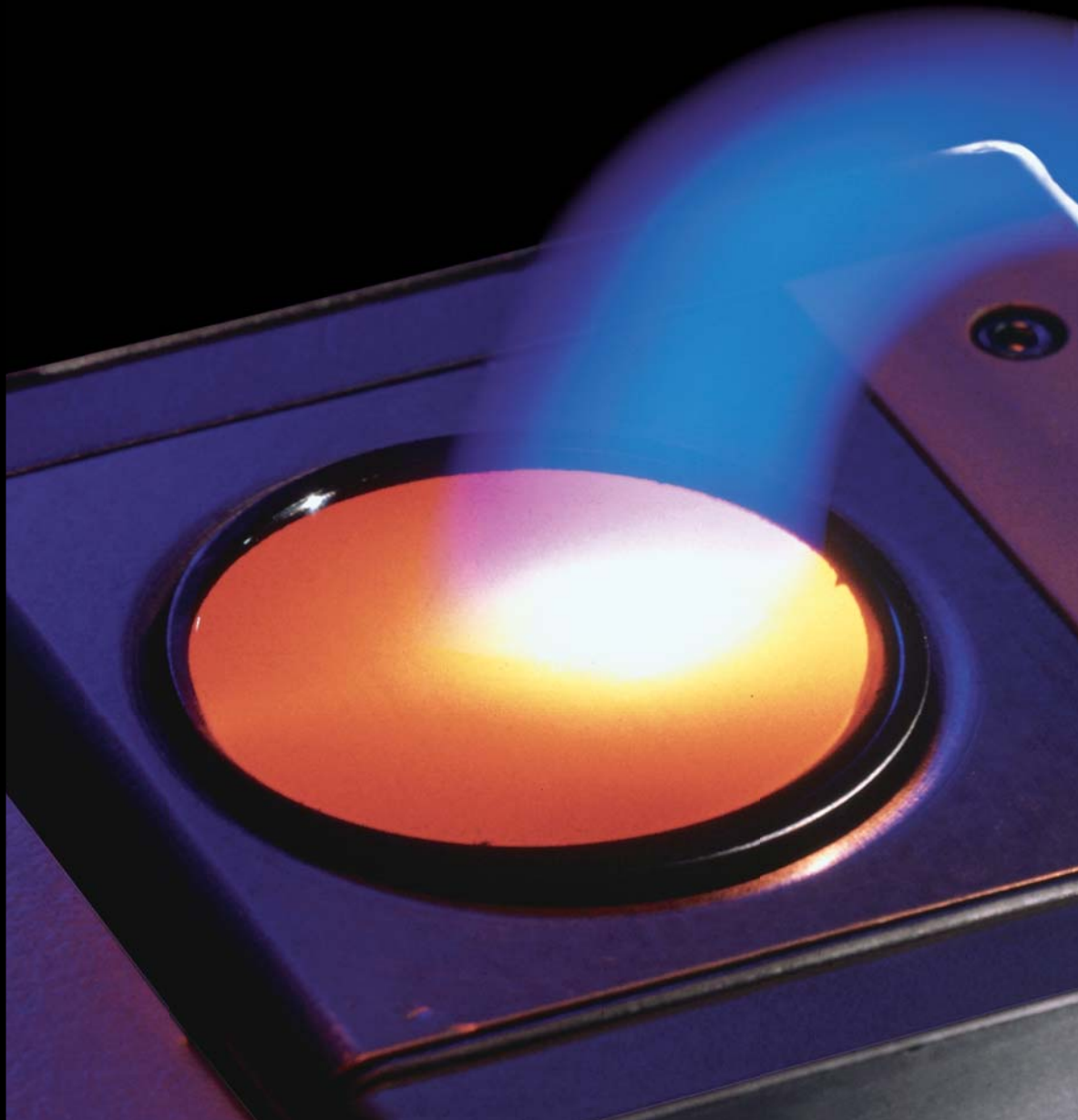
MeiVac INC.

Quality Vacuum Components

e-Vap®

Thin Film Evaporation Sources & Controls





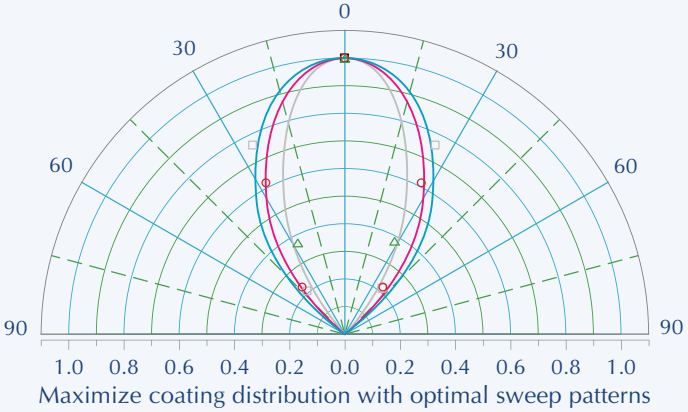
e-Vap®

e-Vap Product

MeiVac designed sources incorporate the best of the original e-vap source with modern features for today's processes. These compact sources use modular construction that is rugged yet simple to maintain. Special attention was placed on common parts throughout the product line. Now the same high performance emitter and magnetic system is used for fixed pocket and rotary pocket sources. You can even interchange crucible assemblies from fixed pocket to multi-pockets without replacing the source. Simple to operate and service, the new e-Vap offers the best evaporation source performance on the market at an affordable price.

e-Vap Advantage

e-Vap sources incorporate the latest magnet designs. These proprietary designs eliminate beam curl and uneven heating for increased material utilization up to 80%. The emitter design includes an ion collection plate to increase filament life 2 to 3x (up to 1800 hours), compared to traditional designs. A single ceramic controls all critical tolerances making assembly simple while assuring top performance every time. Electronics are modern digital units with built-in settings to take full advantage of e-Vap source features. They also include Ethernet, RS-232 and standard graphic user interface (GUI), making e-Vap the best solution for an automated coating tool.



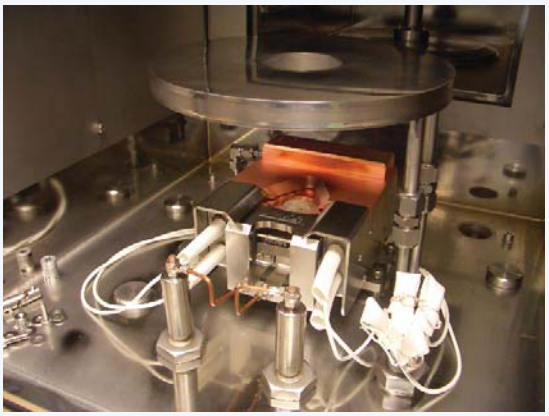
Maximize coating distribution with optimal sweep patterns

How *e-Vap* Works

A filament is heated to create a stream of electrons accelerated by a high voltage power supply. These electrons are directed and focused by permanent and electromagnetic fields to impact a material placed in a water cooled crucible. Striking the material, the beam's kinetic energy is converted to thermal energy. The energy of this concentrated beam can produce temperatures above 3500°C. Temperature can be precisely regulated to allow evaporation of any material. Deposition rates can be regulated as low as 0.2Å/second up to thousands of angstroms per second.

e-Vap Process

Evaporation is a physical vapor deposition (PVD) process. This is a common technique for depositing thin films from mono layers to micron thicknesses. e-Vap sources can deposit metals and alloys as well as ceramics and dielectric materials. Deposition of single layer, multi-layers and co-deposited layers with complete control over composition and deposition rate can be achieved. Virtually any material that remains solid under vacuum can be deposited by this technique. Materials can be readily changed by simply removing and replacing with fresh material.



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e-Vap Performance and Application

System design and layout can vary significantly for specific processes. There are some general rules of thumb that apply to most cases. Vapor from the source conforms to the cosine model with a few exceptions. The most notable being the material's ability to become ionized and influenced by the source's magnetic field. At high deposition rates vapor pressure of the evaporant material can rise to the point of viscous flow. In this case the vapor will have multiple collisions and not act as a point source from the beam impact position. At some height above the crucible, molecular flow will be reestablished and the vapor can again be considered as coming from a point source. This condition is called the virtual source height factor. At low deposition rates <100 Å/minute this effect can be ignored. At high deposition rates this effect can be greater than ½ inch. Models can become very complex but in practical application, the cosine model can be used for initial system layout. Small tooling adjustments may be required for high precision films (<2% uniformity).

e-Vap 3kW rate data at 12″ source to substrate distance. Average Al uniformity 0.68% 2″ sample 2.67% 4″ sample. Maximum Total Film Thickness 1.09 Micron, 1,090 nm

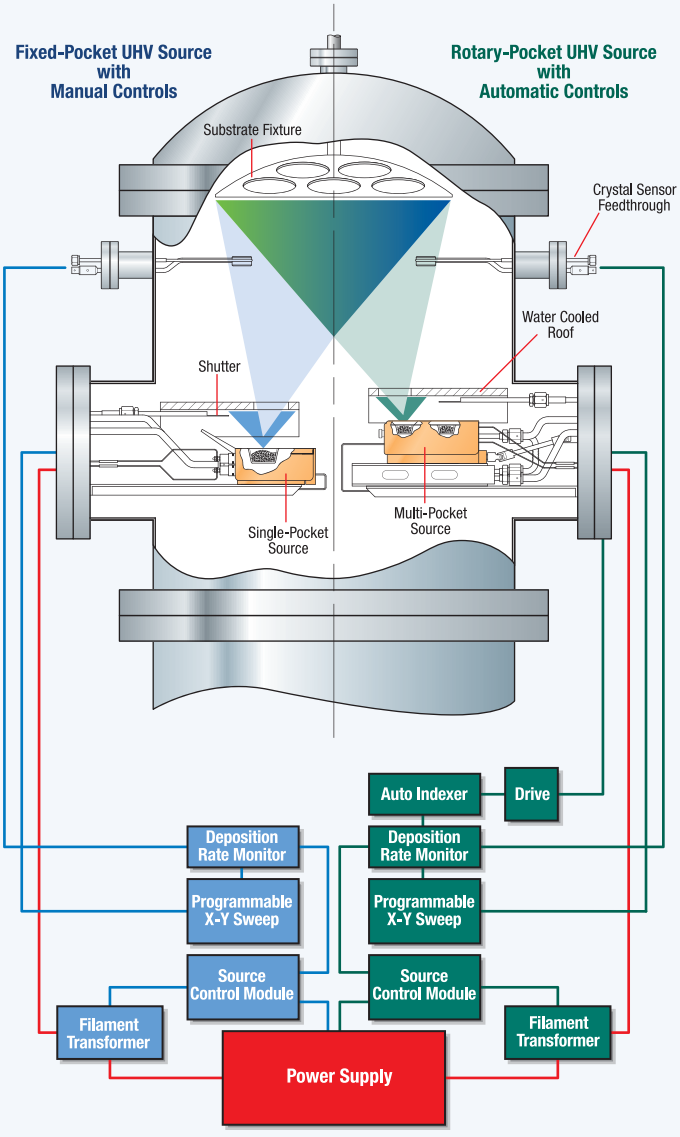
Material	Rate Å/Min	Power
Aluminum	1,000	3 kW
Al2O3	840	1.5 kW
Carbon	3,000	2 kW
Chrome	9,600	1 kW
Copper	960	3 kW
Gold	900	2.5 kW
Niobium	135	3 kW
Silicon	2,100	2.5 kW
SiO2	18,300	1 kW
TiO2	1,080	1.75 kW
Tungsten	60	3 kW

e-Vap 3kW Systems

3 kW sources typically have about 2cc of material capacity. This volume is based on the mass of material that can be loaded versus the amount of power or heat available for the evaporation process. By limiting the volume of material, a 3kW source can readily achieve evaporation of almost any material including high vapor pressure materials and refractory metals. Coating systems with 3kW sources will typically utilize a source to substrate distance of 10 to 14 inches.

e-Vap 6kW to 12kW Systems

These high power sources can hold up to 400cc of material and have up to 6 sequentially selectable crucibles. Crucible size is the primary consideration in determining power level. 7cc to 25cc crucibles should be used with 6kW power supplies. 40cc to 400cc can handle up to 12kW. In some cases a smaller power supply can be used depending on the desired evaporant materials. Coating systems with high power e-Vap sources will typically utilize a source to substrate distance of 18 inches and above. 22 inches and above is typically required for a lift off process. Systems can incorporate a large variety of sample substrate holders from simple static holders to multiple axis planetary rotation holders. In-line systems and web coating systems are also common.



Electronic components fit on standard 19" rack. Filament transformer can be mounted remotely as shown or directly on source flange.

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e-Vap Performance and Application

Determining the proper e-Vap source requires some knowledge of the desired process requirement. Key elements such as vacuum level, total film thickness and total coating time should be considered. In most cases these parameters will change over the life of the coating system to accommodate process improvements or even complete process changes. MeiVac can guide you through the selection process. From source selection to complete systems, MeiVac has the experience and expertise to make your coating concept a reality. Flange mounted source assemblies and OEM packages are available. The following can be used to guide your selection.

- Number of materials
- Crucible size
- Vacuum level (HV or UHV)
- Source to substrate distance
- Total film thickness
- Uniformity

Typical Uniformity for Aluminum. Many factors can affect uniformity. For Reference only.

Source to substrate	2" dia.	4" dia.	6" dia.	8" dia.
12 inch	0.70%	2.75%	6.00%	10.40%
18 inch	0.35%	1.25%	2.75%	4.8%

Crucible Volume	Approx. Total Film Thickness	Source to Substrate Distance
2cc	1.09 Micron	12 inches
7cc	1.6 Micron	18 inches
15cc	3.5 Micron	
25cc	5.9 Micron	
40cc	9.5 Micron	
75cc	17.9 Micron	
100cc	23.9 Micron	

Number of Materials	Crucible Size CC	eVap Source Description	Part Number	Source Vacuum Compatibility
1	2	Fixed Miniature e-Vap Source 2cc	0414-0004-1002	2x10E-11 Torr
	7	Fixed Mighty Source 7cc	0408-0004-1007	
	12	Fixed Mighty Source 12cc	0408-0004-1012	
	7	Fixed Pocket e-Vap 7cc	0402-5004-1007	
	15	Fixed Pocket e-Vap 15cc	0402-5004-1015	
	25	Fixed Pocket e-Vap 25cc	0402-5004-1025	
	40	Fixed Pocket e-Vap 40cc	0402-5004-1040	
	75	Fixed Pocket e-Vap 75cc	0402-5004-1075	
	100	Fixed Pocket e-Vap 100cc	0402-5004-1100	
3	100	Large Frame Rotary Pocket 100cc	0406-0004-3100	2x10E-8 Torr
4	2	Mighty Source 4 Pocket 2cc	0408-0004-4002	
	7	Large Frame Rotary Pocket	0404-0004-4007	
	15	Large Frame Rotary Pocket	0404-0004-4015	
	25	Large Frame Rotary Pocket	0404-0004-4025	
	30	Large Frame Rotary Pocket	0404-0004-4030	
	40	Extra Large Frame Rotary Pocket	0406-0004-4040	
	60	Extra Large Frame Rotary Pocket	0406-0004-4060	
	75	Extra Large Frame Rotary Pocket	0406-0004-4075	
6	7	Large Frame Rotary Pocket	0404-0004-6007	
	12	Large Frame Rotary Pocket	0404-0004-6012	
	25	Extra Large Frame Rotary Pocket	0406-0004-6025	
	40	Extra Large Frame Rotary Pocket	0406-0004-6040	
1	150	Large Frame Rotary Pocket	0404-0004-1150	
	400	Extra Large Frame Rotary Pocket	0406-0004-1400	

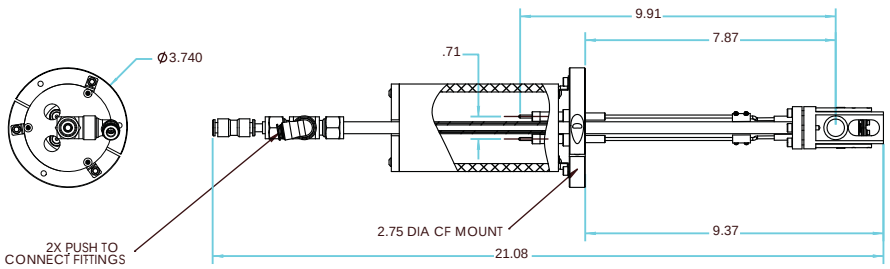
e-Vap®

e-Vap Product Outline Drawings

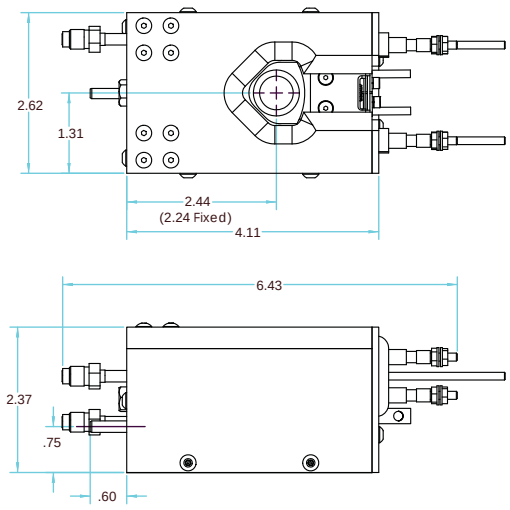
Flange mount, custom assemblies and OEM packages available.
3D-Models available upon request.
For more information contact us at support@meivac.com

Dimensions in inches

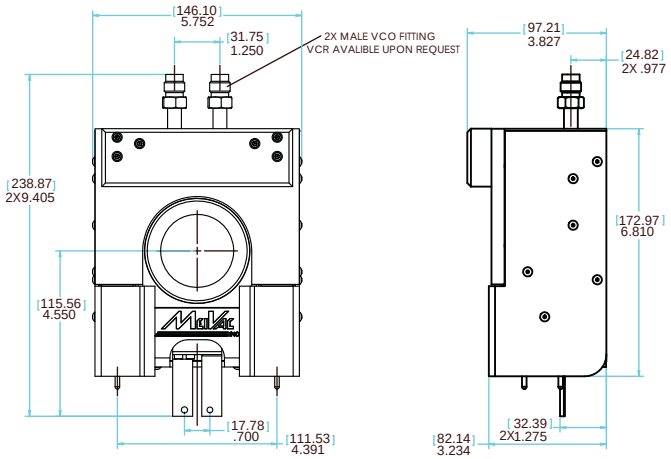
Fixed Miniature Source



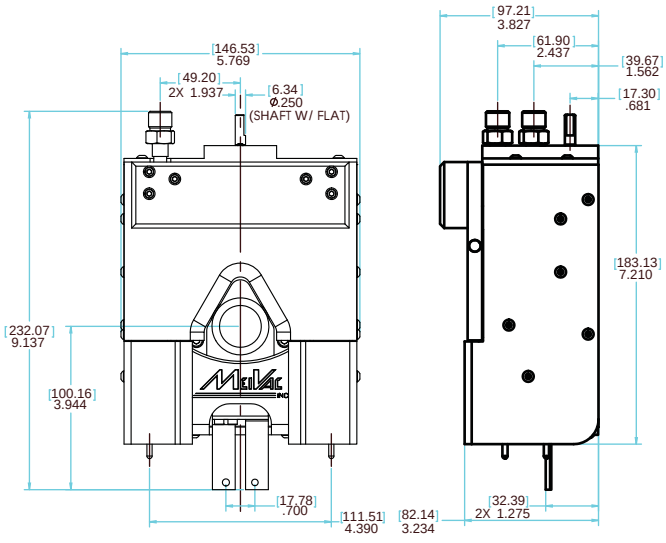
Mighty Source



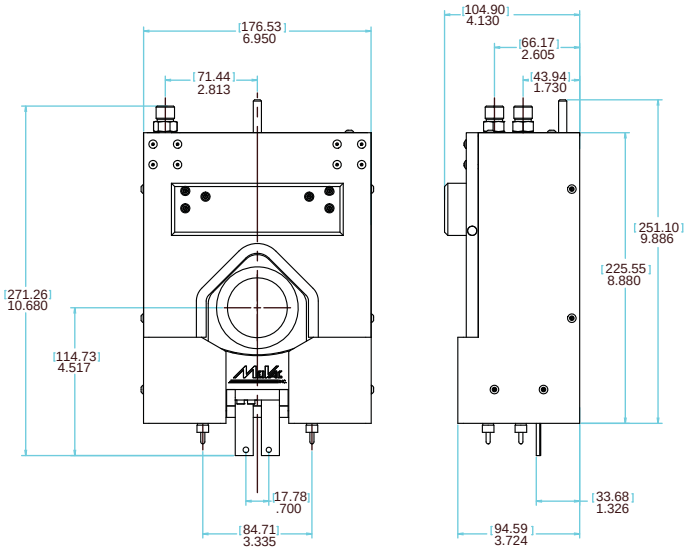
Fixed Pocket



Large Frame Rotary



Extra Large Frame Rotary



e-Vap®

e-Vap Power Supplies and Controls

- 3, 6, and 12kW models
- Solid state high frequency switching technology
- Advanced arc detection and suppression circuits
- Modern interface Ethernet and RS-232
- Graphic user interface GUI
- Programmable control features
- Large display
- CE compliant

3kW e-Vap Power Supply	
Input	220 VAC single phase 50/60 Hz, 18 Amps
Output	0 to -6,000 VDC 0 to 0.5A
Controls	Front panel HV on/off, Filament on/off, emission adjust knob
Arc Suppression	Includes fast-arc recovery system
Interface	Ethernet, RS-232 with GUI
Metering	Digital Voltage and Emission current
Size	3U H x 19" W x 21" D
Weight	46 pounds

6 and 12kW e-Vap Power Supplies	
Input	220 VAC single or 3-phase 50/60 Hz
Output	0 to -10,000 VDC 0 to 0.6 A (6kW) 0 to 1.2 A (12kW)
Arc suppression	Includes fast-arc recovery system
Interface	Ethernet, RS-232 with GUI
Metering	Digital Voltage and Emission Current
Size	3U H x 19" W x 21" D (6kW) 6U H x 19" W x 21" D (12kW)
Weight	46 pounds (6kW) 90 pounds (12kW)

e-Vap Source Control Module	
Input	220 VAC single phase 7.5A
Output	12 VAC 0 to 50 Amp high frequency
Meter	Large graphic display
I/O	Analog and Digital I/O Ethernet, RS-232 with GUI
Filament transformer	Remote mount Includes cable kit
Size	1U H X 19" W X 21" D
Weight	18 pounds

e-Vap Programmable Sweep Control	
Input	115 VAC / 220 VAC, 3A
Output	5 Amp, 200 Hz
Meter	Large graphic display
I/O	RS-232 or Digital I/O
Size	3U H X 8.5" W X 14" D
Weight	11 pounds

e-Vap®

Re-Vap Sources and Power Supplies

MeiVac's Re-Vap resistive evaporation sources offer an economical and reliable method of depositing thin film coatings. Re-Vap power supplies deliver high current low voltage to a resistive element. This element can be a filament, a boat or a basket designed to hold a crucible. Elements can reach temperatures up to 1800°C providing enough power to evaporate most common materials. The low cost elements can be easily replaced making the sources an ideal low-budget solution for R&D or appropriate production tools.

- 900W and 3kW models (can stack to make 6kW)
- Broad range of standard elements
- 3kW switching supply CE compliant
- Clamp system accepts all resistive element types

Re-Vap Sources	
900 Watt source mounted on 2.75: CF Type flange	0413-5004-1000
3,000 Watt Source kit Includes 2 each 1" bolt feedthroughs, Z-bar, 2 rigid clamps and 2 airside clamps	0413-7500-0
Re-Vap Power Supplies	
900 Watt power supply Manual control with analog meter	0413-2504-0
3,000 Watt power supply Solid state. I/O requires control inputs. Metering signal only.	7007-0413-0

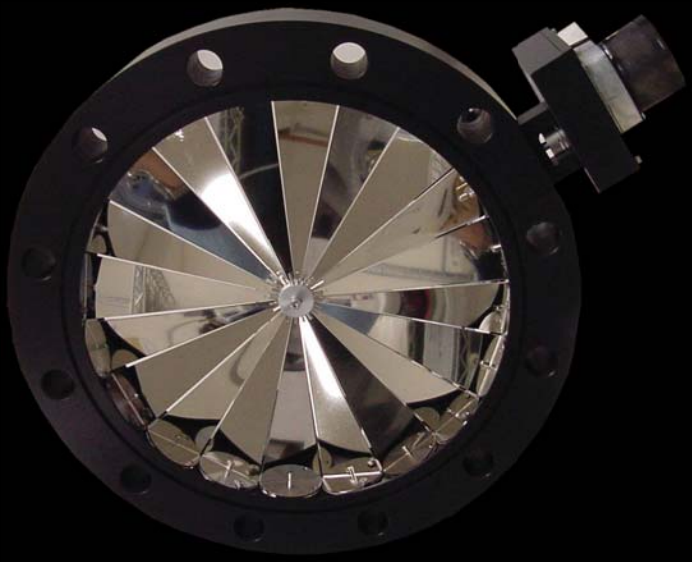
e-Vap Crucible Liners

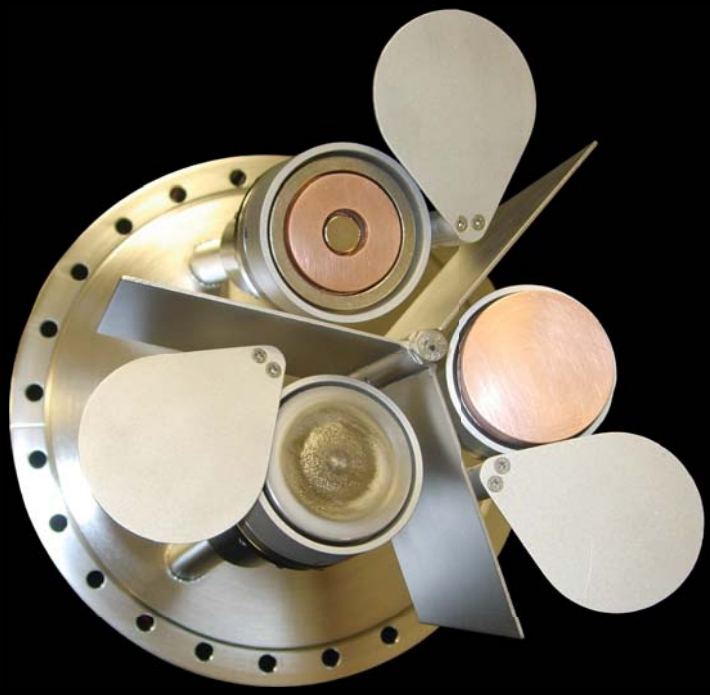
Crucible liners are often used to enhance the coating process. Liners offer thermal insulation allowing higher rates at lower power levels. In some cases the added isolation increases stability of the material making the process easy to perform and reproduce. Crucible liners also protect the evaporation source from damage while keeping the source pocket clean. This allows the user to change materials without cleaning the source with no risk of contamination. Liners are available in a variety of materials and sizes.

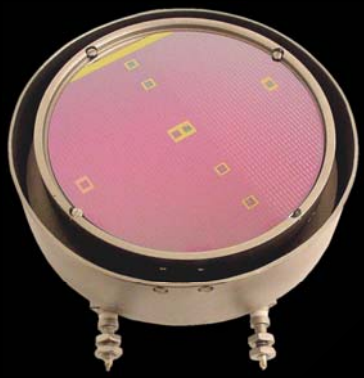
- 2cc, 6cc, 7cc, 15cc, 25cc, 30cc, 40cc, 60cc, 75cc, 100cc
- Graphite, Vitreous Graphite, FabMate, Molybdenum, Tungsten, Boron Nitride, Aluminum Oxide, Intermetallic, Copper

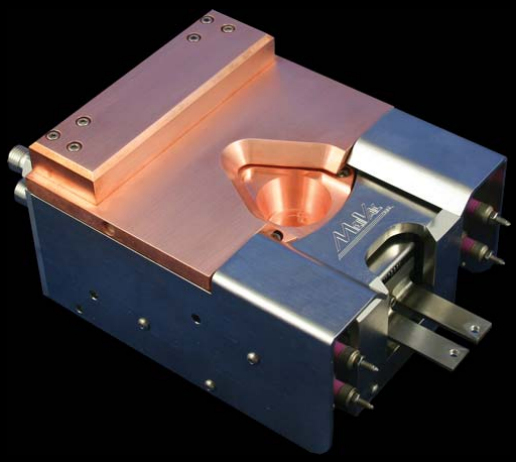
e-Vap Accessories and Spare Parts

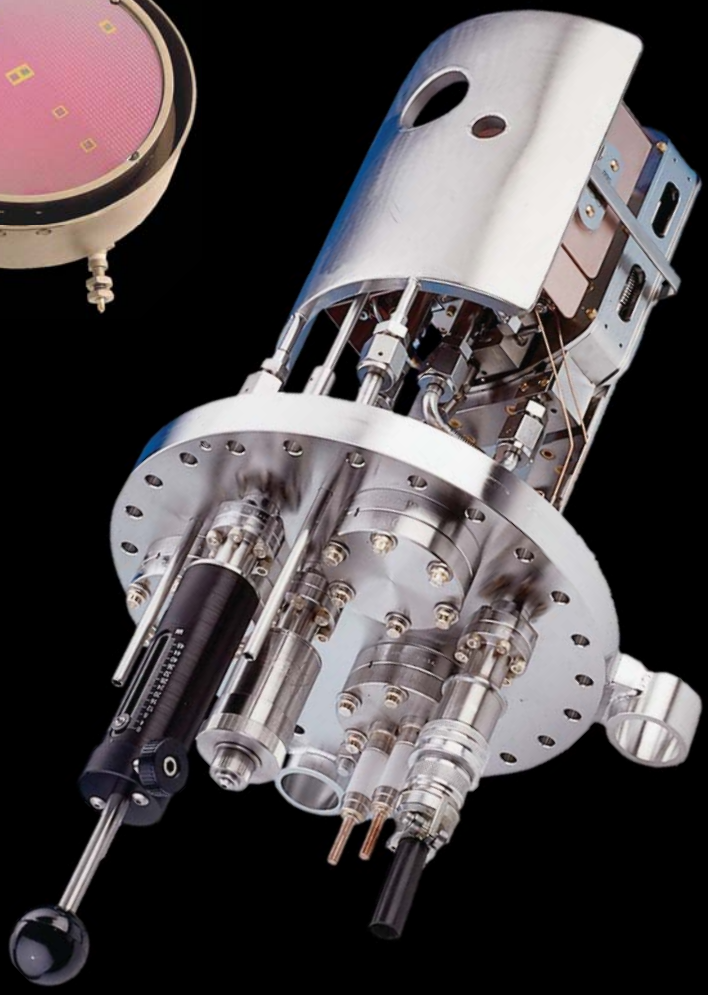
MeiVac offers a complete line of e-Vap accessories and spare parts. Feedthroughs, rate control and monitors, safety interlock switches, HV access covers and consumable spare parts are readily available. Visit our website at www.meivac.com or contact us directly at support@meivac.com for more information about our extensive line of accessories and spare parts. MeiVac also offers custom e-Vap mounting and OEM packages.











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