Deposition Sources

11

In This Section

page(s)

Kurt J. Lesker Company

Introduction & Bibliography

We examine methods of manufacturing thin film and deposition sources in ***Section 15 (Vacuum Systems)***. Here, we give a brief introduction to the mechanics and physics of sputtering and thermal evaporation sources.

For those interested in greater detail, the book list **below** gives a good cross-section of the information. The subject matter is so huge there is little content overlap between these books. Also, despite their age, the first two remain frequently quoted references. (Given the short publication lifespan of technical books, do not expect to find many "in print").

Handbook of Thin Film Technology, Maissel & Glang, McGraw Hill 1970, Lib. of Congress Card No. 73-79497

Thin Film Processes, Vossen & Kern, Academic Press, Inc. 1978, ISBN 0-12-728250-5

Thin Film Processes 2, Vossen & Kern, Academic Press, Inc. 1991, ISBN 0-12-728251-3

Handbook of Sputter Deposition Technology, Wasa & Hayakawa, Noyes Publications 1992, ISBN 0-8155-1280-5

The Materials Science of Thin Films, Ohring, Academic Press 1992, ISBN 0-12-524990-X

Thin-Film Deposition—Principles & Practice, Smith, McGraw Hill 1995, ISBN 0-07-058502-4

Handbook of Thin Film Process Technology, ed. Glocker et. al., Institute of Physics Publishing 1995, ISBN 0-7507-0311-5

Physical Vapor Deposition of Thin Films, Mahan, Wiley Interscience 2000, ISBN 0-471-33001-9

Sputter Deposition, Westwood, AVS 2003

Sputtering

What Is Sputtering?

Sputter deposition, commonly called *sputtering*, removes atoms or molecules from a solid target's surface, projecting them into the gas phase from which they condense on another surface. In the simplest arrangement, a high voltage is applied between two circular, plane-parallel disks: a target (cathode) and a substrate (anode) mounted a few inches apart. An inert process gas at 1 to 100 mTorr flows between the electrodes. Initial electrons from the target's surface cause cascade ionization in the gas, forming a plasma—loosely defined as a confined region with equal concentrations of electrons and positive ions.

Because the plasma is both electrically neutral and highly conductive, there is little voltage drop across it. The drop occurs across thin "dark space" regions between the plasma and each electrode. The target's negative potential attracts positive ions from the plasma's edge. They hit the target with sufficient kinetic energies to eject neutral target atoms or molecules by energy transfer.

While traveling from target to substrate, each ejected atom hits numerous gas atoms or molecules that deflect them and cause energy loss. By optimizing the target-substrate distance, the atoms approach the substrate's surface from partially randomized directions, producing a reasonably uniform film thickness across a textured substrate's surface.

For circular sources, the optimum *throw distance* between target and substrate is larger than the target's diameter to "smooth out" the source's ring-like deposition pattern. By contrast, a linear production source used to coat large-area substrates moving across it has a short optimum throw distance. In this case the linear source's end-effects disturb the uniformity.

Sputter Sources

The differences between diode, magnetron, balanced/unbalanced, RF/DC power options, etc. for various sputter sources are discussed in ***Section 15***.

A source's vacuum compatibility depends on its specific design, but all are suitable for 10^{-6} Torr to 10^{-7} Torr range. Some true UHV versions are compatible with 10^{-10} Torr and bakeable to 400° C (with magnets removed from the air side). The latter group is used where the process chamber must reach UHV conditions (for cleanliness) before backfilling with process gas.

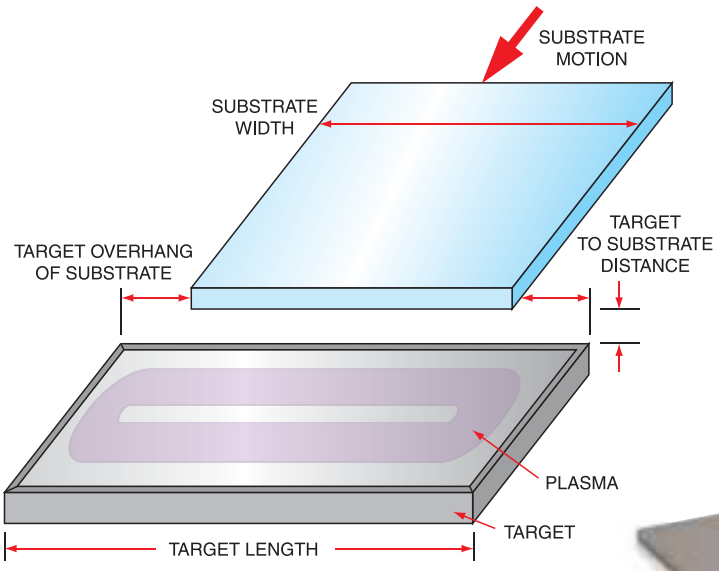
In R&D applications, sources are often mated to existing chambers and the relative positions of the source's mounting port and the substrate holder determine which source mounting is most appropriate: (i) The axial source has its target's surface perpendicular to its utilities tube; (ii) The right angle has its target's surface parallel to the utilities tube; and (iii) The flex has the source and tube connected by a flex metal hose, enabling the angle between their centerlines to vary from 0° to 45°.

Flex head design sputter source

An additional consideration for R&D applications is varying the film composition. For simultaneous or sequential deposition of different materials and quick changes in film compositions, a cluster of 3 or 4 sputter sources mounted on one flange with integral cross-contamination shields, shutters, and gas feeds, may be an ideal arrangement.

Four 3" sputter source cluster

That implies thicker targets which, in turn, demand correctly shaped magnetic fields to penetrate those targets. Another common production need is depositing films on large rectangular substrates. This is addressed with linear sputter source (longer than the substrate is wide) and then moving the substrate across the source during sputtering.



Indium Tin Oxide circular target

Tantalum linear target

Sputter Targets

Most of the electrical energy entering the plasma converts to thermal energy in the target. Water flows through the source and cools the target by *direct* or *indirect* cooling. In direct cooling, the target's non-vacuum side has water flowing over it. Obviously, the target: (a) must be thick enough to ensure sputter etching does not compromise vacuum integrity and (b) must not react with water. For these reasons, direct cooling is often used in high-volume production sources where thick, unreactive targets are common. For indirect cooling, water cools the non-vacuum side of the source's cooling well—a copper "cup" into which the target is clamped. Indirect cooling is used for low-volume production and R&D sputter sources.

Indirectly cooled targets are not bonded to their cooling wells because that would make replacement difficult. However, poor thermal contact between cooling well and target is the cause of significant problems. Poor heat transfer, particularly noticeable when low thermal conductivity targets (oxides, nitrides, glasses, ceramics, etc.) are sputtered leads to: (a) thermal expansion stress cracks in the target; or (b) melting of the indium bonding target to its backing plate.

Two approaches are used to reduce the incidence of these problems: (a) a thermally conductive polymer sheet or silver impregnated paste is placed between target and cooling well; and (b) power is applied or shut off in a series of slow "ramps-and-soaks." In practice, this means the power is slowly ramped from zero to, say, 20% of the full, desired sputter power. The target is then allowed to soak at that power for some minutes before another ramp is initiated. Increasing or decreasing power in this way is good practice for both sputtering and evaporation applications.

Targets are appropriately shaped to fit their respective sources and a wide variety of circular, linear, cylindrical, wedge-shaped, race-track, truncated cones, and other forms are used.

Aluminum race-track target

Sputtering Strengths

a. The depositing atoms or molecule's kinetic energy is usually a few eV, giving good film adhesion on appropriate substrates.

b. Sputtering does not require melting.

c. Materials rarely "spit" lumps at the substrate.

d. The source can be mounted in any orientation.

e. Although plasma electrons are "hot," other species are not and there is little radiative heat transfer to substrates.

f. Surface coverage is not strictly line-of-sight.

g. Elemental mixtures, alloys, and some chemical compounds can be sputtered without changes in stoichiometry.

h. Reactive sputtering (O_2 or N_2 added to Ar) has many applications. In particular, it avoids the problems associated with sputtering low thermal conductivity targets.

i. Linear sources coat large area substrates with metals and inorganic materials.

Evaporation

What Is Evaporation?

As noted in the ***Systems***, strictly, *evaporation* is the conversion of liquid to vapor while *sublimation* is the conversion of solid to vapor. But following common practice, both processes are called evaporation here.

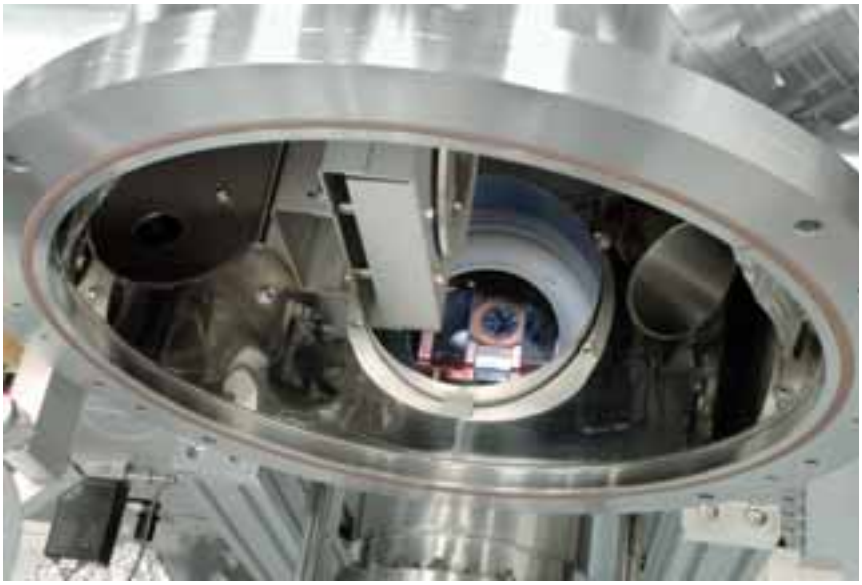
Evaporation Sources

Various evaporation sources are described in the Technical Notes for ***Section 9*** and ***Section 15***. Here, sources not noted in those sections are described together with source combinations used for simultaneous or sequential deposition.

Thermal Sources: As pointed out in ***Section 15 Technical Notes***, alloys and mixtures rarely give films with the original material's stoichiometry. To deposit alloys successfully requires simultaneous deposition from a number of thermal sources in close proximity. Multiple sources can be mounted on one flange in a cluster.

Effusion Cells: The evaporation temperatures of organic materials are low, typically much less than 500° C, and the evaporation rate is exceptionally sensitive to the material's temperature. To achieve satisfactory film deposition demands rigorous temperature control. Low temperature effusion cells, designed specifically for depositing organic thin films, are frequently used in co-deposition and sequential deposition applications. Combinations, some with as many as 10 sources mounted on a single flange, have been developed to fill this need.

E-Beam Sources: Physical size alone makes the installation of more than two e-beam sources in a chamber unlikely. However, multipocket sources can be used for sequential evaporations and one e-beam source with multiple thermal sources is a common configuration for simultaneous or sequential deposition.



E-beam source well shown in-situ

Linear Evaporation Sources: The continuing emphasis on optically active and electrically conductive organic materials for display panel technology revealed a need for a source capable of covering large substrate areas with a highly uniform coating. Our (patented) linear source coats substrates up to 600mm wide of any length. Because this source's footprint is only 3" wide, multiple sources can be mounted side-by-side in an in-line system for sequential deposition of organic materials.

Evaporation Strengths

a. Thermal evaporation equipment costs are usually low.

b. Mechanical arrangements are often simple and constraints few.

c. Material usage is high and re-filling is simple. (For RF induction sources, it is automatic during operation.)

d. E-beam and RF inductive evaporators give high deposition rates.

e. For R&D applications, thermal evaporation is particularly flexible.

f. Organic materials can only be deposited by evaporation.

g. Linear sources coat large area substrates with organics and high vapor pressure inorganic materials.

Ion Bombardment

What Is Ion Bombardment?

Ion bombardment is used in three ways for surface modification and thin film deposition:

Substrate Cleaning. Using high-energy inert gas ions, bombarding the substrate provides a good way of removing tightly adsorbed gases and vapors. It is frequently used just prior to deposition.

Surface Modification. For some substrates, particularly plastics, ion bombardment is used to "modify" the surface. This means not only are adhering atoms/molecules removed as in substrate cleaning, but the surface morphology is changed in a way that increases the adhesion of any film that is immediately deposited on it.

Morphological Effects. A thin film deposited by any PVD or CVD method may have a film morphology that: is columnar, grainy, with many voids, and has a lower density than the bulk crystalline material. To "densify" the film, it is bombarded with inert gas ions during deposition—called *ion-assisted deposition*. When sputtering, an unbalanced source can provide some degree of substrate ion bombardment and for CVD methods, the "plasma enhanced" versions create similar bombardment conditions. However, where the technique cannot be adapted to provide that bombardment, separate ion sources are used.

Ion Sources

An ion source, in this context, directs a wide, uniform flux of ions toward the depositing film. The energy is chosen so the incident ion exchanges energy with the film's atoms, causing the latter to move without sputtering.

Some ion sources use thermionic emission of electrons to generate ions. However, this limits their use to inert gases, and they may be adversely affected by reactive species from the chamber. Other ion sources have no filaments and will make ions of both inert and reactive gases. This is particularly useful where surface modifications require oxide or nitride formation.

Sputtering & Evaporation Applications

This is a small selection of the total number of products made by physical vapor deposition methods, roughly grouped according to the main body of users.

Industry & Business

- IR-reflective architectural glass
- Anti-reflective lenses for laser lenses
- Band-pass and notch filters, superlattices, rugates
- Hardcoats for printheads, machine tools, turbine blades
- Anticorrosive coats for nuclear fuel rods, marine components, jet engine turbine blades
- Impermeable coatings for food packaging film, moisture barriers
- Photovoltaic devices, solar panels
- Organic flat-panel displays
- Optical/conductive flat-panel coatings

Consumer

- Reflective/magnetic video disks, compact disks, space blankets
- Decorative bright-plastic parts, car "chrome," jewelry, plumbing fixtures
- All mirrors, mirrored sunglasses
- Anti-reflective camera lens coatings

Microelectronics

- Magnetic disk drives, disk read heads
- Metal film capacitors and resistors
- IC metals, resistors, insulators, gate barriers
- ICs for all industrial, business, military, and consumer computers
- Microprocessors for consumer electronics
- Optical data storage disks

Medical

- Wear coats for prosthetic joints
- Culture-surface modification for bacteria growth
- Neutralizing of passivating catheters
- Super-insulation for cryogenic magnets in diagnostic scanners

Scientific

- Heat-resistant coating of SEM samples
- High-Tc superconductors
- Tribology films
- Telescope mirrors

Military

- Conductive layers for aircraft canopies
- IR-transmissive optics
- Light-amplifying night vision optics
- Antidamage coating for laser windows

➤ R&D Sources

Overview

Kurt J. Lesker Company first started producing the TORUS® line of magnetron sputtering cathodes in the early 1980s. Nearly 25 years later, we are a clear leader in the magnetron sputtering industry. As new applications for sputtering continue to emerge, KJLC® is well positioned to lead the sputtering industry well into the future.

We have a comprehensive line of TORUS magnetron sputtering products to address nearly any sputtering challenge. KJLC offers a full line of standard and custom designed sputtering cathodes for the thin film industry.

Our global support network includes a dedicated applications and development lab, applications and technical support staff, and a worldwide sales and service network backed by a 100% customer satisfaction guarantee.

Features:

- 25+ years of sputter cathode manufacturing experience
- 25+ years of sputtering system manufacturing and integration expertise
- Full applications support and consultation
- Worldwide sales and service
- Extensive offering of R&D and Production cathodes
- Circular and linear designs
- Standard and customer-specific designs
- Cathode retrofit and rebuild services available

*Contact our Process Equipment Division at **ped@lesker.com** to discuss your specific vacuum application and process equipment needs.*

TORUS HV Circular

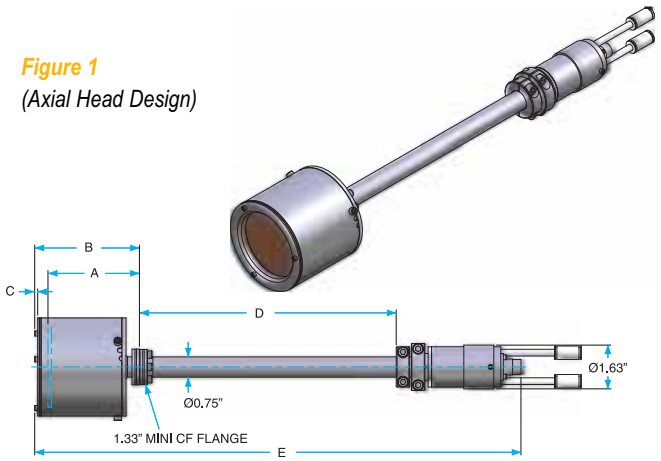
POWER SUPPLIES
See Pages 12-32 to 12-35

KJLC offers a comprehensive line of circular TORUS magnetron sputter sources suited for most R&D applications. These sputter cathodes range in size from one to four inches in diameter, are functional with virtually any material, have exceptional target utilization, and can be driven by RF, DC, or Pulsed-DC power supplies.

Engineered for Optimum Performance:

- Wide pressure range operation to 10^{-9} Torr
- Low outgassing
- Excellent thin film uniformity and deposition rates
- Efficient sputter target utilization
- Superior target hold down mechanism eliminates the need for thermal pastes, keepers, etc.
- Compact, modular magnet array
- Magnets NOT exposed to vacuum
- Magnets NOT exposed to cooling water
- Cooling water is not exposed to vacuum chamber during target change
- Unbalanced operation and compatibility with magnetic materials is available (please contact us at **sputtering@lesker.com** for more information)
- Full line of accessories available (gas injection, chimneys, shutters, cluster arrays, etc.)
- Custom sputter source configurations available

Figure 1
(Axial Head Design)



■ TORUS® HV Circular (continued)

TORUS Configuration and Pricing Matrix

Select from the configuration options to create a part number and price for the particular TORUS sputter source required. Be sure to reference the Options table for valid options for a given source size.

Figure 2
(Right Angle Head Design)

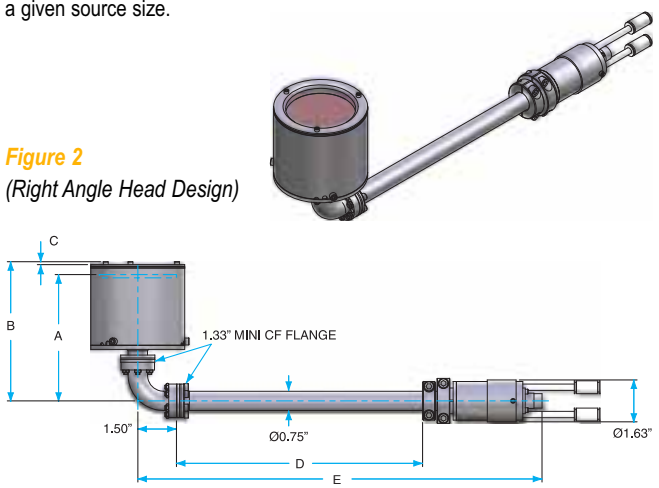
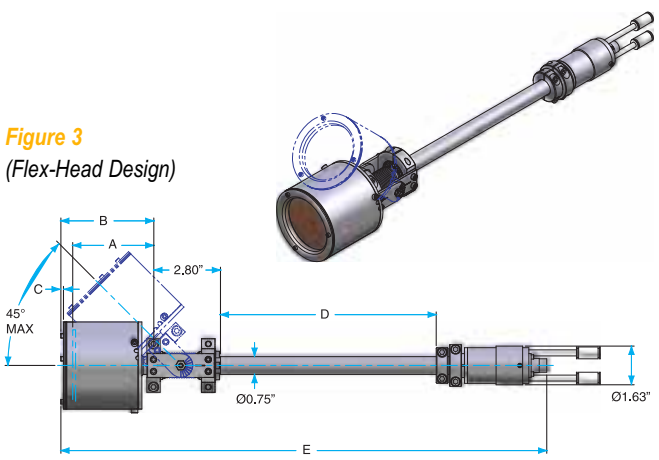


Figure 3
(Flex-Head Design)



*NOTE: See **www.lesker.com** for current information and models of Torus Sources.*

Example Configuration: TM2RS10FBF is a 2" O.D. right angle mount head on a 10" long tube with a standard magnet array mounted to an 6" CF flange with gas injection and pneumatic shaft-style shutter. Example configuration options selected shown in red **below**.

	Part No. Prefix	Base Price
For 1" O.D. Targets (0.063"–0.125")	TM1	Call
For 2" O.D. Targets (0.080"–0.25")	TM2	Call
For 3" O.D. Targets (0.080"–0.25")	TM3	Call
For 4" O.D. Targets (0.080"–0.25")	TM4	Call
	Option Part No.	Additional Price
Mounting Style		
Axial	A	N/C
Right Angle	R	Call
Flex-Head	F	Call
Magnet Array		
Standard	S	N/C
Magnetic Materials (Not avail. for TM1)	M	Call
Tube Length		
10"	10	N/C
14"	14	N/C
Flange Size		
6" CF Flange (1.26" offset)	6	Call
6" CF Flange (on-center)	F	Call
8" CF Flange (1.5" offset)	8	Call
8" CF Flange (on-center)	K	Call
(none)	X	N/C
Gas Injection		
Gas Injection Ring	G	Call
Deposition Chimney (Not avail. for TM1)	C	Call
Gas Injection Ring and Chimney	B	Call
(none)	X	N/C
Shutter		
Pneumatic Actuation Flip-Style	F	Call
Pneumatic Actuation Swing-Style	S	Call
(none)	X	N/C

	Applicable Source	Part No.	Base Price
300W RF Package, 220 VAC	TM1, TM2, TM3	RF03A22XX300	Call
600W RF Package, 220 VAC	TM3, TM4	RF06A22XX300	Call
1kW RF Package, 220 VAC	TM4	RF10A22XX300	Call
500W DC Package, 115 VAC	TM1, TM2, TM3	DC05A12NN	Call
500W DC Package, 208 VAC	TM1, TM2, TM3	DC05B12NN	Call
1.5kW RF Package, 208 VAC	TM3, TM4	DC15B12NU	Call
2.5kW RF Package, 208 VAC	TM4	DC25B12NU	Call

*All RF packages come with interconnect cables and a 3' cable from the tuner.
**All DC packages come with a 12' cable from the power supply.

*NOTE: Unbalanced magnet arrays, custom tube lengths, and flange sizes, and rotary style shutters available upon request. Some configurations may not physically be compatible. Please contact **ped@lesker.com** for more information.*

Model	Figure	Head Mount Style	Dimensions (in.)* A	B	C	D	E	Options & Accessories Available: Deposition Chimney	Gas Injection Ring	Magnetic Materials
TM1	1	Axial	4.05	4.39	0.11	9.56	18.59	Yes	Yes	No
TM1	2	Right Angle	5.55	5.89	0.11	9.56	15.71	Yes	Yes	No
TM1	3	Flex	4.05	4.39	0.11	9.56	20.39	Yes	Yes	No
TM2	1	Axial	4.08	4.49	0.11	9.56	18.69	Yes	Yes	Yes
TM2	2	Right Angle	5.58	5.99	0.11	9.56	15.71	Yes	Yes	Yes
TM2	3	Flex	4.08	4.49	0.11	9.56	20.98	Yes	Yes	Yes
TM3	1	Axial	3.41	3.90	0.11	9.56	18.11	Yes	Yes	Yes
TM3	2	Right Angle	4.91	5.40	0.11	9.56	15.71	Yes	Yes	Yes
TM3	3	Flex	3.41	3.90	0.11	9.56	20.39	Yes	Yes	Yes
TM4	1	Axial	3.66	4.16	0.11	9.56	18.37	Yes	Yes	Yes
TM4	2	Right Angle	5.16	5.66	0.11	9.56	15.71	Yes	Yes	Yes
TM4	3	Flex	3.66	4.16	0.11	9.56	20.65	Yes	Yes	Yes

** NOTE: Dimensions involving flange-to-target thickness assume a standard target thickness of 1/8". Add or subtract accordingly based on your particular sputter target size.*

➤ R&D Sources

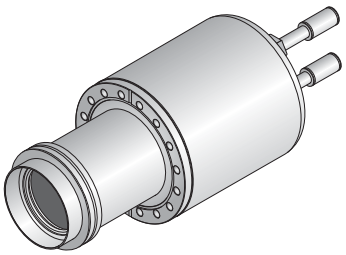
TORUS® UHV Circular

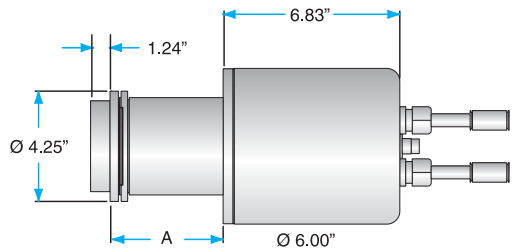
We offer a comprehensive line of circular TORUS® magnetron sputter sources, in 2" and 3" diameters, suited for ultra high vacuum R&D applications.

These sputter sources are "True UHV" cathodes, able to reach base pressures below 10^{-10} Torr due to their all-welded construction and 350° C bakeout temperature.

Their unique high-strength rare earth magnet arrays can be adjusted without breaking vacuum, enabling the user to optimize the sputtering profile.

Additionally, these sputter sources are available with an integral gas injection port for introducing the process gas directly to the target.





*NOTE: See **www.lesker.com** for current information and models of Torus Sources.*

- Versatile RF, DC, and Pulsed-DC operation
- True UHV all-welded design (no elastomeric seals)
- Excellent film uniformity (±3%) and target utilization (up to 30%)
- Integral gas injection port to introduce process gas at the target's surface
- Optional deposition chimneys and flip-style shutters reduce contamination during co-deposition
- High-strength rare earth magnet arrays for sputtering magnetic and non-magnetic materials available for 3" UHV source
- Magnet array is isolated from cooling water and can be removed without breaking vacuum
- Standard—Type-N (male) power connectors, indirect water cooling, and balanced magnetic operation
- Unbalanced operation is available (please contact us at **ped@lesker.com** for more information)
- Cathode bakeable to 350° C (with magnet array removed)

TORUS Configuration & Pricing Matrix

Select from the configuration options to create a part number and price for the particular TORUS sputter source required.

Example Configuration: TM3US046GF is a 3" O.D. source mounted on a 4" body (measured from flange to target surface) with a standard magnet array mounted to a 6" CF flange with gas injection and pneumatic flip-style shutter. Example configuration options selected shown in red **below**.

	Part No. Prefix	Base Price
TORUS Model/Size		
For 2" O.D. Targets (0.060"–0.25")	TM2U	**Call**
For 3" O.D. Targets (0.060"–0.25")	TM3U	**Call**
	Option Part No.	Additional Price
Magnet Array		
Standard	S	**N/C**
Magnetic Materials (Not avail. for TM2U)	M	**Call**
Insertion Length *		
4"	04	**N/C**
9.25"	09	**N/C**
Flange Size **		
6" CF Flange	6	**N/C**
Gas Injection		
Gas Injection Ring	G	**Call**
Gas Injection Ring and Chimney	B	**Call**
Shutter		
Pneumatic Actuation Flip-Style	F	**Call**
Pneumatic Actuation Swing-Style	S	**Call**
(none)	X	**N/C**

*Custom insertion lengths available.
**Other flange sizes available.

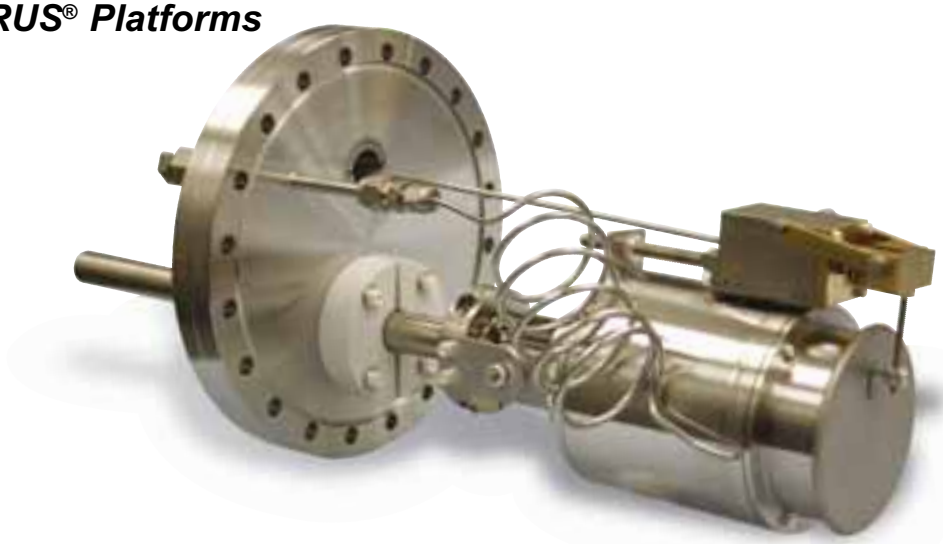
*NOTE: Contact our Process Equipment Division at **ped@lesker.com** to discuss your specific vacuum application and process equipment needs.*

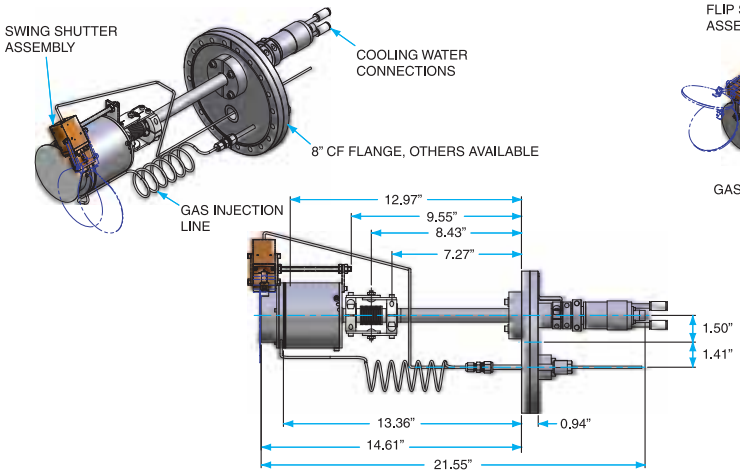
	Applicable Source	Part No.	Base Price
300W RF Package, 220 VAC	TM2U, TM3U	RF03A22XX300	**Call**
600W RF Package, 220 VAC	TM2U, TM3U	RF06A22XX300	**Call**
500W DC Package, 115 VAC	TM2U, TM3U	DC05A12NN	**Call**
500W DC Package, 208 VAC	TM2U, TM3U	DC05B12NN	**Call**
1.5kW RF Package, 208 VAC	TM2U, TM3U	DC15B12NU	**Call**

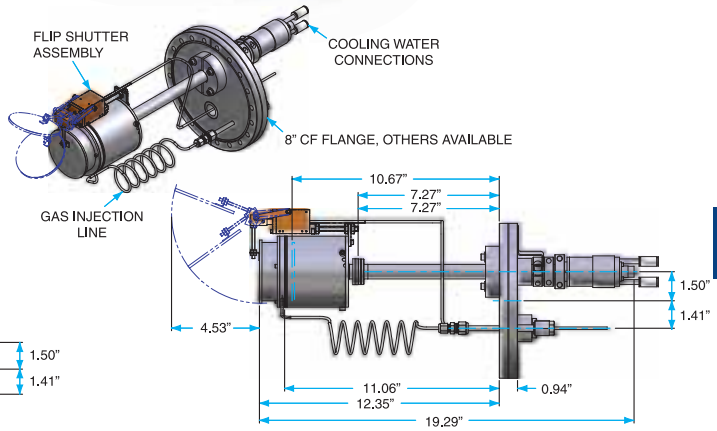
*All RF packages come with interconnect cables and a 3' cable from the tuner.
**All DC packages come with a 12' cable from the power supply.

TORUS® Platforms

POWER SUPPLIES
See Pages 12-32 to 12-35







Our unique TORUS® Platform is a complete sputtering package. The sputter source (cathode), shutter assembly, and integral gas injection are all combined on a rotatable 8" CF flange (other mounting flanges available).

The TORUS sputter source is offset from the center by 1.5", allowing for an eccentric rotation of the cathode. This cathode rotation enables the user to manipulate the thin film deposition by offsetting the source from a rotating substrate.

The 8" CF flange is equipped with a VCR® port for use with the gas distribution shroud to inject the process gas directly to the sputter target's surface.

Through the use of compression fittings, the source-to-substrate distance is easily adjusted with up to 6" of variability.

- Platform packages available for 1" to 4" circular TORUS sputter sources
- Axial, right angle, or flexible head assemblies
- RF, DC, or Pulsed-DC operation
- Adjustable source-to-substrate distance
- Pneumatic flip-style or swing-style UHV compatible shutter assemblies
- Standard 8" rotatable CF flange mount (other mounting flanges available)
- Integral gas injection port delivers process gas directly to target surface

*Contact our Process Equipment Division at **ped@lesker.com** to discuss your specific vacuum application and process equipment needs.*

➤ R&D Sources

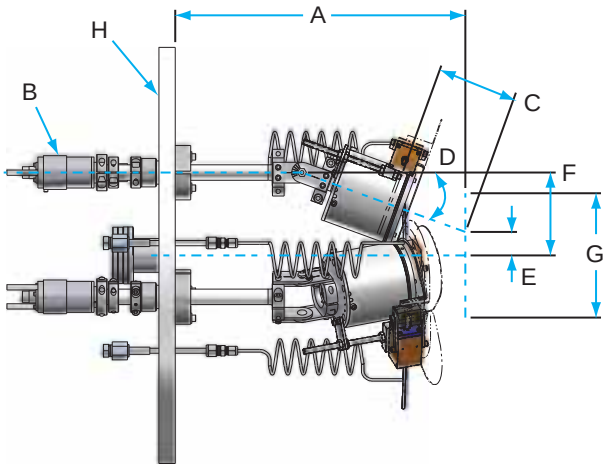
■ TORUS® Clusters

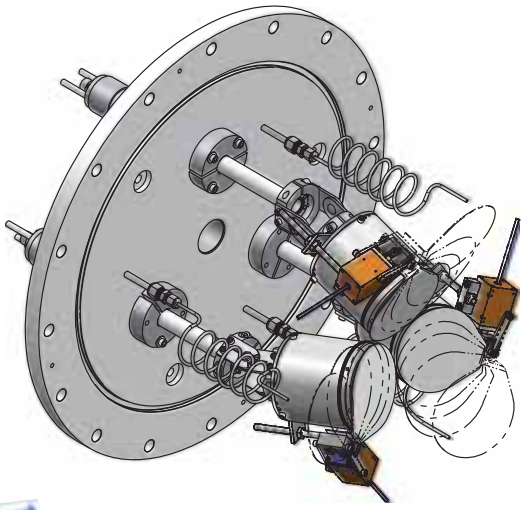
Co-deposition of materials is an important adjunct to thin film materials research and production. Clusters of multiple TORUS® sputter sources (cathodes) mounted on a single flange are ideal for these applications.

TORUS cluster sources are available with optional cross-contamination shields, integral target gas injection ports, individual source shutters, and a variety of flange mounting options.

For applications requiring simultaneous depositions on large substrates, provisions should be made to the deposition system for substrate rotation to ensure uniform film thickness and alloy composition, or during non-rotating depositions a planned compositional gradient can be created.

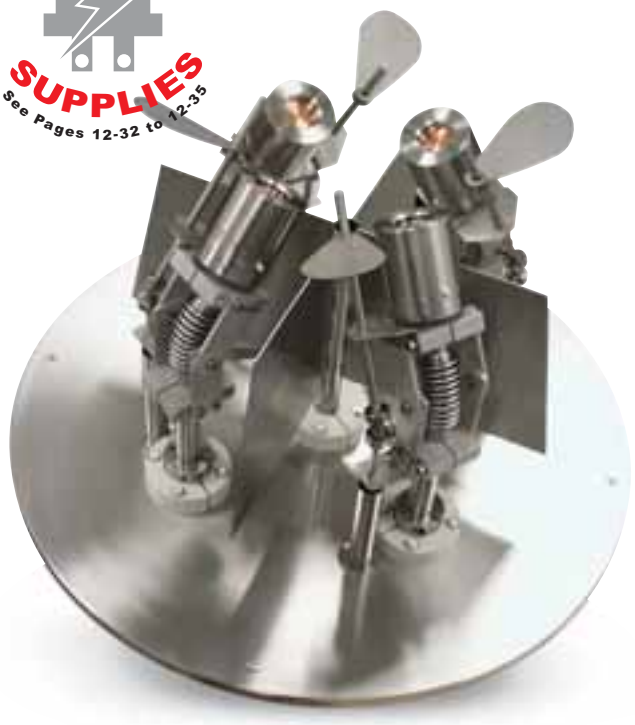
NOTE: LTE and HTE Clusters sources are also available. Please contact us for more information.





Please email specifications to our Process Equipment Division at ped@lesker.com or call us at 1-800-245-1656 to discuss your specific process needs. For the TORUS® Cluster Source configuration tool please see www.lesker.com to start your process.

POWER SUPPLIES
See Pages 12-32 to 12-35



How To Order a TORUS® Cluster Source

Our extensive systems manufacturing and applications integration expertise enables us to optimize virtually any deposition process. Please follow the drawing guidelines when customizing your TORUS® Cluster source.

Description	Dimension
Distance from Cluster Flange to Substrate	A
Source Specifications and Quantity	B
Throw Distance	C
Angle	D
Offset Distance	E
Source Offset Distance from Center	F
Substrate Size	G
Flange Size and Type	H

➤ Production Sputtering Sources

Our TORUS® line of performance production magnetron sputter sources is a major breakthrough in the field of high-volume sputtering with target utilization up to 50%.

These sputter sources feature a unique combination of exceptional target life, high sputter rates, and increased power densities unmatched in the industry. The **patented magnet designs** trap electrons in inner, center, and outer erosion zones with precise magnetic field shapes to enable even erosion at maximum sputter target usage.

With circular production sources available from 6" to 12" diameter and linear sources available in lengths up to 140", KJLC® is positioned to offer the sputter solution for your production environment.

- Target utilization up to 50%
- Operating voltage drops as low as 15% for deposition process stability
- Patented magnet designs for magnetic or nonmagnetic materials
- Standard linear cathode sizes from 2" to 11" wide and up to 140" long
- Standard circular cathode sizes up to 12" diameter
- Versatile RF, DC, or Pulsed-DC operation
- Internal or flange-mount configurations
- Customer-specific designs available
- Cathode retrofit and rebuild services available

*Contact our Process Equipment Division at **ped@lesker.com** to discuss your specific vacuum application and process equipment needs.*

Applications:

- Automotive coatings
- Architectural glass
- Photovoltaic cells
- Superconductors
- Tool coatings
- Wear coatings
- Flat panel displays
- Lighting
- OLED/PLEDs
- Medical coatings
- Optical coatings

Utilization by Target Size

Our production cathodes optimize sputter target utilization for a wide range of target sizes, geometries, and materials. The values represented in the utilization table were from using aluminum targets eroded at 9kW and 10^{-3} Torr using argon.

Target Size (in.)	Utilization by Weight (no backing plate)	kW Hr.	Volume Used (in^3)	Groove Depth
Linear Cathode Production Sources				
2 x 38 x ¼	0.28	181	5.1	0.183"
3½ x 30 x ⅜	0.4	558	15.7	0.25"
5 x 12 x ½	0.38	371	12	0.45"
5 x 12 x ⅝	0.33	409	15	0.525"
5 x 36 x ½	0.37	975	36	0.461"
6 x 15 x ⅝	0.41	793	23	0.575"
6 x 46 x ⅝	0.4	2170	69	0.583"
8 x 36 x ⅞	0.44	3361	111	0.763"
11 x 45 x 1	0.43	5869	173	0.81"
Circular Cathode Production Sources				
6 x ½	0.37	146	5.5	0.45"
7 x ⅝	0.41	346	10	0.555"
7 x ¾	0.41	410	11.8	0.62"
8 x ¾	0.38	495	14.1	0.583"
8 x ⅞	0.41	719	18	0.726"
8 x 1	0.42	870	20.2	0.82"
12 x ⅞	0.45	1576	44.5	0.79"

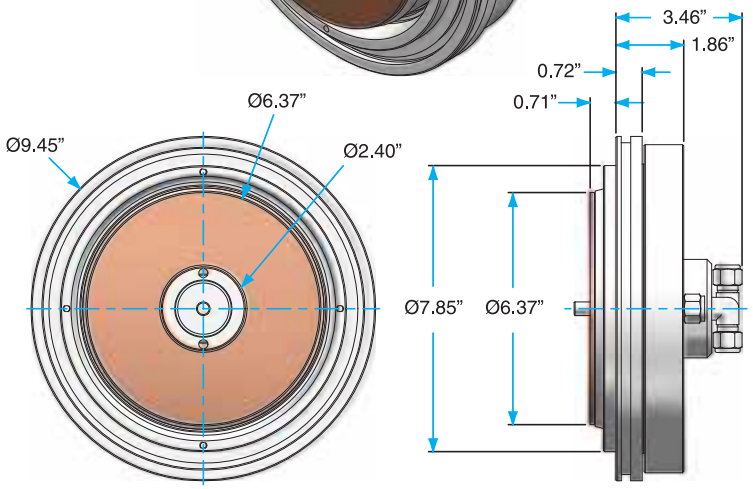
➤ Performance Production Sources

■ TORUS 10 CA Performance Production Cathodes

The KJLC® TORUS® 10 CA (center anode) production sputtering cathodes are designed specifically for applications using masks that are best attached directly to the sputter source. (ie. CD and DVD metallization)

The CD industry has long realized the benefits of our unique design, which features:

- Production style, high volume sputter source
- 6.37" diameter target with center anode design
- 6" round center anode design
- Dual race track designs
- High target material utilization
- High power versions available
- Isolated magnet assemblies
- A variety of mounting configurations
- RF, DC, or Pulsed-DC operation



SPECIFICATIONS

Target Diameter — 6⅜"
Target Thickness — ⅝"
RF, DC, Pulsed-DC — Yes
Power Density — >500W/in^2
Direct Cooled Target — No
Indirect Cooled Target — Yes
Magnet Cooling — Indirect
Axial Mount (1.5" O.D. tube) — No
Flange Mount — Yes

*Contact **ped@lesker.com** for more information on our patent-pending TORUS 10 CA sputter cathodes.*

➤ Services

We design, manufacture, and service all of our TORUS® sputter sources. Our in-house experts have decades of combined magnetron cathode applications and service experience.

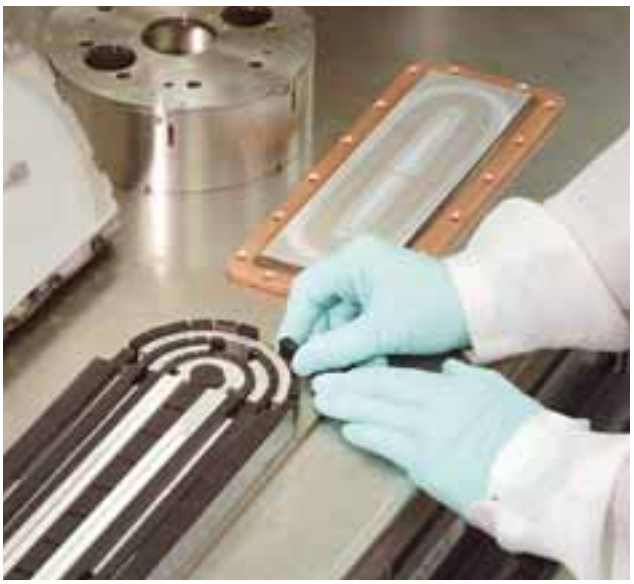
Magnetron Cathode Retrofits:

We can produce retrofit magnetron designs for many obsolete sputter source cathode designs. Perkin Elmer and Varian sputtering systems, among others, are serviced and retrofitted in our dedicated cathode assembly clean area at our Pittsburgh, Pennsylvania, U.S. facility.

Magnetron Cathode Rebuild Service:

We offer a complete rebuild service for our popular TORUS brand and other magnetron cathodes in both circular and linear configurations.

We can supply retrofit assemblies, service and replace worn parts, or provide a complete rebuild based on your specifications.



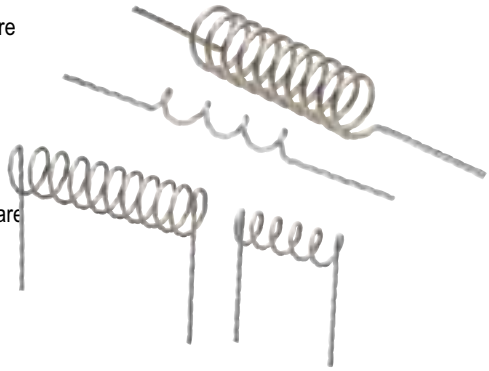
*NOTE: Contact our cathode service technicians at **cathodeservice@lesker.com** to discuss your specific cathode service and retrofit needs.*

Evaporation Sources

We offer a vast selection of thermal sources in Section 9 Evaporation Sources of our catalog for evaporating materials for thin film deposition. Included are both direct and indirect resistive heating thermal sources available as filaments, baskets, boxes, boats, rods, and crucibles. Crucibles for electron beam (e-beam) sources are also available.

Filaments

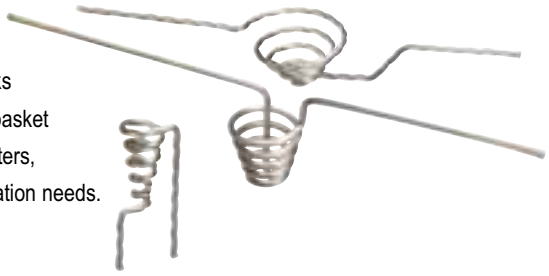
A filament is a single or multiple-strand tungsten wire that is bent into a shape (loop, point, coil, etc.) that suits either a particular mounting or evaporation pattern. Evaporant material is deposited on the wire by either dipping into a melt or solution or by physically capturing the material. Our filaments are offered in various shapes, lengths, and power requirements to suit your evaporation needs.



See pages 9-4 to 9-9.

Basket Heaters

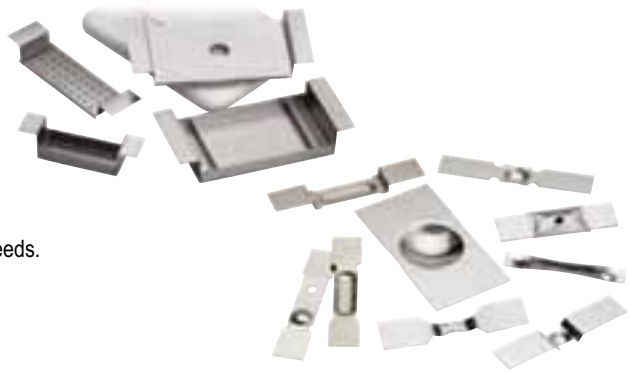
Basket heaters are filaments that are shaped into a conical form to hold either larger chunks of evaporant or to heat small crucibles. Our basket heaters are offered in various shapes, diameters, and power requirements to suit your evaporation needs.



See pages 9-10 to 9-12.

Boxes & Boats

Boxes and boats are thin, flat metal sheets of tungsten, tantalum, or molybdenum formed into shapes with creases, dimples, folds, etc., to hold evaporant material. Baffled boxes are a specific type of box heater that have internal baffling designed to prevent line-of-sight between evaporant and material for materials that crepitate. Our box and boat heaters are offered in various shapes, lengths, and power requirements to suit your evaporation needs.



For boat heaters see pages 9-14 to 9-35.
For baffled box heaters see pages 9-36 to 9-41.

Chrome-Plated Tungsten Rods

Chrome-plated tungsten rods are used to produce thin films of chromium by evaporation. These tungsten rods have a lower resistance than filaments, which enables more precise control of evaporation at low temperatures. Our tungsten rods are offered in various lengths, thicknesses, and power requirements to suit your evaporation needs.

See page 9-42.

Crucibles

Crucibles act as the container for basket or foil thermal sources and to keep the e-beam hearth free of evaporant for electron beam evaporation applications. Our crucibles for thermal and e-beam evaporation are offered in various sizes, shapes, materials, wall thicknesses, and pocket sizes.

For thermal evaporation crucibles see pages 9-44 to 9-45.
For e-beam crucible liners see pages 9-48 to 9-54.

*NOTE: Contact our Materials Division at **materials@lesker.com** for more information or visit our website.*

➤ Thermal Evaporators

POWER SUPPLIES
See Pages 12-32 to 12-35

Thermal/resistive evaporation is a proven and economical method of depositing thin film coatings in vacuum.

Materials such as iron, nickel, aluminum, copper, tin, silver, gold, and platinum are frequently deposited using thermal evaporation methods. Resistive evaporation is used in various applications ranging from decorative coating to semiconductor manufacturing processes.

KJLC® offers a number of complete thermal evaporation solutions, including filament, boat, and crucible types. In addition to manufacturing these sources, we have gained extensive applications experience using them in our PVD systems (see **Section 15**).

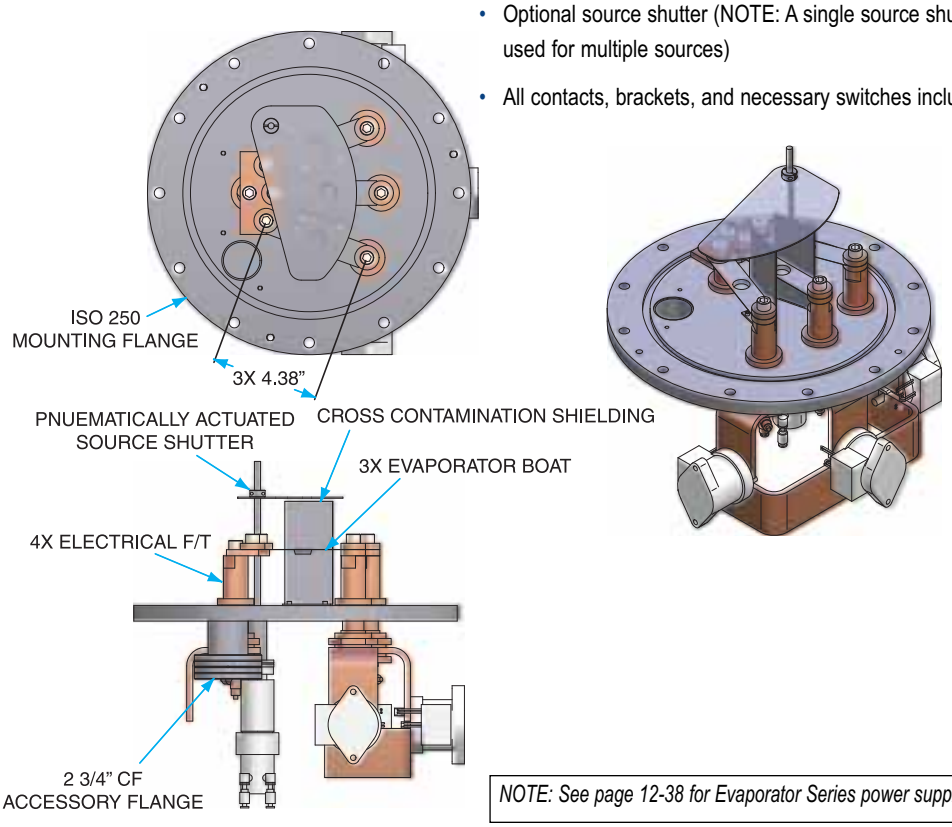
■ *Resistive Thermal Evaporator Kits*

These starter kits combine all of the necessary components required for thermal evaporation.

NOTE: Because each application is unique, the filaments, boats, and crucibles need to be specified separately. Power supplies should also be selected per the application. Custom solutions can be offered to fit specific requirements.

Kit features:

- Water-cooled evaporation feedthrough posts
- Universal clamping mechanism
- Shared evaporation "tree" for adjoining multiple sources on a sequentially operated source
- Cross contamination shielding on multiple source models
- Choice of flange mounts
- Optional source shutter (NOTE: A single source shutter is typically used for multiple sources)
- All contacts, brackets, and necessary switches included



Resistive Thermal Evaporator Kit
(3-position style shown)

NOTE: See page 12-38 for Evaporator Series power supply options.

Example Configuration: EVSK 3 I X

3-position evaporation starter kit on an ISO250 flange with a pneumatic source shutter available for only $3,958.00

Base	Deposition	Positions	Flange Mounts	Shutter
EV	SK = Sequential Deposition	1 = **Call**	X = No Flange	X = None
	CK = Co-Deposition	2 = **Call**	I = ISO250 (F-style) = **Call**	P = Pneumatic = **Call**
		3 = **Call**	C = 12" CF = **Call**	
		4 = **Call**	B = 10" CF = **Call**	
			S = Special	
			(Contact us for additional sizes)	

*For EVCK kits each source requires an individual power supply

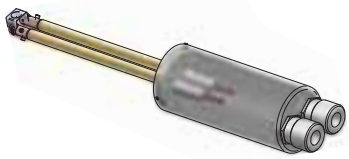
➤ Thermal Evaporators

■ Mini EVP Flange-Mounted Thermal Evaporators

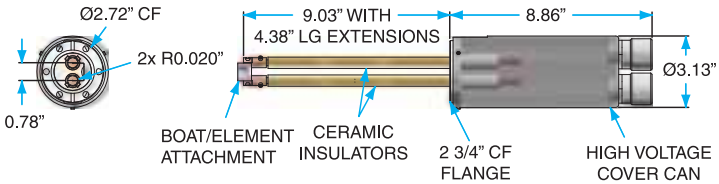
An economical way to add thermal evaporation capability to virtually any system.

Features:

- Filament or Coil/Crucible Style Sources
- $2^{3}/_{4}$" CF flange mount
- Vertical or horizontal mounting
- Optional post extension kit
- Optional linear transfer mechanism (LTM)
- 150A Max



Flange-Mounted Mini EVP Thermal Evaporator



Example Configuration: MEVP S T B

Base	Port Length	Source	LTM
MEVP	S = Standard = **Call** E = Extension Kit = **Call**	W = Tungsten Boat= **Call** T = Tantalum Boat = **Call** M = Molybdenum Boat = **Call** C = Coil Style = **Call** A = Alumina Crucible = **Call** N = Boron Nitride Crucible = **Call** Q = Quartz Crucible = **Call**	A = 50mm = **Call** B = 100mm = **Call** X = None

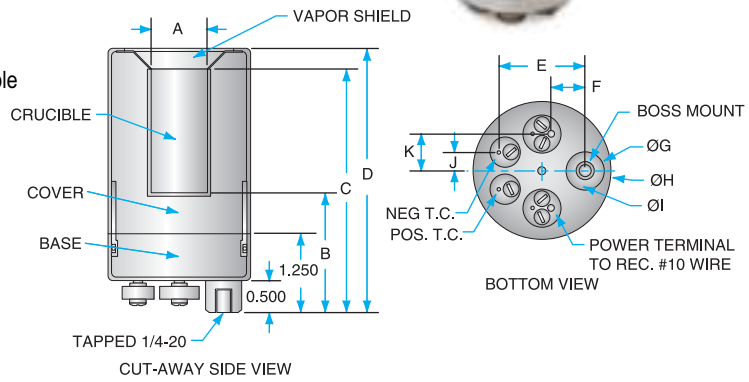
NOTE: This works with our APE122P00110 MAPS power supply and it's ordered separately. See page 12-38 for power supply options.

■ HTE Furnaces

Our High Temperature Evaporation (HTE) Furnaces are a compact and highly controllable method of evaporating materials with evaporation temperatures up to 1500° C. Because of their UHV compatible construction and outstanding temperature control, HTE evaporators are an ideal alternative to more expensive Knudsen cells.

Features:

- Evaporates materials up to 1,500° C
- HTE 01 has 5 cc crucible (2 cc charge capacity)
- HTE 10 has 15 cc crucible (10cc charge capacity)
- Promotes a "directed" evaporation plume
- Compact design
- UHV compatible
- Optional quartz, boron nitride, Ta, W, and Mo crucibles available
- Simple installation
- Integral Type K thermocouple
- Optional flip shutter assembly
- Optional matching M.A.P.S. HTE Series Power Supply



Base	Crucible Size	Charge Capacity	Dimensions (in.) A	B	C	D	E	F	G	H	I	J	K
HTE 01	5 cc	1 cc	0.395	1.590	2.540	2.850	1.095	0.370	0.500	1.750	1.040	0.300	0.625
HTE 10	15 cc	10 cc	0.875	1.885	3.825	4.150	1.400	0.550	0.625	2.250	1.400	0.300	0.600

Example Configuration: HTE 01 2 D F

Base	Crucible Size	Crucible Material	Feedthrough Mount	Shutter
HTE	01 = 1cc = **Call** 10 = 10cc = **Call**	X = None 1 = Al_2O_3 = **Call** 2 = Quartz = **Call**	X = None D = $4^{1}/_{2}$" CF Flange = **Call** E = 6" CF Flange = **Call** C = $2^{3}/_{4}$" CF & $1^{1}/_{3}$" for T/C = **Call** B = 1" Baseplate	X = None F = Pneumatic Flip Style* = **Call** * Includes a 1" BP F/T

NOTE: See page 12-39 for Evaporator Series power supply options.

Kurt J. Lesker Company

➤ Point Source Evaporators for Organic Materials

POWER SUPPLIES
See Pages 12-32 to 12-35

LTE Evaporators

Our low temperature evaporator (LTE) deposits volatile organic materials for thin film formation needed to produce organic light emitting devices (OLEDs), photovoltaic cells, and other organic material-based devices.

PID temperature control and uniform SCR-based power output using our M.A.P.S. power supplies enables precise deposition rate control and ensures high-quality, uniform films.

Multiple sources may be arrayed in order to co-deposit dyed or doped films for color displays.

Features:

- UHV compatible
- "Plug-in" source design facilitates easy removal
- Unique design for use with low temperature volatile organics
- Ability to grow films with 5% uniformity on 150mm substrates at > 5 Å/sec.
- Optimum plume configuration distributes material evenly across substrate
- PID control (±0.1° C) for low temperature operation (50° C to 600° C)
- Thermocouple in contact with crucible base for accurate temperature readings
- Efficient heater coil for optimum heating profile
- Easy to remove source cover for crucible exchange
- Alumina crucibles reduce organic spitting while evenly distributing temperature
- Integral flip shutter available

NOTE: See page 12-39 for Evaporator Series power supply options.

Example Configuration: LTE 01 2 D F

Base	Crucible Size	Crucible Material	Feedthrough Mount	Shutter
LTE	01 = 1cc = **Call** 10 = 10cc = **Call** 30 = 30cc = **Call**	X = None 1 = Al_2O_3 = **Call** 2 = Quartz = **Call**	X = None D = 4½" CF Flange = **Call** E = 6" CF Flange = **Call** C = 2¾" CF & 1⅓" for T/C = **Call** B = (3) 1" Baseplate F/T = **Call** F = 4½" CF Flange = **Call** G = 6" CF Flange = **Call**	X = None F = Pneumatic Flip Style* = **Call** * Includes a 1" BP F/T

LTE SERIES SPECIFICATIONS

	LTE 01	LTE 10	LTE 30
Height	3.49"	5.09"	5.59"
Diameter	1.5" O.D	2.24" O.D	2.44" O.D.
Standard Crucible	5cc Alumina	15cc Alumina	35cc Alumina
Charge Capacity	1cc	10cc	30cc
Temperature Range		50° C to 600° C	

Typical LTE 10 Throw Rates
(300mm Throw Distance)

AlQ_3	50 Å/sec
PTCDA	0.2 to 2.0 Å/sec
CuPc	0.2 to 2.0 Å/sec
C_{60}	0.2 to 2.0 Å/sec

*NOTE: Contact our Organic Material Evaporation specialists at **organic@lesker.com** to discuss your specific vacuum application and process equipment needs.*

LTE Cluster Sources

We have the ability to configure a complete OLED source flange, including multiple (up to 9) LTE sources, metals evaporation, and quartz crystal deposition controllers. Each source can be adjusted vertically to vary the "throw" distance, and therefore, the flux density at the surface of the substrate. Please contact us for more information.

➤ E-Beam Sources

E-beam source well (open)

E-beam source well (closed)

We offer an integrated solution to electron beam (e-beam) evaporation applications. Our electron beam retrofit assemblies can be easily added to existing vacuum systems or designed into a new build. The customer has the ability to specify pocket size and number, as well as power supply and control options.

POWER SUPPLIES
See Pages 12-32 to 12-35

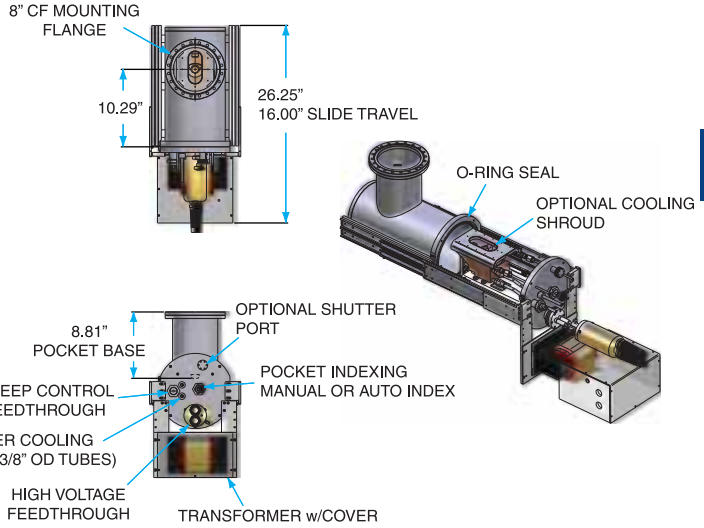
Options:

- Shutters
- Cross-contamination shields
- Automatic crucible indexers
- Deposition monitors/controllers
- Custom mounting

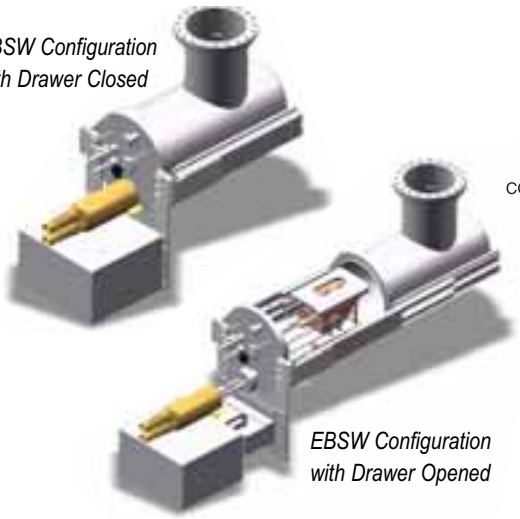
Source Well Configurations (EBSW)

The Electron Beam Source Well (EBSW) is comprised of an electron beam evaporator mounted in a dedicated stainless steel "well." The electron beam source is mounted to a source drawer that provides easy and unrestricted access through a Viton® sealed door to the e-beam source for service and material replenishment.

Source wells can be fitted with shielded viewing windows and can be modified to work in many different applications.



EBSW Configuration with Drawer Closed



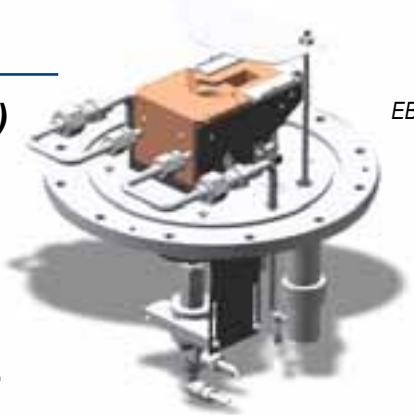
EBSW Configuration with Drawer Opened

*NOTE: Contact our e-beam experts at **ebeam@lesker.com** to discuss your specific vacuum application and process equipment needs.*

Flange-Mount Configurations (EBFM)

For more typical arrangements, we offer a baseplate, or Flange Mounted Electron Beam Assembly (EBFM). In this configuration, the entire electron beam evaporator is conveniently located on a single "flange mounted" unit. The flange can be customized to suit the mounting requirements.

For E-Beam crucibles and liners, see pages 9-48 to 9-54.



EBFM Configuration

➤ Single Pocket

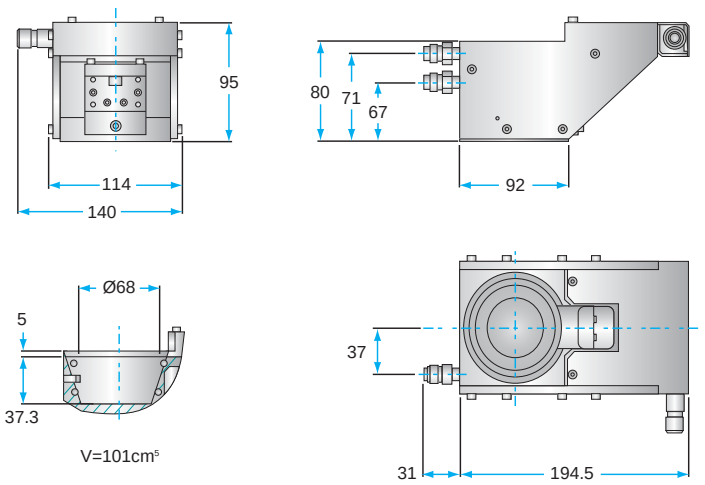
■ Single Pocket

Features:

- Small beam spot regardless of position in pocket
- Low inductance x- and y-coils with dynamic defocusing capability
- Extended filament lifetime
- Reproducible and quick filament fixture
- Plug-in connector for magnet leads

Benefits:

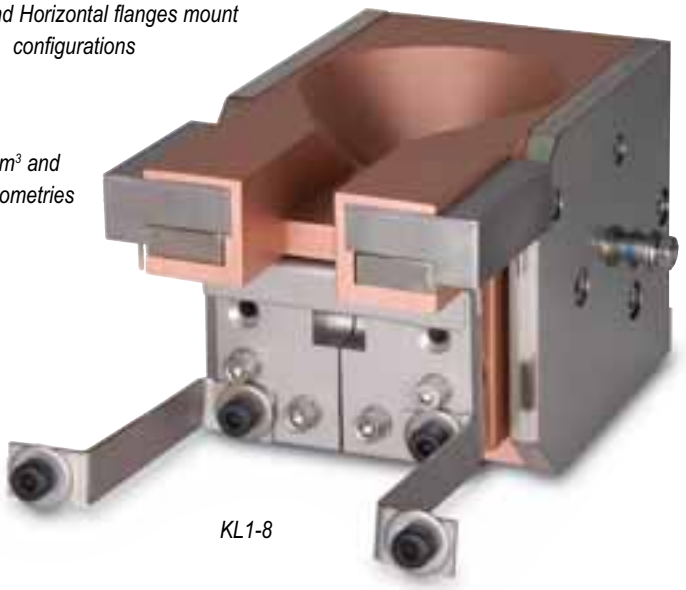
- Homogeneous material depletion
- Stable beam sweep at high beam deflection frequencies
- Reduced maintenance and down-time
- Enhanced run-to-run repeatability
- Non-interchangeable connections



KL-1 Dimensions

Vertical and Horizontal flanges mount configurations

Standard pocket volumes are 8 cm³ and 40/100 cm³. Other volumes and geometries are available on request



KL1-8

Water cooling via VCO® fittings for standard high vacuum versions and VCR® fittings in UHV versions

Filament replacement downtime is reduced by unsurpassed filament lifetime and quick and reproducible filament block installation

KL1-100

Magnet deflection assembly creates a focused beam with minimized distortion regardless of its position in the pocket. The high frequency sweep ensures homogeneous material depletion for advanced evaporation processes

■ Multi-Pocket

Features **static water-to-vacuum seals** eliminating risk of water leakage into the vacuum system due to failing rotary seals.

Features:

- Small beam spot regardless of position in pocket
- Low inductance x- and y-coils with dynamic defocusing capability
- No dynamic water-vacuum interface
- Integrated coaxial water feedthrough for health and source body cooling
- Extended filament lifetime
- Reproducible and quick filament fixture
- Hearth positioning using optical encoder
- Plug-in connector for magnet leads

Benefits:

- Homogeneous material depletion
- Stable beam sweep at high beam deflection frequencies
- Eliminates water leakage into vacuum system
- No additional water feedthrough required
- Reduced maintenance and down-time
- Enhanced run-to-run repeatability
- Built-in hearth rotation with high positioning accuracy
- Non-interchangeable connections

NOTE: Requires only (3) feedthroughs for installation

KL-6

Integrated water distribution unit

Quick-coupler water fittings

Direct motor drive with optical encoder for high positioning accuracy

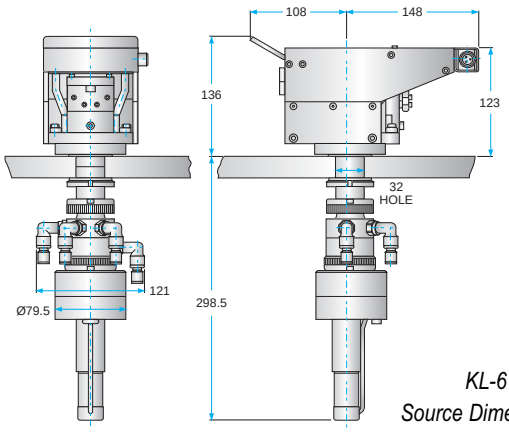
Pocket position calibration

Plug-in magnet current connector

High-frequency sweep deflection system

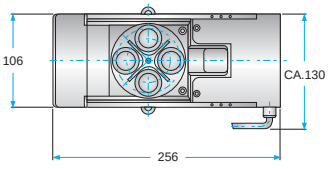
KL-6

Plug-in emitter assembly with long filament lifetime, easy exchange of filament system



KL-6
Source Dimensions

Rotary feedthrough with coaxial water lines



➤ Power Supply Options

■ Power Supply Options

Through a combination of an intelligent arc recognition system and the high switching frequency of the power unit, arcs are extinguished extremely fast. This minimizs the energy that would otherwise continue to feed the arc. Full power is returned within 3 to 5 ms to allow the evaporation process to continue. The built-in arc management also supports processes with continuous arching by either setting an arc rate threshold or by automatically switching into a robust recovery mode.

Controller Features:

- Emission control
- High voltage control
- Filament current control
- Programmable sweep control with bipolar power output
- Pocket control for DC and stepper motors
- Sequential evaporation control
- Functions interlock circuit protection
- External I/O control, e.g. shutter control
- Logical I/O addressing
- Master-Slave mode for simultaneous evaporation

High Voltage Power Supply:

- Sequential or simultaneous supply for up to three evaporators
- Robust primary switched mode power supply
- Arc detection within 200 ns and suppression within 1 µs
- Full arc recovery within 5 ms
- Controllable arc management system withstands continuos arching
- Continuously variable high voltage from 2 kV to 10 kV
- Up to 4 HV outputs for parallel operation
- Switchable HV output for glow discharge process (optional)
- Compact and lightweight design
- CE certified

NOTE: All controller functions are accessible from the handheld remote which can be used to manually control the evaporation process as well as set all process and system parameters. Access to the menu functions may be limited with three password protected user levels (e.g. Operator, Standard, Service).

➤ Filament Block Assembly Tool

■ Filament Block Assembly Tool

Designed for fast and simple filament replacement or source cleaning. Simply remove the anode plate and the main body, place the filament holder into the assembly tool to disassemble, clean the parts and reassemble with the same tool. The filament will automatically be aligned in the correct position; further adjustment of the filament is no longer necessary.

Filament Block Assembly Tool

Standard E-Beam Source Configuration Matrix

Select from the configuration options to create a part number and price for a particular source package.

Example Configuration: EBPKL 1 1X8 5KW S

	Part No. Prefix
Base Unit	EBPKL
Source Gun Assembly	
KL-1	1
KL-6	6
KL-8	8
Standard Hearth Pocket Options*	
1 x 8cc (KL-1 gun) 5kW	1 x 8
1 x 40cc (KL-1gun) 10kW	1 x 40
1 x 100cc (KL-1 gun) 10kW	1 x 100
4 x 8cc (KL-6 gun) 5kW	4 x 8
6 x 4cc (KL-6 gun) 4kW	6 x 4
8 x 2cc (KL-6 gun) 2kW	8 x 2
4 x 35cc (KL-8 gun) 8kW	4 x 35
6 x 20cc (KL-8 gun) 6kW	6 x 20
8 x 12cc (KL-8 gun) 6kW	8 x 12
Power Supply	
5kW	5KW
10kW	10KW
Beam Sweep Controller	
Standard	S

* Other hearth configurations are available on request.

SPECIFICATIONS

Model	KL--1	KL-6	KL-8
Maximum Power	10kW	6kW	10kW
Acceleration Voltage	4 - 10 kV	4 - 10 kV	4 - 10 kV
Maximum Filament Current	50 A @ 10 VAC	50 A @ 10 VAC	50 A @ 10 VAC
Primary Beam Deflection	270° by permanent magnet	270° by permanent magnet	270° by permanent magnet
Magnet System (Bakeout Temperature)	STD (150°C)	STD (150°C)	STD (150°C)
X Deflection	± 3 A (150 Hz)	± 3 A (150 Hz)	± 3 A (150 Hz)
Y Deflection	± 3 A (150 Hz)	± 3 A (150 Hz)	± 3 A (150 Hz)
Spot Size Diameter	8cc hearth = 5 mm (1/4")	3 mm (1/8")	3 mm (1/8")
Maximum Evaporation Rate*	8 cc hearth - 7,000 Å/min 40 cc hearth - 12,000 Å/min	12,000 Å/min	25,000 Å/min
Hearth Rotation	N/A	Integrated motor with optical positioning	Integrated motor with optical positioning
Minimum Base Pressure	10^{-8} mbar (Torr)	10^{-8} mbar (Torr) UHV option = 10^{-10} mbar (Torr)	10^{-8} mbar (Torr)
Cooling Water Requirement	6 l/minl 3 bar (2 gpm; 45 psi)	6 l/minl 3 bar (2 gpm; 45 psi)	8 l/minl 3 bar
Gun Mounting Requirement	N/A	32 mm base plate hole	32 mm base plate hole
Weight	5 kg (11lb)	12 kg	15 kg

* Max rate based on aluminum with source-to-substrate distance of 250 mm (10") at rated power.

Kurt J. Lesker Company

➤ Filamentless Ion Source Packages

Our Ion Source systems include the ion source, power supply, cabling, feedthroughs, flexible internal utilities, swivel/rotating mounting collar, and choice of grids.

Our patented ion sources do not use thermionic tips nor filaments when generating plasma and neutralizing up to 85% of energy.
These ion sources are offered in 3, 5, and 10 cm configurations.

*NOTE: For additional product information and pricing, contact our ion source specialists at **ionsource@lesker.com** or call **1.800.245.1656***

Features:

- 3, 5, and 10 cm configurations
- Filamentless sources
- Reactive gas compatible
- Internal or flange mount
- Collimated or focused grids
- UHV compatible

Applications include:

- Ion-assisted deposition
- Plasma cleaning
- Oxiding
- Nitriding
- Surface modification

Ion Source Remote Mount Configuration Kit

NOTE: We also offer (production linear and R&D) ion sources for applications requiring high ion current density, low energy fluxes, and where minimal damage to the substrate is essential—such as magnetic storage discs, flexible polymer substrates, and flat panel displays.

Because they employ no filaments, hollow cathode electron sources, or thermionic emitter and are intensively watercooled, the heat contribution to the overall process environment is low, an important factor in manufacturing processes with temperature-sensitive substrates.

*Contact our ion source specialists at **ionsource@lesker.com** for more information.*

➤ Filamentless Ion Source Packages

SPECIFICATIONS

	3cm Source	5cm Source	10 cm Source
Filaments	None	None	None
Process Gas	Argon (standard)	Argon (standard) Oxygen (optional)	Argon (standard) Oxygen (optional)
Ion Beam Currents	2 mA at 25 eV to 7 mA at 1,000 eV	2 mA at 25 eV to 35 mA at 1,200 eV	2 mA at 25 eV to 67 mA at 1,200 eV
Ion Optics	Molybdenum Collimated Optics (standard); Divergent, Convergent, and Graphite Ion Optics (optional)		
Ion Beam Uniformity	± 10% in the inner 75% of beam diameter		
Mounting	Remote Mount (standard) 8" min. CF Flange (optional)	Remote Mount (standard) 8" min. CF Flange (optional)	Remote Mount (standard) 10" min. CF Flange (optional)
Feedthrough	Dual 1" Gas and Electrical Feedthrough (standard); 2.75" CF Flanged Feedthrough (optional)		
Source Material	300/400 Series Stainless Steel; High Purity, High Temperature Fired Ceramic		
Required Gas Flow	7 to 15 sccm to Sustain the Plasma		
Operational Pressure (based on 2,000 L/s effective pumping speed for N_2)	1.2×10^{-4} to 4×10^{-4} Torr	9×10^{-5} to 2×10^{-4} Torr	9×10^{-5} to 2×10^{-4} Torr
Nominal Pump Speed	1,000 liters/sec	2,000 liters/sec	2,000 liters/sec
Emitter Power Supply (constant current controlled)	100V to 475V @ 0 to 225 mA	100V to 475V @ 0 to 225 mA	100V to 525V @ 0 to 225 mA
Anode Power Supply (constant voltage controlled)	0 to 1,000V @ 2 to 7 mA	0 to 1000V @ 2 to 35 mA	0 to 1000V @ 2 to 67 mA
Accelerator Power Supply (constant voltage controlled)		0 to 100V @ 1 to 2 mA	
Dimensions:			
Ion Source	3" diameter x 5.26" length	5.5" diameter x 7" length	6.1" diameter x 8.45" length
DC Switching Power Supply		19" Rackmount (5.25" height x 18" depth)	

Standard Ion Configuration & Pricing Matrix

Select from the configuration options to create a part number and price for a particular ion source package.

Example Configuration: I 3 L M A X R X 1

	Part No. Prefix	Base Price
Ion Gun		
Ion Gun	I	
Gun Size		
3 cm	3	**Call**
5 cm	5	**Call**
10 cm	1	**Call**
Grid Selection		
Collimated	L	**N/C**
Divergent	V	**N/C**
Convergent	N	**N/C**
Material		
Molybdenum	M	**N/C**
Graphite	G	**N/C**
Operating Primary Gas		
Argon (Standard)	A	**N/C**
100% Oxygen	O	**Call**
Four Gas Service		
None	X	**N/C**
Four Gas Service (5 cm/10 cm only)	C	**Call**
Mounting Type		
Remote	R	**N/C**
Flange	F	**Call**
Flange Type		
*None (remote)	X	**N/C**
*ISO	I	**N/C**
*ConFlat®	C	**N/C**
Power Supply Voltage		
110V	1	**N/C**
220V	2	**N/C**

*Must specify flange size.

NOTE:

Minimum ConFlat Flange Dimensions

3 cm gun — 6¾" flange with 5" diameter tube

5 cm gun — 8" flange with 6" diameter tube

10 cm gun — 10" flange with 8" diameter tube

Minimum ISO Flange Dimensions

3 cm gun — ISO 160

5 cm gun — ISO 200

10 cm gun — ISO 250

*NOTE: Please visit **www.lesker.com** for our full line of Ion Sources.*

Global Distribution & Support Network

We have an unprecedented global distribution and sales support system strategically setup to service the international vacuum community.

- Multi-million dollar inventory spanning five global distribution centers
- Over 10,000 products in-stock for immediate delivery
- Consignment inventories and customized B2B solutions available
- Comprehensive sales and support coverage