# Vacuum Chambers

13

	paye(s)
Technical Note	13-2 to 13-3
Pyrex® Bell Jars	13-4 to 13-5
Cylindrical Chambers	13-6 to 13-9
Bell Jars (304 SS)	
Service Wells (304 SS)	
Feedthrough Collars (304 SS)	
Endplates	
Spherical Chambers	
Box Chambers	
D-Shape Chambers	
Cylindrical Chamber Assemblies	
Frames & Hoists	13-14 to 3-17
Carbon Steel Frames	13-14 to 13-15
Extruded Aluminum Frames	
Motorized Hoists and Accessories	13-17
Custom Chambers	13-18 to 13-20
Capabilitites	
Build Your Own Camber	
Overtetien Feman	40.00

Kurt J. Lesker



### ■ Geometries & Characteristics

Vacuum chambers are built in a huge variety of shapes and sizes, limited only by application, imagination, and engineering consideration.

Chambers range in volume from less than 1 cc to the "world's largest vacuum chamber" at NASA Plumbrook, USA which is 100 ft diameter by 122 ft tall (~3.5 x 1010 cc).

The more 'standard' vacuum chamber shapes include: box, sphere, cylinder, D-shape, and bell jar. Additional components, used in vacuum chamber construction, include: endplates, feedthrough collars, and service wells. All are separately discussed to illustrates the strengths of the basic shapes/designs.

#### Box

The box shape chamber is available in two basic forms. One, sealed with metal wire and flat copper gaskets and often called a rectangular chamber, is designed for UHV applications. The other, called a box chamber, has one complete side hinged as an o-ring sealed door and operates at high vacuum. Since both versions are flat-sided, either thick walls or extensive bracing is used to withstand atmospheric pressure.

The box chamber's door provides easy, fast access to any part of the internal volume. It is the platform-of-choice for any repetitive batch process such as: coating multiple substrates; product degassing; evacuation before impregnation, etc. However, its accessibility also makes it an excellent chamber for research applications where, for example, deposition sources, coating materials, and deposition geometry are frequently changed.

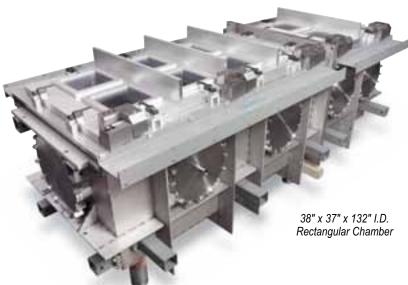
#### Spherical



The spherical chamber equipped with CF (ConFlat® style) flanges is a popular choice for applications requiring radial component placement as in pulse laser deposition or surface sciences. These chambers have many ports for particle/radiation sources or analytical instrumentation directed at the sphere's center or other relevant focal points. With suitable surface preparation and pumping, such chambers can reach pressures in the UHV range.

### Cylindrical

While cylindrical chambers can be made with metal wire seals, most are o-ring sealed and, therefore, appropriate for high vacuum operation. The thin cylindrical walls resist atmospheric pressure well and is a commonly used shape, in either vertical or



horizontal orientation. Vertical cylinders are often chosen for thin film deposition research. The interior is accessed, for changing evaporant or target, by removing the lid or lifting the whole cylinder off its baseplate. Some vertical cylinders have secondary load-lock chambers attached to a side port for substrate changing.

Horizontal cylinders are often equipped with hinged, domed, o-ring sealed end-doors the same diameter as the cylinder.

### Metal Bell Jars

A metal bell jar is essentially a cylindrical chamber which has a domed top-plate already welded in place. With a metal wire seal base flange metal bell jars can reach the UHV range with suitable surface preparation and pumping. However, the o-ring sealed base flange version is very popular for high vacuum application. It is relatively simple to cool metal bell jars using an cooling-water trace welded to the outer surface. Such bell jars are often chosen for high temperature applications and because the simple design makes manufacturing easier and lowers costs.

### Pyrex® Bell Jars

Bell jars made from Pyrex are inexpensive and transparent vacuum chambers. Using an 'L-shape' gasket to seal the bottom edge to a metal baseplate, they are a good choice for laboratory high vacuum applications. However, as is obvious, glass is fragile. To protect personnel (and the chamber) surround the bell jar with a metal grid guard before applying vacuum. Although wall thickness is carefully controlled during manufacture, no two bell jars are exactly alike.

### **Endplates**



Endplates or baseplates (depending on mounting orientation) are flat metal flanges made to cap standard pyrex/metal bell jars and cylinders. Endplates usually have one large flanged port where the HV pump is attached, plus a number of smaller ports for feedthroughs and components.

#### Service Wells

Service wells, like endplates, act as transition stages between the pumping stack and the bell jar or other chamber. The physical distinction is that service wells are wide-bore tubes, closed at the bottom, with feedthrough flanges radially penetrating the tube walls. Because there is a much larger area for feedthrough ports and because the ports are not buried beneath the lowest surface, the service well's primary advantages are number of feedthroughs and convenience.











### Feedthrough Collars

This name sometimes misleads, as a feedthrough collar has no feedthroughs. Like the service well, it has a number of radial ports for feedthroughs, but otherwise is simply a tube with flanges at each end, used as a transition piece between a bell jar and an endplate.

### D-Shape

The D-shape chamber (when viewed from above) combines the thin wall of the cylindrical chamber with the volume and large, o-ring sealed access door of the box chamber making it appropriate for high vacuum applications. The door is frequently aluminum to reduce weight. For many applications, including substrate rotation during deposition, the cylindrical rear section of the D creates no serious dimensional restrictions. The shape is often chosen for the same applications as the more traditional box chambers.

### Materials

The most commonly used material for high vacuum and UHV chambers is a 300-series stainless steel-most frequently 304L (carbon content >0.03%), which is available in sheet, tube, bar, plate, and forged forms. This steel, and others such as 316L, has desirable vacuum chamber properties: mechanically strong, machinable, weldable; magnetic permeability close to 1; resistance to atmospheric corrosion; takes a high polish; and can be effectively outgassed by baking. For large space simulation chambers operating in the HV Torr range, mild steel is a costeffective option. However, its magnetic, corrosion resistance, and out-gassing properties make it generally unacceptable.

For experiments disturbed by residuel magnetic fields or radioactive backgrounds. or which require chamber walls with excellent thermal or electrical conductivity, weldable grades of aluminum (typically 6061) are used

for high vacuum and UHV. Two problems prevent the regular use of aluminum for vacuum chambers: (a) it is more difficult to weld when vacuum integrity is required and (b) its low strength means it cannot be used for CF flange knife-edges without expensive modification.

Glass is a common chamber material in educational and some research laboratories. Many types of glass have low gas permeability (except for helium) and good vacuum characteristics. The background radioactivity due to potassium 40; however, it may be high enough to preclude it for some uses. Obviously, glass is more susceptible to damage and less easily modified by the average machine shop than metal, but glass bell jars offer the benefits of low cost, transparency, and simplicity.

When the earth's magnetic field interferes with experiments, the complete chamber is sometimes made of mu-metal. However, anecdotal evidence suggest it has strange properties when used as a vacuum construction material (see Liners for an alternative solution).

Common materials such as brass are sometimes used, but not recommended. Less common. chemically inert materials such as Monel® and Inconel® have special applications. Zinc or cadmium-plated steels or screws should never be used inside a vacuum chamber. Their relatively high vapor pressure can cause operational adventures that are best avoided.

### Water Cooling

For applications with high heat outputs, double chamber walls with channeling and baffles provide the most effective method of water cooling to provide a "cold wall." For lower heat outputs, a water trace (a channel welded to the external chamber surface) is used. The trace covers a small fraction of the surface but, using data on heat input and thermal conductance. the trace pattern is designed for adequate cooling efficiency. Occasionally, copper tubing is brazed to the chamber's exterior. Although less expensive, this is never as effective as the first two methods.

Water-cooled chambers should undergo rigorous testing procedures to ensure they are free of leaks. Testing methods include stress-testing all water cavities with a pressurized gas (typically dry nitrogen) and helium leak checking all internal and external welds.

### Liners

Two common applications for chamber liners are: (a) reducing the effects of magnetic fields by installing multiple mu-metal liners inside the chamber (often a better solution than a mumetal chamber), and (b) preventing sputtered or evaporated materials reaching the chamber's surfaces using aluminum foil or thin (shaped) stainless liners.

### Inspecting and Using **Pyrex® Chambers**



When receiving a Pyrex chamber, immediately look for shipping damage. Any Pyrex chamber will have a variety of small imperfections.

We recommend you ignore small surface scratches and blisters/bubbles (either flattened and elongated, or tiny spheres), because they are difficult to avoid in manufacturing and handling thick glass, and will not adversely affect vacuum applications.

However, do not ignore cracks, particularly those causing a distinct dark line more than an inch long in the bulk of the glass. A crack suggests shipping damage. If undamaged, re-pack the glass chamber in its original box until ready for installation. If you find damage, please contact us immediately for further instruction. We will do everything we can to rectify the situation.

During use, examine the glass chamber regularly for clouding, cracks, star formations (caused by point impact), or deep, long scratches. Clean the external surface using commercial glass cleaners. If the process clouds the internal surfaces, seek advice on the best method to remove the deposit. But remember, if you are depositing some "inert" or hard-coating material on a substrate, it will form an inert, hard layer on the glass. Do not compromise the vacuum by using cleaners that cannot wash away with water or clean solvent.

Never allow hydrogen fluoride (HF—gas or aqueous solution) near the glass chamber. It attacks glass, causing it to become opaque. Never use harsh abrasives, wire brushes, files, or metal scrapers on the glass surface. If the glass chamber becomes cracked or starred, discard it immediately.



## Pyrex® Bell Jars

### Open Ended Cylindrical & Domed End Bell Jars

- · Made from Pyrex to withstand thermal shock and chemical attack
- · Bottom of bell jar is ground flat to accept an L-gasket for sealing to our baseplates, feedthrough collars, or service wells
- · Inexpensive and transparent
- · Features good high-vacuum properties
- · Pyrex cylinders in various diameters and lengths



	O.D.	Nominal	Height	Wall			
O.D.	Tolerance	Height	Tolerance	Thickness	Flatness	Part No.	Price
Pyrex Bell Jar							
10.25"	1/8"	12"	1/8"	4.8mm-8mm	.007"	BJ10X12	Call
10.25"	1/8"	18"	1/8"	4.8mm-8mm	.007"	BJ10X18	Call
12.5"	1/8"	12"	1/8"	4.8mm-8mm	.007"	BJ12X12	Call
12.5"	1/8"	18"	1/8"	4.8mm-8mm	.007"	BJ12X18	Call
14.25"	1/8"	12"	1/8"	4.8mm-8mm	.007"	BJ14X12	Call
14.25"	1/8"	18"	1/8"	4.8mm-8mm	.007"	BJ14X18	Call
14.25"	1/8"	21"	1/8"	4.8mm-8mm	.007"	BJ14X21	Call
15.375"	1/8"	18"	1/8"	4.8mm-9.5mm	.010"	BJ15X18	Call
15.375"	1/8"	24"	1/8"	4.8mm-9.5mm	.010"	BJ15X24	Call
15.375"	1/8"	30"	1/8"	4.8mm-9.5mm	.010"	BJ15X30	Call
18"	1/8"	12"	1/4"	4.8mm-9.5mm	.010"	BJ18X12	Call
18"	1/8"	18"	1/4"	4.8mm-9.5mm	.010"	BJ18X18	Call
18"	1/8"	24"	1/4"	4.8mm-9.5mm	.010"	BJ18X24	Call
18"	1/8"	30"	1/4"	4.8mm-9.5mm	.010"	BJ18X30	Call
12"	1/8"	12"	1/8"	4.8mm-8mm	.007"	BJ12X12EURO	Call
12"	1/8"	18"	1/8"	4.8mm-8mm	.007"	BJ12X18EURO	Call
Pryex Cylinder O	pen Ended						
12.5"	1/8"	12"	1/8"	4.8mm-8mm	.007"	CY12X12	Call
12.5"	1/8"	18"	1/8"	4.8mm-8mm	.007"	CY12X18	Call
12.5"	1/8"	24"	1/8"	4.8mm-8mm	.007"	CY12X24	Call
18"	1/8"	12"	1/4"	4.8mm-9.5mm	.010"	CY18X12	Call
18"	1/8"	18"	1/4"	4.8mm-9.5mm	.010"	CY18X18	Call
18"	1/8"	21"	1/4"	4.8mm-9.5mm	.010"	CY18X21	Call

NOTE: Although carefully controlled during manufacture to ensure a minimum wall of 1/16" and checked under vacuum, glass chambers are individually blown into molds. No two are exactly alike.









## > Pyrex Open Ended Cylindrical & **Domed Bell Jar Guards**

### Pyrex Bell Jar Guards

· Carbon steel and painted



Compatible Chamber	Required Hoist Bracket	Part No.	Price
BJ10X12	HSTLD-12GBKT	BG10X12	Call
BJ10X18	HSTLD-18GBKT	BG10X18	Call
BJ12X12	HSTLD-12GBKT	BG12X12	Call
BJ12X18	HSTLD-18GBKT	BG12X18	Call
BJ14X12	HSTLD-12GBKT	BG14X12	Call
BJ14X18	HSTLD-18GBKT	BG14X18	Call
BJ14X21	HSTLD-21GBKT	BG14X21	Call
BJ15X18	HSTLD-18GBKT	BG15X18	Call
BJ15X24	HSTLD-24GBKT	BG15X24	Call
BJ15X30	HSTLD-30GBKT	BG15X30	Call
BJ18X12	HSTLD-12GBKT	BG18X12	Call
BJ18X18	HSTLD-18GBKT	BG18X18	Call
BJ18X24	HSTLD-24GBKT	BG18X24	Call
BJ18X30	HSTLD-30GBKT	BG18X30	Call
BJ12X12EURO	HSTLD-12GBKT	BG12X12EURO	Call
BJ12X18EURO	HSTLD-18GBKT	BG12X18EURO	Call
CY12X12	HSTLD-12GBKT	CG12X12	Call
CY12X18	HSTLD-18GBKT	CG12X18	Call
CY12X24	HSTLD-24GBKT	CG12X24	Call
CY18X12	HSTLD-12GBKT	CG18X12	Call
CY18X18	HSTLD-18GBKT	CG18X18	Call
CY18X21	HSTLD-21GBKT	CG18X21	Call



NOTE: For our standard chambers please refer to www.lesker.com for downloadable Adobe PDF 2D Dimensional Drawings, Engineering Files in DXF (2D), STP (3D) formats, and interactive 3D models which enable users to rotate, zoom, and much more.

### Pyrex Bell Jar L-Gaskets

Designed to fit over the outer surface of the pyrex chamber.

Bell Jar Gaskets: Bell jar and cylinder gaskets have an "L" crosssection. The bell jar sits inside the riser of the "L" and is sealed by atmospheric pressure pushing it down into the horizontal surface. The lower side of the horizontal surface seals against the baseplate. To make a good seal, many users lubricate the bell jar gaskets with Apiezon® hydrocarbon grease or Dow Corning silicone grease (see Section 6 for greases).

Bell Jar O.D.	Gasket Material	Part No.	Price
10.25"	Buna-N	LG10B	Call
12" & 12.5"	Buna-N	LG12B	Call
14.25"	Buna-N	LG14B	Call
15.375"	Buna-N	LG15B	Call
18"	Buna-N	LG18BP	Call
10.25"	Viton®	LG10V	Call
12" & 12.5"	Viton	LG12V	Call
14.25"	Viton	LG14V	Call
15.375"	Viton	LG15V	Call
18"	Viton	LG18V	Call

NOTE: Because the pyrex chamber's rim may have imperfections, many users lubricate the gaskets with either a hydrocarbon or silicone grease.



## ➤ Bell Jars (304 SS)

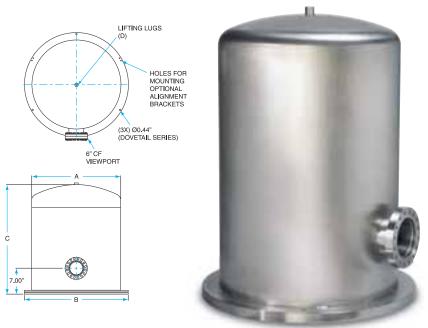
Our standard range of bell jars are available in dovetail o-ring grooved and standard ISO Flange mounting configurations. In conjunction with KJLC standard hoist and frame, the bell jar can be quickly lifted and moved for easy access to your equipment. The bell jar is also fully compatible with our line of feedthrough collars, service wells and end plates.

### Standard Features:

- · Manufactured from 304 stainless steel
- 6" CF viewport (4" nominal viewing area) kit supplied for all bell jars (assembly not included)
- O-ring sealed chambers are capable of reaching High Vacuum (HV) Levels
- Viton® o-ring included (assembly not included)
- Lifted Lug on center ½-13 UNC thread size

### **Available Options:**

- · Additional flanged ports
- · Water cooling-trace and double wall
- Extruded aluminum and Carbon Steel Frame available
- Standard hoist options



### ■ Dovetail O-Ring Grooved Flange

- Constructed from vertical cylinders with 12", 18<sup>3</sup>/<sub>8</sub>", 24", and 30" O.D.
- Domed at the top and features a dovetailshaped o-ring groove sealing flange at the bottom
- · Includes a Viton o-ring for the bottom flange

Chamber O.D.	Ring O.D.	OAH	# Lifting Lugs	Approx.		
Α	В	С	D	Weight	Part No.	Price
12.00	16.00	12.00	1 (center)	54 lbs.	BJ1212SU	Call
18.38	22.00	19.43	1 (center)	104 lbs.	BJ1819SU	Call
18.38	22.00	28.50	1 (center)	113 lbs.	BJ1829SU	Call
24.00	28.00	29.50	1 (center)	184 lbs.	BJ2429SU	Call
30.00	34.00	27.375	1 (center)	230 lbs.	BJ3028SU	Call
With Hoist Brac	ket Included					
12.00	16.00	12.00	1 (center)	64 lbs.	BJ1212SUBKT	Call
18.38	22.00	19.43	1 (center)	114 lbs.	BJ1819SUBKT	Call
18.38	22.00	28.50	1 (center)	123 lbs.	BJ1829SUBKT	Call
24.00	28.00	29.50	1 (center)	194 lbs.	BJ2429SUBKT	Call
30.00	34.00	27.375	1 (center)	240 lbs.	BJ3028SUBKT	Call

### ■ ISO Flange

- Constructed from vertical cylinders with 12<sup>3</sup>/<sub>4</sub>", 16", and 20" O.D.
- Domed at the top and features a standard ISO flange at the bottom

Chamber O.D.	Ring O.D.	OAH	# Lifting Lugs	Approx.		
Α	В	С	D	Weight	Part No.	Price
12.75	14.57 (ISO320-K)	12.00	1 (center)	42 lbs.	BJ1312SQ	Call
16.00	17.72 (ISO400-K)	16.00	1 (center)	63 lbs.	BJ1616SQ	Call
20.00	21.65 (ISO500-K)	29.50	1 (center)	124 lbs.	BJ2029SQ	Call

NOTE: Please contact chambers@lesker.com with your specific requirements for a customized chamber quotation.











## ➤ Service Wells (304 SS)

Our standard range of Service Wells are available in dovetail o-ring grooved and standard ISO flange configurations. The service well can be used with our line of Pyrex® or Metal Bell Jars feedthrough collars.

### Standard Features:

- · Manufactured from 304 SS
- · O-ring sealed chambers are capable of reaching High Vacuum (HV) levels

### **Available Options:**

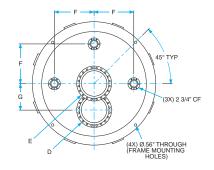
- · Additional Flanged Ports or replace with KF style ports
- · Water cooling-trace or double wall
- · Extruded aluminum and Carbon steel frames available
- Mounting Tabs

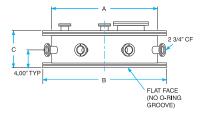
### Dovetail O-Ring Grooved Flange

### Standard Features:

- Constructed from vertical cylinders with 12", 18%", 24", and 30" O.D.
- · A flat surface on one end to accept an o-ring seal
- · Opposite end to have a flat welded plate

### Dovetail O-Ring Grooved Flange





Chamber O.D.	Ring O.D.	OAH	Pump	Port	Port Loc	ations			Approx.		
Α	В	С	D	E	F	G	Mating Bell Jar	Utility Ports	Weight	Part No.	Price
12.00	16.00	8.38	N/A	6"CF	N/A	N/A	Pyrex or Metal	(6) x 2.75" CF	95 lbs.	SW1208SU	Call
18.38	22.00	8.38	8"CF	N/A	6.50	5.25	Metal Only	(11) x 2.75" CF	166 lbs.	SW1808SU	Call
18.38	22.00	8.5	8"CF	N/A	6.50	5.25	Pyrex or Metal	(11) x 2.75" CF	173 lbs.	<b>SW1808SUG</b>	Call
24.00	28.00	8.38	8"CF	N/A	9.00	6.00	Pyrex or Metal	(11) x 2.75" CF	257 lbs.	SW2408SU	Call
30.00	34.00	8.38	8"CF	N/A	9.00	6.00	Metal Only	(11) x 2.75" CF	360 lbs.	SW3008SU	Call



NOTE: For our standard chambers please refer to www.lesker.com for downloadable Adobe PDF 2D Dimensional Drawings, Engineering Files in DXF (2D), STP (3D) formats, and interactive 3D models which enable users to rotate, zoom, and much more.

### ■ ISO Flange

- Constructed from vertical cylinders with 12<sup>3</sup>/<sub>4</sub>", 16", and 20" O.D.
- One end has a standard ISO flange; other end features a blank plate with a pumping port
- Mounting tabs



Chamber C	D.D. Ring O.D.	OAH	Pump	Port	Port Loca	itions			Approx.		
Α	В	С	D	E	F	G	Mating Bell Jar	<b>Utility Ports</b>	Weight	Part No.	Price
12.75	14.57 (ISO320-K)	8.12	N/A	6"CF	N/A	N/A	Metal Only	(6) x 2.75" CF	59 lbs.	SW1308SQ	Call
18.38	22.00	8.12	N/A	6"CF	N/A	N/A	Metal Only	(6) x 2.75" CF	80 lbs.	SW1608SQ	Call
18.38	22.00	8.09	N/A	6"CF	N/A	N/A	Metal Only	(6) x 2.75" CF	110 lbs.	SW2008SQ	Call

NOTE: Please contact **chambers@lesker.com** with your specific requirements for a customized chamber quotation.



## Feedthrough Collars (304 SS)

Our Standard range of Feedthrough Collars are available in dovetail o-ring grooved and standard ISO flange mounting configurations. The Feedthrough Collar can be used with our line of Pyrex or metal bell jars, Service Wells and Endplates...

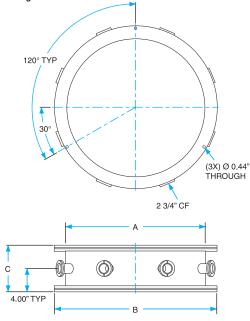
### Standard Features:

- · Manufactured from 304 SS
- · Viton o-ring provided (assembly not included)
- O-ring sealed chambers are capable of reaching High Vacuum (HV) levels.



### **Available Options:**

- · Replace CF ports with KF style ports and/or additional flanged ports
- · Water cooling—trace and double wall
- Standard frames—Extruded aluminum and carbon steel (starting at starting at page 13-14)
- · Mounting tabs



### Dovetail O-Ring Grooved Flange

- Constructed from vertical cylinders with 12, 18<sup>3</sup>/<sub>8</sub>, 24, and 30 O.D.
- Dovetailed/o-ring sealed on one end, and features a flat sealing surface to accept an o-ring seal on the other end
- Includes a Viton® o-ring

Chamber O.D.	Ring O.D.	OAH			Approx.		
Α	В	С	<b>Utility Ports</b>	Mating Bell Jar	Weight	Part No.	Price
12.00	16.00	8.00	(6) x 2.75" CF	Pryex or Metal	64 lbs.	FT1208SU	Call
18.38	22.00	8.00	(8) x 2.75" CF	Metal Only	93 lbs.	FT1808SU	Call
18.38	22.00	8.13	(8) x 2.75" CF	Pyrex or Metal	96 lbs.	FT1808SUG	Call
24.00	28.00	8.00	(8) x 2.75" CF	Pyrex or Metal	128 lbs.	FT2408SU	Call
30.00	34.00	8.00	(8) x 2.75" CF	Metal Only	157 lbs.	FT3008SU	Call

### ISO Flange

- Constructed from vertical cylinders with 12<sup>3</sup>/<sub>4</sub>", 16", and 20" O.D.
- · Standard ISO flanges on both ends

Chamb	er O.D.	Ring O.D.	OAH			Approx.		
Α		В	С	Utility Ports	Mating Bell Jar	Weight	Part No.	Price
12.7	75 1 <sub>4</sub>	4.57 (ISO320-K)	8.00	(6) x 2.75" CF	Metal Only	34 lbs.	FT1308SQ	Call
16.0	00 1	7.72 (ISO400-K)	8.00	(6) x 2.75" CF	Metal Only	41 lbs.	FT1608SQ	Call
20.0	00 2	1.65 (ISO500-K)	8.00	(6) x 2.75" CF	Metal Only	50 lbs.	FT2008SQ	Call

NOTE: Please contact chambers @lesker.com with your specific requirements for a customized chamber quotation.











# **Endplate**

Endplates, also known as top plates or baseplates are available in 304 SS or 6061-T6 Aluminum. Endplates can be used in conjunction with our pyrex or metal bell jars and feedthrough collars.

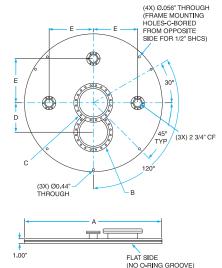
### **Dovetail O-Ring Grooved Flange**

#### Standard Features:

- · Disc-shaped, 1" thick with a flat sealing surface to accept a o-ring or L-gasket seal
- · Welded bosses for lifting
- · On aluminum baseplates all ports will be machined profile

### **Available Options:**

- · Replace CF ports with KF style ports and/or add additional flanged ports
- · Water cooling-trace or machine groove with laser cut cover into plate
- · Mounting tabs
- Standard frames—extruded aluminum and carbon steel (starting at page 13-14)
- Add Dovetail oring grooved to mate to Servicewell



Ring O.D.	Pum	p Port	Port I	Locations		Approx.	Mating		
A	В	С	D	E	Utility Ports	Weight	Bell Jar	Part No.	Price
Stainless Steel									
16.00	N/A	6"CF	N/A	N/A	N/A	57 lbs.	Pyrex or Metal	BP1200SU	Call
22.00	8"CF	N/A	5.25	6.50	(3) x 2.75" CF	108 lbs.	Pyrex or Metal	BP1800SU	Call
28.00	8"CF	N/A	6.00	9.00	(3) x 2.75" CF	172 lbs.	Pyrex or Metal	BP2400SU	Call
30.00	8"CF	N/A	6.00	9.00	(3) x 2.75" CF	255 lbs.	Metal Only	BP3000SU	Call
Aluminum									
16.00	N/A	QF100-SWK	N/A	N/A	N/A	19 lbs.	Pyrex or Metal	BP1200SUA	Call
22.00	QF160-SWK	N/A	5.25	6.50	(3) QF40	35 lbs.	Pyrex or Metal	BP1800SUA	Call
28.00	QF160-SWK	N/A	6.00	9.00	(3) QF40	58 lbs.	Pyrex or Metal	BP2400SUA	Call
30.00	QF160-SWK	N/A	6.00	9.00	(3) QF40	86 lbs	Pyrex or Metal	BP3000SUA	Call



NOTE: For our standard chambers please refer to www.lesker.com for downloadable Adobe PDF 2D Dimensional Drawings, Engineering Files in DXF (2D), STP (3D) formats, and interactive 3D models which enable users to rotate, zoom, and much more.

### ISO Flange

### Standard Features:

· Disc-shaped 304 stainless steel plate using standard ISO flanges

- · Replace CF ports with KF style port and/or add additional flanged ports
- · Water cooling-trace
- · Standard pumping and gauging packages
- · Standard frames—carbon steel and extruded aluminum with or without rackmounting

Ring O.D.	Pump Port	Weight	Mating Bell Jar	Part No.	Price
14.57 (ISO320-K)	6" CF	34 lbs.	Metal only	BP1300SQ	Call
17.72 (ISO400-K)	6" CF	49 lbs.	Metal only	BP1600SQ	Call
21.65 (ISO500-K)	6" CF	72 lbs.	Metal only	BP2000SQ	Call

NOTE: Please contact chambers@lesker.com with your specific requirements for a customized chamber quotation.



## Kurt J. Lesker Company

## Spherical Chambers



**Available Options:** 

- Replace CF port with KF style port and/or add additional flanged ports
- · Standard frames— extruded aluminum and carbon steel

### **Standard Features:**

- 304 stainless steel hemisphere x 3/16" wall
- Flanges are CF (knife-edge or ConFlat® style), with through-holes
- · Each port's center-line passes through the sphere's center point
- Sphere is bakeable to 400° C when fitted with copper-gasketed blank flanges and pumped
- Metal Seal chambers are capable of reaching Ultra High Vacuum (UHV) levels
- Part numbers below ending with EP have electropolish finish inside and outside



			Approx.		
O.D.	Material	Ports	Weight	Part No.	Price
12"	304 SS	(4) 8.00" CF, (2) 6.00" CF, (1) 4.50" CF, (4) 2.75" CF	52 lbs.	SP1200S	Call
12"	304 SS	(4) 8.00" CF, (2) 6.00" CF, (1) 4.50" CF, (4) 2.75" CF	52 lbs.	SP1200SEP	Call
18"	304 SS	(6) 8.00" CF, (1) 6.00" CF, (4) 4.50" CF, (8) 2.75" CF	97 lbs.	SP1800S	Call
18"	304 SS	(6) 8.00" CF, (1) 6.00" CF, (4) 4.50" CF, (8) 2.75" CF	97 lbs.	SP1800SEP	Call

### **Spherical Chamber Accessories**

				Approx.		
Description	O.D.	Material	Compatible Frames	Weight	Part No.	Price
Frame Mounting Adapter Ring	14"	304 SS	FRMA-S001-A, FRMA-S001-B,	14 lbs.	SPMGFGS	Call
			FRMA-S001-C, FRMC-S001-B, FRMC-S00	)1-D		

<sup>\*</sup> Adapter ring required to mount 12" or 18" spherical chambers to standard frames.

NOTE: Please contact chambers@lesker.com with your specific requirements for a customized chamber quotation.











## **Box Chambers**

### Standard Features:

- 304 stainless steel plate with KF utility ports and a 6061 aluminum hinged door
- Aluminum door features a dovetail—o-ring groove, and includes a Viton® o-ring and rectangular view port with safety cover (Viton o-ring seal in center of the door with a viewing area of 31/4" x 51/4")
- · O-ring sealing box chambers are capable of reaching High Vacuum (HV) levels





### **Available Options:**

- · Replace KF port with CF style port and/or add additional flanged ports
- · Water cooling-trace
- Standard frames— extruded aluminum and carbon steel

NOTE: Frames not included. Standard frames start on page 13-14.

	I.D.					Approx.		
Width	Depth	Height	Box Sides	Box Door	Ports	Weight	Part No.	Price
12"	12"	12"	304 SS	6061 AI	(1) QF40, (1) QF100-SWK	172 lbs.	BX1212S	Call
12"	12"	24"	304 SS	6061 AI	(2) QF40, (1) QF100-SWK	266 lbs.	BX1224S	Call
16"	16"	16"	304 SS	6061 AI	(2) QF40, (1) QF100-SWK	253 lbs.	BX1616S	Call
24"	24"	24"	304 SS	6061 AI	(2) QF40, (1) QF100-SWK	670 lbs.	BX2424S	Call
24"	24"	30"	304 SS	6061 AI	(4) QF40, (1) QF160-SWK	775 lbs.	BX2430S	Call
30"	30"	30"	304 SS	6061 AI	(4) QF40, (1) QF100-SWK & (1)QF160-SWK	1471 lbs.	BX3030S	Call
36"	36"	48"	304 SS	6061 AI	(4) QF40, (1) QF100-SWK & (1)QF320-SWK	2674 lbs.	BX3648S	Call

NOTE: Please contact chambers@lesker.com with your specific requirements for a customized chamber quotation.

## Kurt J. Lesker

## ➤ D-Shape Chambers

### Standard Features:

- · Constructed from 304 stainless steel and 6061-T6 aluminum
- Includes machined configurations into the top and bottom with aluminum blanking flanges supplied with Viton o-ring and clamps
- · KF Utility Ports
- The aluminum door features a dovetailed o-ring groove and Viton® o-ring seal; rectangular viewport (fluorocarbon o-ring sealed in center of the door with a viewing area of 3¹/₄" x 5¹/₄")
- O-ring sealing "D" shaped chambers are capable of reaching pressures in the 10<sup>-7</sup> Torr range—clean, dry, and empty





### **Available Options:**

- Replace KF port with CF style port and/or add additional flanged ports
- · Water cooling—trace
- · Replace standard frame with rackmounting frame
- · Mounting Feet
- · Customer specific options as needed

NOTE: Frames not included. Standard frames start on page 13-14.

	I.D.					Approx.		
Width	Height	Depth	Chamber	Chamber Door	Ports	Weight	Part No.	Price
14"	24"	14.69"	304 SS	6061 AI	(1) ISO100-SWK, (1) ISO160-SWK, (2) ISO250-F	173 lbs.	DS1424S	Call
18"	22"	18.69"	304 SS	6061 AI	(1) ISO100-SWK, (1) ISO160-SWK, Custom o-ring seal	300 lbs.	DS1822S	Call
24"	30"	26.38"	304 SS	6061 AI	(1) 160-SWK, (1) 250-SWK, Custom o-ring seal	670 lbs.	DS2430S	Call

NOTE: Please contact chambers@lesker.com with your specific requirements for a customized chamber quotation.











# ➤ Cylindrical Chambers

Our standard range of Horizontal chamber assemblies are available with a welded, dome end on one side and a hinged, aluminum door on the opposite end. The chamber assembly can be mated with a standard aluminum frame.

### Standard Features:

- · Chamber body manufactured from 304 Stainless Steel
- · Chamber door manufactured from 6061-T6 aluminum
- · The aluminum door features a dovetailed o-ring groove, and includes a Viton® o-ring and rectangular viewport with safety cover (Viton® o-ring sealed in center of the door with a viewing area of 31/4" x 51/4")
- · QF utility ports
- · Mounting feet

### **Available Options:**

- · Replace QF utility ports with CF style ports and/or add additional flanged ports
- · Water Trace Cooling available
- Standard Frames
- Customer specific options as needed



NOTE: Frames not included. Standard frames start on page 13-14.

			Approx.		
Door O.D.	OAL	Ports	Weight	Part No.	Price
22"	24.18	(2) QF40, (1) QF160-SWK	272 lbs.	CA1821S	Call
22"	33.19	(2) QF40, (1) QF160-SWK, (1) QF250-SWK	301 lbs.	CA1830S	Call
28"	33.19	(2) QF40, (1) QF160-SWK, (1) QF250-SWK	440 lbs.	CA2430S	Call
34"	33.41	(2) QF40, (1) QF160-SWK, (1) QF250-SWK	420 lbs.	CA3030S	Call
34"	53.41	(2) QF40, (1) QF160-SWK, (1) QF250-SWK	522 lbs.	CA3050S	Call
	22" 22" 28" 34"	22" 24.18 22" 33.19 28" 33.19 34" 33.41	22"       24.18       (2) QF40, (1) QF160-SWK         22"       33.19       (2) QF40, (1) QF160-SWK, (1) QF250-SWK         28"       33.19       (2) QF40, (1) QF160-SWK, (1) QF250-SWK         34"       33.41       (2) QF40, (1) QF160-SWK, (1) QF250-SWK	Door O.D.         OAL         Ports         Weight           22"         24.18         (2) QF40, (1) QF160-SWK         272 lbs.           22"         33.19         (2) QF40, (1) QF160-SWK, (1) QF250-SWK         301 lbs.           28"         33.19         (2) QF40, (1) QF160-SWK, (1) QF250-SWK         440 lbs.           34"         33.41         (2) QF40, (1) QF160-SWK, (1) QF250-SWK         420 lbs.	Door O.D.         OAL         Ports         Weight         Part No.           22"         24.18         (2) QF40, (1) QF160-SWK         272 lbs.         CA1821S           22"         33.19         (2) QF40, (1) QF160-SWK, (1) QF250-SWK         301 lbs.         CA1830S           28"         33.19         (2) QF40, (1) QF160-SWK, (1) QF250-SWK         440 lbs.         CA2430S           34"         33.41         (2) QF40, (1) QF160-SWK, (1) QF250-SWK         420 lbs.         CA3030S

NOTE: Please contact chambers@lesker.com with your specific requirements for a customized chamber quotation.





## **Carbon Steel Frames**

### Carbon Steel Bay-Style Frames

Pre-engineered frames to accept a variety of standard chambers with ability to add a hoist. Bay-style frames are fully welded and powder coated in durable gray finish.

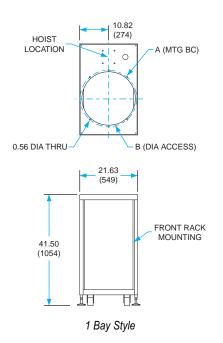
### Standard Features:

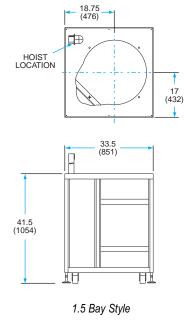
- · Front 19" rack instrument mounting
- · Removable side and rear door panels
- · Stainless steel top work surface
- · Carbon steel bottom plate deck
- · Rear bulkhead panels and power distribution box brackets
- Heavy-duty swivel casters and leveling pads
- · Designed to accept standard KJLC motorized hoist assemblies

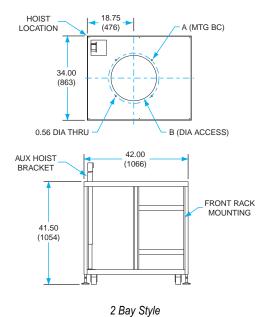


13

















## ➤ Carbon Steel Frames

### **Carbon Steel Bay-Style Frame Options**

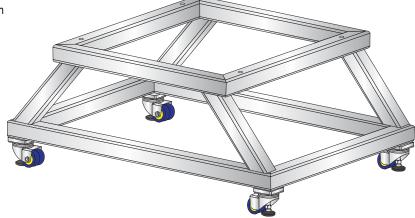
Compatible Standard Product	Bay Size	Dimensions	A Mounting B.C.	B Access Diameter	Hoist Compatible	Part No.	Price
SP1200S SP1200SEP SP1800S SP1800SEP	1 Bay	21%" W x 34" D x 31" H	10.50" dia.	8.50" dia.	No	FRMC-S001-B	Call
SP1200S SP1200SEP SP1800S SP1800SEP	2 Bay	42" W x 34" D x 41½" H	10.50" dia.	8.50" dia.	No	FRMC-S001-D	Call
BP1200SU BP1200SUA SW1208SU	1 Bay	21% W x 34" D x 41½" H	15.00" dia.	14.00" dia.	Yes	FRMC-S010-B	Call
BP1800SU BP1800SUA SW1808SU SW1808SUG	1 Bay	215%" W x 34" D x 411%" H	20.50" dia.	18.375" dia.	Yes	FRMC-S011-B	Call
BP1800SU BP1800SUA SW1808SU SW1808SUG	1.5 Bay	31½" W x 34" D x 41½" H	20.50" dia.	18.375" dia.	Yes	FRMC-S011-C	Call
BP1800SU BP1800SUA SW1800SU SW1800SUG	2 Bay	42" W x 34" D x 41½" H	20.50" dia.	18.375" dia.	Yes	FRMC-S011-D	Call
BP2400SU BP2400SUA SW2400SU	1.5 Bay	31½" W x 34" D x 41½" H	26.50" dia.	24.50" dia.	Yes	FRMC-S012-C	Call
BP2400SU BP2400SUA SW2408SU	2 Bay	42" W x 34" D x 41½" H	26.50" dia.	24.50" dia.	Yes	FRMC-S012-D	Call
BP3000SU BP3000SUA SW3008SU	2 Bay	42" W x 34" D x 41½" H	32.50" dia.	30.50" dia.	Yes	FRMC-S013-D	Call
BP3000SU BP3000SUA SW3008SU	3 Bay	623/6" W x 34" D x 411/2" H	32.50" dia.	30.50" dia.	Yes	FRMC-S013-F	Call

NOTE: Please contact chambers@lesker.com with your specific requirements for a customized frame quotation.

### Carbon Steel A-Frame Style Frames

### Standard Features:

- · Fully welded and powder coated in durable gray finish
- · Heavy-duty swivel casters and leveling pads



### Carbon Steel A-Frame Style Options

Compatible Standard Product	Dimensions	Part No.	Price
BX3648S	56" W x 40½" D x 22.61" H	FRMC-S020-A	Call
CA3030S	54" W x 33" D x 241/2" H	FRMC-S040-A	Call
CA3050S	54" W x 33" D x 241/2" H	FRMC-S041-A	Call



## ➤ Extruded Aluminum Frames

### ■ Extruded Aluminum Bay-Style Frames

### Standard Features:

- Constructed of Extruded Aluminum
- · Clean Room Compatible
- · Standard Chamber Mounting
- · Light weight
- Leveling Pads



Choose the standard base unit from chart below and add available options. Next, compose the order code as shown, below.

### Example Configuration Part No.: FRMA-S001-B-C

Base Unit	Part No. Prefix
Bay-Style Aluminum Frames	FRMA-S001-B
	FRMA-S001-C
	FRMA-S020-C
	FRMA-S021-D
	FRMA-S030-C
	FRMA-S031-C
	FRMA-S032-D
	FRMA-S040-C
Upright-Style Aluminum Frames	FRMA-S001-A
Options	Optional Part No.
Casters-swivel with integrated leveling pads	С
Rack Mounting–Front and Rear	R
Top Work Surface–Bonded to a plastic core 4mm thick	Т
Bottom–Plastic, electrostatic protected area 16mm thick	В
Side Panels-Left and Right Gray Plastic 4mm thick	Р
Front and Rear Panels-Gray Plastic 4mm thick	Q
Hoists*	Н
1101010	11

<sup>\*</sup> Frames are capable to accept a standard KJLC hoist. See hoist options to select the correct product for your application.

### **Extruded Aluminum Bay-Style Frames**

Compatible			Available		
Standard Product	Bay Size	Dimensions	Options	Part No.	Price
SP1200S SP1200SEP SP1800S SP1800SEP	1 Bay	24¾" W x 35" D x 37% "H	B, C, P, Q, R, T	FRMA-S001-B	Call
SP1200S SP1200SEP SP1800S SP1800SEP	1.5 Bay	37⅓₂" W x 35" D x 37⅓₅" H	B, C, P, Q, R, T	FRMA-S001-C	Call
BX1212S BX1224S BX1616S BX2424S	1.5 Bay	37³/s2" W x 35" D x 345/16" H	B, C, P, Q, R, T	FRMA-S020-C	Call
BX2430S BX3030S	2 Bay	49½" W x 38" D x 34¾6" H	B, C, P, Q, R, T	FRMA-S021-D	Call
D-Shaped DS1424S	1.5 Bay	371/8" W x 35" D x 3415/16" H	B, C, P, Q, R, T	FRMA-S030-C	Call
D-Shaped DS1822S	1.5 Bay	371/8" W x 35" D x 3415/16" H	B, C, P, Q, R, T	FRMA-S031-C	Call
D-Shaped DS2430S	2 Bay	471/8" W x 393/4" D x 3115/16" H	B, C, P, Q, R, T	FRMA-S032-D	Call
CA1821S CA1830S CA2430S	1.5 Bay	37 <sup>3</sup> / <sub>32</sub> " W x 38" D x 27 <sup>15</sup> / <sub>16</sub> " H	B, C, P, Q, R, T	FRMA-S040-C	Call

<sup>\*</sup>Additional charges will be added for crating

### **Extruded Aluminum Upright-Style Frames**

Compatible			Available		
Standard Product	Bay Size	Dimensions	Options	Part No.	Price
SP1200S SP1200SEP SP1800S SP1800SEP	Upright Style No Bay	28" W x 28" D x 36" H	С	FRMA-S001-A	Call

<sup>\*</sup>Additional charges will be added for crating

NOTE: Please contact **chambers@lesker.com** with your specific requirements for a customized frame quotation.











## Motorized Hoists & Accessories

### Motorized Hoists & Accessories

Chamber hoists commonly raise and lower chamber lids or bell jars to enable access to the internal fittings of vacuum systems.

Motorized hoists safely raise and lower bell jars or chamber top plates, enabling access to the internal fixturing of vacuum systems. They include vacuum interlocks and have hand-held pendants for operation. Power input is 115 VAC.

Two different styles of hoists are offered:

### Industrial Style Hoist

A rugged, industrial style hoist that comes in a heavy-duty model. With its heavy mounting base and tall outer column, it can be easily retrofitted to existing framework. Mechanical lower and upper limit switches can be adjusted to limit stroke.

### Telescoping Hoists

The compact telescoping hoist is modular in design. The standard-duty model is ideal for clean room applications. The light-duty model is suited for glass bell jars and lighter top plates. Fixed limit switches prevent under- or over-run.

All hoists require a top shaft assembly that connects the component to be raised with the hoist itself. Most models rotate 360° to offer full, unobtrusive access to the internal fixturing. Light-duty hoist applications simply raise and lower.

The top shaft assembly is purchased separately, with custom configurations manufactured to fit your application. Please contact chambers@lesker.com for more information.

### **Hoist Specifications**

Туре	Stroke	Rating	Load Part No.	Price
Industrial Heavy Duty	28"	900 ftlbs.	HSTHD	Call
Standard Duty	16"	400 ftlbs.	HSTST	Call
Telescoping Standard Duty	16"	400 ftlbs.	HSTSTTE	Call
Telescoping Light Duty	18"	100 ftlbs.	HSTLD	Call

### **Mounting Assemblies For HSTLD**

Description	Part No.	Price
12" High Bell Jar Guard Bracket*	HSTLD-12GBKT	Call
18" High Bell Jar Guard Bracket*	HSTLD-18GBKT	Call
21" High Bell Jar Guard Bracket*	HSTLD-21GBKT	Call
24" High Bell Jar Guard Bracket*	HSTLD-24GBKT	Call
30" High Bell Jar Guard Bracket*	HSTLD-30GBKT	Call
Bell Jar Guard Bracket, HSTLD**	HSTLD-BJGBKT	Call

NOTE: Please contact chambers@lesker.com with your specific requirements for a customized hoist quotation.

HSTLD-XXGBKT Bracket Mates to Bell Jar Guard HSTLD-BJGBKT Bracket Mates between HSTLD-XXGBKT Bracket & HSTLD Hoist

Large Machining Capability

13



## Capabilities

### Introduction

The Kurt J. Lesker Company® is a leading manufacturer of high and ultra-high (HV & UHV) vacuum chambers. We are recognized worldwide for specializing in both R&D and production environments.

From smaller, spherical chambers several inches in diameter for R&D, to large box chambers over 14' long for production coatings, our expansive machine shop at our Pittsburgh, Pennsylvania facility is poised to service any and all of your custom vacuum chamber needs.

Spherical

- Culindrian
- Cylindrical

Geometries:

- Box and rectangular
- Bell jar
- · D-shape
- Custom

#### Materials:

- 304 and 304L
- 316 and 316L
- Aluminum (6061)

### Quality:

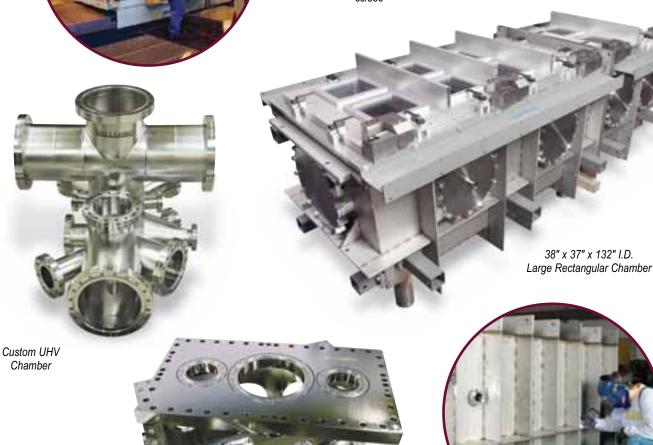
- Coordinate Measuring Machine (CMM) inspection
- Helium mass spectrometers with sensitivity to 5 x 10<sup>-12</sup> STD cc/sec

### **Surface Finishing Options:**

- #8 Mirror
- #4 Brush Finish
- · Glass Bead Blasted
- #2 B
- DA Finish
- #1 Mill Finish
- Electropolish
- Surface Ground
- Blanchard Ground

### **Water Cooling Options:**

- Double wall and water trace available
- Pressurized and helium leak checking of water channels





Fabrication and Welding Expertise







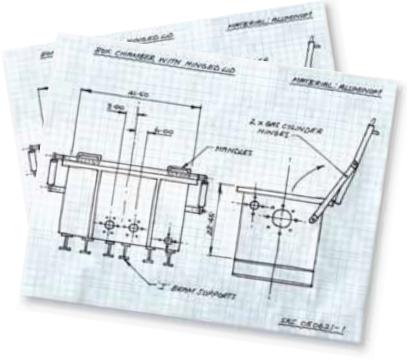
Rectangular UHV Chamber



## ➤ Build Your Own Chamber

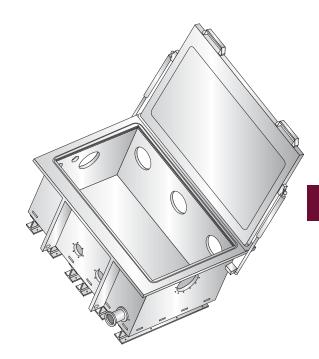
Building a custom chamber is as simple as 1, 2, 3...

with the Kurt J. Lesker Company®.



# Clarify Your Needs

Submit your sketch, CAD drawing, or process requirements by email to chambers@lesker.com. Our Process Equipment Division will review your fabrication requirements and specifications to resolve any design conflicts and provide you with a quotation. Use the Custom Chamber RFQ (request for quotation) worksheet (next page) for assistance.



# Engineering & Design

Our design and project engineers work together to design a chamber to suit your application. During this process, we encourage your input as part of the design team.



# Manufacturing

Our cutting-edge facilities are equipped to handle the integral machining, inspection, and cleaning processes with the available on-site support of our vacuum technicians and engineers to ensure a quality, timely finished product built to your specifications.

Asia: china@lesker.com



## **Quotation Form**

### **Port Configuration**

#### **Termination**

The port will terminate in either a flange or weldable tube end. For ports terminating in a flange, specify the flange system, size, and type using the table **below**. Note the selection of a particular flange will limit your Tube O.D. and Tube Length choices for standard flange configurations.

### Tube O.D.

Specify the port tube O.D. Selection may be limited by select flange size, where applicable.

### **Focal Point**

Specify the focal point, or target point, for a particular port using your defined Cartesian coordinate system.

#### **Focal Length**

Specify the port focal length. The focal length is measured from the face of the flange or tube end edge to the focal point specified for the particular point.

### Azimuthal Angle (a)

Specify the azimuthal (a) angle by setting one of the axes equal to 0° along the chamber's centerline and indicating the clockwise angle from the 0° reference line to the port's centerline.

#### Polar Angle (ß)

Specify the polar (ß) angle by setting the vertical axis equal to 0° and indicating the angle from the 0° vertical reference line to the port's centerline.

### Instrument or Tolerance

Identify any known instruments that will be mounted to the port or specific tolerances in order to identify any critical tolerances needed to accommodate the selected focal length.

### Custom Chamber RFQ Worksheet

Use the worksheet below or use our online worksheet at www.lesker.com/chamberRFQ.cfm to create a custom chamber RFQ. You may fax your chamber RFQ to 412-387-9200 or email us at chambers@lesker.com.

### Step 1: Specify Chamber Size and Geometry

Indicate unit	Specify the shape and size of the chamber body:						
of measure:	Spherical & Hemispherical	Outside Radius					
inches	Box & Rectangular	Length	Width	_ Height			
feet	Cylindrical	Outside Diameter	Overall Heig	jht			
centimeters	D-Shape	Overall Height	Width	_ Depth			
meters	Other (please specify)						

### Step 2: Select Chamber Material

304 Stainless Steel	316 Stainless Steel	
6061 Aluminum	Other (please specify)	_

### Step 3: Specify Port Configuration

In the chart **below**, specify the following for each of the required ports. Establishing an orthogonal set of axes (X,Y,Z) will be necessary when specifying the port's location.

Termination	Standard Tube O.D. (in.)	90°
Weldable Tube End	N/A	D AZIMUTHAL ANGLE (α)
11/3" CF	0.750	
21/8" CF	1.000	9900 F
23/4" CF	1.500	180° 0° 0°
23/4" CF	1.625	E"T C
33/8" CF	2.000	
4 <sup>1</sup> / <sub>2</sub> " CF	2.500	
6" CF	4.000	В
8" CF	6.000	270° TOP VIEW
10" CF	8.000	TOT VIEW
KF10	0.500	
KF16	0.500	DATUM 1 POLAR ANGLE
KF16	0.750	DATUM 1 POLAR ANGLE (+β)
KF25	1.000	
KF40	1.500	
KF50	2.000	
ISO63	2.500	POLAR ANGLE
ISO80	3.000	DATUM (-β)
ISO100	4.000	HEIGHT DATUM 2
ISO160	6.000	ISOMETRIC VIEW
ISO200	8.000	ISSNETHIS VIEW

lange Type & Size	Rotatable or Non-Rotatable (CF Flanges only)	Through-Holes or Tapped Holes (CF Flanges only)	Clamped or Bolted (ISO Flanges only)	Tube O.D.	Focal Point	Focal Length	Azimuthal Angle (a)	Polar Angle (ß)	Instrument/ Tolerance
11/3"CF	Rotatable	Tapped	N/A	0.75"	0,0,4	2.50"	45	165	N/A
	& Size	ange Type Non-Rotatable (CF Flanges only)	ange Type Non-Rotatable or Tapped Holes & Size (CF Flanges only) (CF Flanges only)	ange Type Non-Rotatable or Tapped Holes or Bolted (CF Flanges only) (CF Flanges only) (ISO Flanges only)	ange Type Non-Rotatable or Tapped Holes or Bolted Tube & Size (CF Flanges only) (CF Flanges only) (ISO Flanges only) O.D.	ange Type Non-Rotatable or Tapped Holes or Bolted Tube Focal & Size (CF Flanges only) (CF Flanges only) (ISO Flanges only) O.D. Point	ange Type Non-Rotatable or Tapped Holes or Bolted Tube Focal Focal & Size (CF Flanges only) (CF Flanges only) (ISO Flanges only) O.D. Point Length	ange Type Non-Rotatable or Tapped Holes or Bolted Tube Focal Focal Azimuthal (CF Flanges only) (ISO Flanges only) O.D. Point Length Angle (a)	ange Type Non-Rotatable or Tapped Holes or Bolted Tube Focal Focal Azimuthal Polar & Size (CF Flanges only) (CF Flanges only) (ISO Flanges only) O.D. Point Length Angle (a) Angle (ß)

<sup>\*</sup>Example Port Configuration shown in table above.

### Step 4: Specify Base Pressure Required

### Step 5: Select Desired Surface Finish

#8 Mirror*	#DA Finish
#4 Brush Finish	#1 Mill Finish
Glass Bead Blasted	Electropolish
Surface & Blanchard Ground**	

<sup>\*(</sup>available in cylindrical & D-shape only) \*\*(available in box & rectangular only)





